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RICHARD LYDEKKER, B.A., F.R.S., ETC.

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P. L. SCLATER, M.A., PH.D., F.R.S., ET

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ERRATA

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343. Line 7 from foot, *for* "five" *read* "nine."

350. The superb glossy starling (*Lamprocolius superbus*), figured on this page, is a native of East Africa, and is easily recognised by the white band across the chest; the mantle being steely green, and the upper part of the head and neck black.

351. Line 11 from foot, *for* "later on" *read* "p. 347"; line 4 from foot, *for* "*Eulabetes*" *read* "*Eulabes*."

363. Line 10 from foot, *for* "*D. leucocephala*" *read* "*Dinemellia leucocephala*."

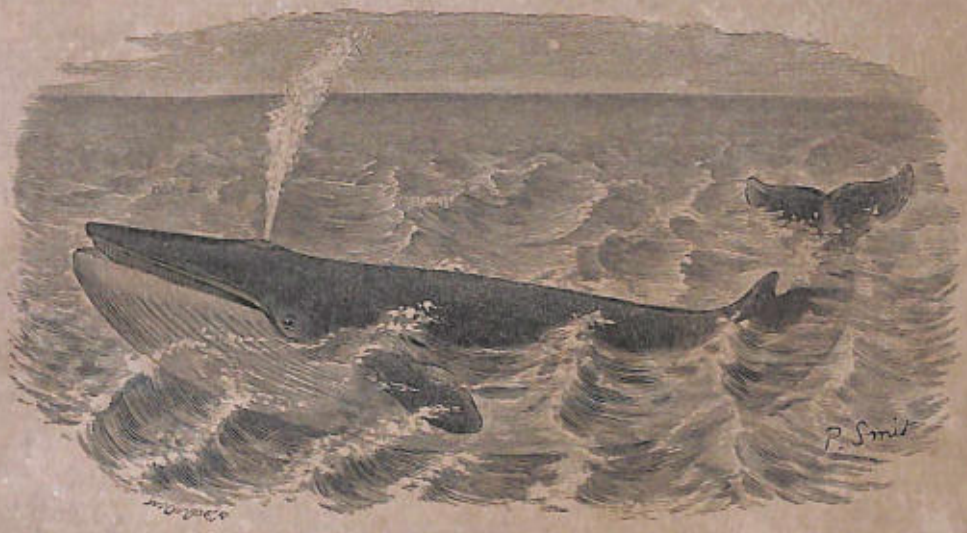
364. First line, *after* "the" *add* "typical representative of a."

376. Transpose numbers 4 and 5 in Plate.



THE RED KANGAROO.

THE ROYAL NATURAL HISTORY.



MAMMALS.

CHAPTER XXIX.

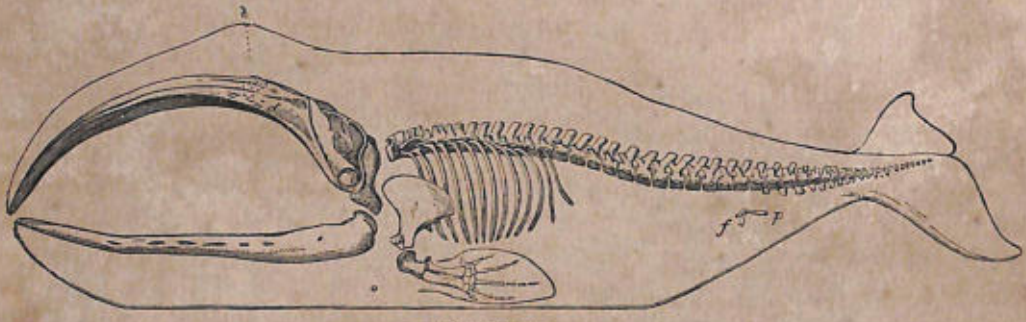
CETACEANS,—Order CETACEA.

UNDER the general title of Cetaceans may be included the whole of those mammals commonly known as whales, porpoises, and dolphins, which differ from all hitherto described in their assumption of a fish-like form, and their complete adaptation to a purely aquatic mode of life. Indeed, so like are Cetaceans in their general outward appearance to fishes, that they are commonly regarded as belonging to that class. In all essential features of their organisation they are, however, true mammals, breathing atmospheric air by means of lungs, having warm blood, a four-chambered heart, the skull articulating with the first joint of the backbone by means of two condyles, and the cavity of the body divided into two chambers by a midriff; while they produce living young, which are nourished by milk drawn from the bodies of their mothers.

Form. The assumption of a fish-like form by the Cetaceans is one of the best-marked examples of what are known as adaptive characters, which are merely produced in order to suit the animals in which they exist to their

external surroundings, and have no sort of connection with their affinities. The fish-like resemblances of the Cetaceans are, moreover, not so close as they may at first sight appear; since the tail-fin, instead of being vertical, is horizontal, while the structure of the skeleton of the fore-limb is totally different from that of any fish. The general fish-like form of the body is, however, that best adapted for progression through the water, which affords sufficient reason for its having been acquired in the present group of animals; and we may likewise mention that Cetaceans generally resemble fish in having the upper-part of the body coloured dark, while the under-parts are light, such a coloration rendering the animals in which it occurs not easily seen, either from above or below, when in their native element.

No Connection with Fishes. That whales are not even directly descended from fishes is evident from the fact of their breathing atmospheric air, by means of lungs, for if they had so originated it would be quite clear that they would have



SKELETON OF GREENLAND WHALE.

retained fish-like gills, and thus have avoided the necessity of coming periodically to the surface for the purpose of breathing. It is probably for this reason that Cetaceans have their tails with the expansion placed in a horizontal instead of a vertical plane, since the strokes of such a horizontally-expanded organ are the best calculated to bring an animal rapidly to the surface.

Origin. The additional circumstance that Cetaceans retain traces of the hairy covering, which is so characteristic of mammals in general, affords evidence that they derive their origin from terrestrial mammals; and, taken together with the absence of hind-limbs, is amply sufficient to disprove any notion that they themselves are in any sort of way connected with the ancestral stock from which the other members of the class have originated. Cetaceans may, therefore, be regarded as some of the most specialised of all mammals. With regard to the terrestrial mammals to which these animals are most closely related, there is still great uncertainty and some difference of opinion among zoologists. Sir W. H. Flower is inclined to consider that they show more resemblances to Ungulates, and especially the Even-toed group; but the teeth of the earliest forms are quite unlike those of any Ungulates, and approximate much more closely to those of Carnivores. It may, therefore, be suggested that the alliance between Cetaceans and Carnivores may prove to be closer than is often considered

to be the case. It may be noted here that the few Cetaceans inhabiting fresh-water are somewhat less markedly different in structure from ordinary mammals than are the marine representatives of the order; and this leads the writer last cited to conclude that Cetaceans were first modified for the assumption of a purely aquatic life from land mammals frequenting the banks of rivers, and that after having acquired natatorial powers in fresh water, their ancestors subsequently migrated to the sea, where they have attained their present remarkable development.

Characteristics. Before making any further remarks on Cetaceans in general, it will, however, be convenient to take into consideration the leading structural features by which they are distinguished from other mammals. As already mentioned, Cetaceans are characterised by their fish-like form, the head passing imperceptibly into the body without any distinct neck, and at the other extremity the trunk gradually tapering to the tail, which terminates in a forked, horizontal fin-like expansion, commonly known as the "flukes." The head is large in proportion to the body, with a wide mouth, often furnished with a few bristles, at least in the young state. The fore-limbs are represented by flippers, encased in a continuous skin, showing no outward indications of digits, and without the slightest trace of nails or claws, while of the hind-limbs there is not the least external trace. With the exception of the aforesaid sparse bristles in the neighbourhood of the mouth, the smooth and shining skin is entirely devoid of all traces of hair, neither has it any structure corresponding to the scales of fishes. Beneath, it is underlain by the thick layer of oily fat termed "blubber," the function of which is to prevent the absorption of the heat of the body by the water. The majority of the species have a fin on the back, which is entirely composed of integument, and has no internal skeleton corresponding to the similarly situated fins of fishes. The eye is extremely small; and, as in fishes, the ear has no external conch, and opens by an exceedingly small aperture behind the eye. The nostrils, which may have either a single or double opening, are situated on the very summit of the head, and thus reach the surface of the water before any other part when the animals rise horizontally.

Skeleton. In the skeleton the bones are remarkable for their loose and spongy structure; and in the living state are saturated with oil. The majority of the species have teeth, which may be confined to the lower jaw, and these represented only by a single pair. In all cases these teeth are of a simply conical or compressed form; and in many of the dolphins they are much more numerous than in any other mammals. In no instance is there any replacement of the teeth; but Dr. Kükenthal has discovered that in some species there are rudimentary successional teeth which never come to maturity, whence it is considered that the functional teeth correspond to the milk-series of those mammals in which there is a replacement. With regard to the great number of teeth present in some Cetaceans, the same investigator considers that this is due to the division of a number of trilobed teeth like those of certain seals (compare the figure in Vol. II. p. 142) into three parts, whereby three distinct teeth have been produced out of what was originally a single tooth. In the baleen, or whalebone-whales, the place of teeth is taken by the horny structure technically termed "baleen," but

commonly known as "whalebone," the nature of which will be explained later on. Even in this group, however, there are rudiments of teeth deeply buried in the gums of the young; and the structure of these rudiments is such as to indicate the origin of at least that group of Cetaceans from mammals furnished with teeth of a complex type. It is further inferred by Dr. Kükenthal that these rudimentary teeth correspond with those of the permanent set in other mammals.

Neck. In conformity with the absence of any external indications of a neck, the vertebræ in that region of the backbone of Cetaceans are abnormally shortened, so that even in the largest species this part of the column may not much exceed a foot in length. This shortening of the neck is, however, not accomplished by any reduction in the number of the vertebræ from the normal seven, but by the shortening of the body of each of these vertebræ until it assumes the form of a broad, thin plate. The necks of a giraffe and a whale present, therefore, the extremes in the modifications assumed by their constituent vertebræ; these joints undergoing the maximum degree of elongation in the one, and of abbreviation in the other. In many Cetaceans the whole or a certain number of the vertebræ of the neck are welded together into one solid mass. In the hinder portion of the backbone the region of the tail is only distinguished from that of the trunk by the vertebræ (as shown in our figure of the skeleton of the Greenland whale) carrying chevron-bones affixed to their under-surfaces; there being no mass of united vertebræ, corresponding to the sacrum of other mammals.

Limbs. The skeleton of the fore-limbs exhibits all the segments characterising those of terrestrial mammals, although some of these are much modified. There are no collar-bones (clavicles); but the shoulder-blades, or scapulæ, are very large, and are much elongated in the antero-posterior direction. The humerus, or bone of the upper arm, although much shorter than usual, has a free movement at its articulation with the shoulder-blade; but its junction with the two bones of the fore-arm, like all the joints lower down in the limb, admits of scarcely any motion. Indeed, in all these joints the bones articulate by flattened surfaces closely applied to one another, and are bound together by fibrous tissue. The bones of the fore-arm (radius and ulna) are elongated and flattened, and lie nearly parallel, one in front of the other. The number of digits in the flippers is usually five, although occasionally reduced to four; and in the second and third of these there are always more than the ordinary three joints below the metacarpus. The only rudiments of the hind-limbs are a few small bones beneath the sacral region of the backbone representing part of the pelvis, and occasionally part of the limb itself (*f.* and *p.* in the figure on p. 2).

Skull. In accordance with the position of the nostrils at its summit, the skull departs considerably from the ordinary type. It will suffice to state here that the supraoccipital bone extends forward to join the frontals, and thus excludes the parietal bones from taking any share in the formation of the roof of the middle line of the skull; while in front of the opening for the nostrils there is a more or less prolonged rostrum.

Soft Parts. In regard to the soft parts, it may be mentioned that the stomach is always complex; and that the female has two teats, placed far back on the abdomen. In order to enable these animals to swim with their mouths

wide open, the upper part of the windpipe (larynx) is prolonged so as to reach the opening of the nostrils in the hinder portion of the mouth, and thus form a closed tube from the external nostrils to the lungs.

Spouting. As there is frequently some misconception as to the so-called "spouting" or "blowing" of Cetaceans, a few words are advisable on this point. When a whale comes to the surface of the water after a longer or shorter period of submergence, its first act is to discharge the air from the lungs previous to taking a fresh inspiration. The air is expelled from the lungs with great force, and thus rises a considerable height above the surface of the water, and as it is saturated with water-vapour at a high temperature the contact with the cold external air at once condenses this vapour, which forms a column of steam or spray. Frequently, however, a whale commences to "blow" before its nostrils are actually above the surface, and then a certain amount of sea-water is forced up with the column of air.

A Modern Group. Cetaceans include the largest animals now existing on the globe; and they were only approached in point of size by some of the gigantic land reptiles which existed during the Secondary period. As a group, they are comparatively modern, being unknown before the upper portion of the Eocene division of the Tertiary period. In the preceding Secondary period their place in the ocean was taken by huge extinct marine reptiles, such as the ichthyosaurs and plesiosaurs; but as these seem to have died out at the close of that period, while whales are unknown in the early part of the Eocene, it would seem that there was an interregnum, during which our seas were not tenanted by any large animals except fishes.

Difficulty of Observing. From their oceanic habits and huge size, the study of the larger Cetaceans is a matter of extreme difficulty; the majority of the comparatively few specimens that are cast ashore not being seen by naturalists, while even in cases where opportunity is afforded for inspection, the bodies are usually more or less distorted from their proper form, while nothing can, of course, be learnt as to the habits of the animals. The acquisition of such knowledge as we possess of the habits and form of the larger whales has consequently been acquired very slowly; but, thanks to the careful observations of several gentlemen engaged in the whaling trade, we have a considerable amount of information on these subjects, although there is room for much further investigation.

Distribution. Cetaceans are found in all seas, from the Equator to within the Arctic Circle; and in former years even many of the larger species were extraordinarily abundant in certain regions, although they have been greatly reduced in numbers, and in some instances almost or completely exterminated. Many of the smaller forms, known as porpoises and dolphins, ascend rivers for longer or shorter distances; while some of these, as well as all the members of one family are exclusively fluviatile; the latter inhabiting the larger rivers of South America and South-Eastern Asia. With the single exception of a kind of dolphin recently discovered in the large rivers of the Cameruns district on the West Coast of Africa, which is believed to be herbivorous, all Cetaceans are carnivorous. Their food is, however, very varied; and the size of the animals devoured for food bears no sort of relation to the dimensions of their devourers. Thus while the killer, or

grampus, feeds on seals and some of the smaller Cetaceans, and is indeed the only member of the order which subsists on warm-blooded animals, many of the toothed Cetaceans prey on fishes of various kinds, while others devour small crustaceans, jelly-fish, and the molluscs known as pteropods. The food of many of the larger species consists almost exclusively of squids and cuttles; and so small are the animals on which the Greenland whale feeds, that it is commonly said that this species would be choked if it attempted to swallow a herring.

Habits. Although the killer is renowned for the ferocity of its disposition, the majority of Cetaceans are harmless and timid animals, usually associating together in companies known as "schools," which may sometimes comprise several thousands of individuals. As a rule, the members of a school are said to display an affectionate disposition to one another; and numerous anecdotes attest the strong attachment and solicitude displayed by the females towards their offspring. Some of the finner whales appear to produce two young at a birth not uncommonly, but the usual number is one.

Classification. Existing Cetaceans are divided into two great primary groups, the one comprising the true, or whalebone whales, in which the place of teeth is taken by baleen or "whalebone," and the toothed whales, characterised by the presence of functional teeth, at least in the lower jaw. These two groups differ from one another in many important respects, and if they are derived from a single stock, their common ancestor must have existed at a comparatively remote epoch. Dr. Kükenthal is, however, of opinion, that the whalebone and the toothed whales have originated independently of one another from totally distinct groups of terrestrial mammals. If this view be ultimately maintained, it will be evident that the Cetacean order, as at present constituted, is a heterogeneous group; while we should have a most remarkable instance of the power of adaptation to a particular mode of life of producing similarity in form.

The Whalebone Whales.

Family *Balænidæ*.

The whalebone, or true whales, constitute but a single family, and are characterised as follows. They have no teeth after birth; but the palate is furnished with numerous horny plates of baleen or whalebone, which serve to strain the small animals on which these whales feed from the water, the structure of this being explained below. The skull is symmetrical; and the two branches of the lower jaw are outwardly curved, and are joined at the chin only by fibrous tissue. The nostrils open externally by two distinct longitudinal apertures. In the skeleton the ribs are but very loosely united with the backbone, articulating only with the horizontal transverse processes of the vertebræ, and having no connection with the bodies of the same. The breast-bone is composed of but a single piece, to which only one pair of ribs articulate.

As remarked by Sir W. H. Flower, in the substitution of baleen for teeth, as well as in the loose connection of the ribs with the backbone and the breastbone, and in the reduction in the size of the latter, the whalebone whales are more

specialised than the other group of Cetaceans; this laxity of connection between the ribs and the other parts of the skeleton, allowing of a greater degree of expansion of the cavity of the chest, and thus permitting a longer submergence beneath the water without the necessity of coming up to breathe. On the other hand, in the retention of the double apertures to the nostrils, and in their symmetrically-formed skulls, as well as in the position of a distinct olfactory organ, and certain other features of their organisation, the members of the present group

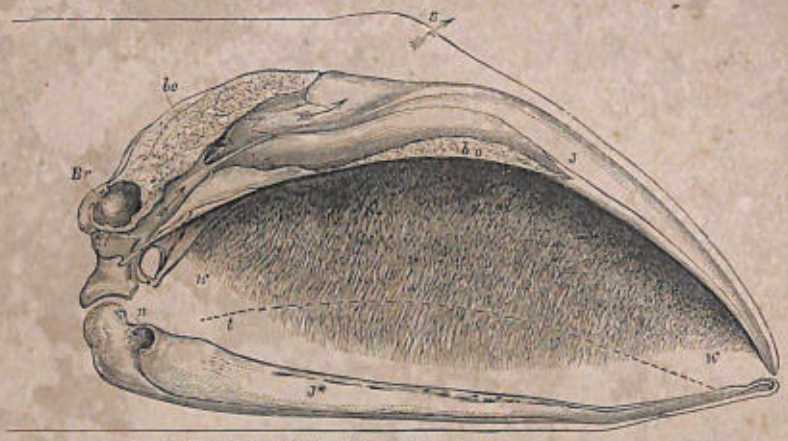


THE GREENLAND WHALE ($\frac{1}{150}$ nat. size).

depart less widely from the ordinary type of mammalian structure than do the existing toothed Cetaceans.

Whalebone. The baleen or whalebone, which does not appear until after birth, is composed of a numerous series of flattened horny plates, placed transversely on either side of the palate, and separated from one another by an open space in the middle line. The plates vary greatly in length in the different species, and are triangular in form, with their broad bases attached to the palate, and their points hanging downwards. Although smooth externally, the inner edge of each plate is frayed out into a kind of fringe, thus giving a hairy appearance to the whole of the inside of the mouth when viewed from below. The plates attain the greatest length in the middle portion of the series, from whence they gradually diminish in size towards the two extremities. Baleen differs greatly not only in length, but likewise in its relative thickness and degree of elasticity, in the

different species. In colour it may vary from black to creamy white; while in some cases it is ornamented with stripes of dark and light. The object of the baleen, as already said, is to strain the water from the small animals on which the whale feeds; and its mode of action is described by Sir W. H. Flower as follows:—"In feeding, the immense mouth is filled with water containing shoals of these small creatures, and then, on the whale closing the jaws and raising the tongue, so as to diminish the cavity of the mouth, the water streams out through the narrow



MEDIAN SECTION, SHOWING THE LEFT SIDE OF THE SKULL OF THE GREENLAND WHALE, WITH THE WHALEBONE.

Br, brain-cavity; J,J* upper and lower jaws; *bo*, bones of roof of skull; *s*, blow-hole, with arrows leading from the cavity of the nostrils; *w*, whalebone; *t*, contour of tongue; *n*, aperture of nerve canal in lower jaw. (From Southwell's *British Seals and Whales*. —After Eschricht.)

intervals between the hairy fringe of the whalebone blades, and escapes through the lips, leaving the living prey to be swallowed."

Various Kinds. The whalebone whales are commonly divided into right-whales, humpbacks, and rorquals or finners, severally representing as many genera, in addition to which there are two less well-known forms, each of which is entitled to generic distinction.

Right-Whales.

Genus *Balæna*.

The right-whales, of which the Greenland whale is the best known representative, are characterised by the absence of any fin on the back, and of any furrows in the skin of the throat; and likewise by the proportionately large size of the head, and the arched form of the sides of the mouth, which ascends in the middle far above the level of the eye. The flipper is relatively short, and contains five distinct digits; and the whole of the seven vertebræ of the neck are welded together into a solid mass. The baleen is long, narrow, very elastic, and black in colour.



THE GREENLAND WHALE

Greenland Whale. The Greenland whale (*Balæna mysticetus*) is a northern species, characterised by the enormous size of the head, which often exceeds one-third the entire length of the animal, by the high arching of the mouth, and the great number and length of the baleen plates. The latter in the middle region attain a length of 10 or even 12 feet, and their total number may exceed 380 on each side of the jaw. In order to afford room for such enormous structures, the narrow upper jaw is greatly arched from before backwards, while the two branches of the lower jaw are widely separated behind, and curve much outwards in the middle of their course.

The manner in which the plates of baleen perform their function has been explained by Captain D. Gray. When the mouth of the animal is closed, the slender extremities of the baleen curve backwards in the direction of the throat, the longer ones in the middle of the jaw occupying the hollow formed by the shorter ones behind. When the jaws are opened for feeding, the baleen by its own elasticity springs downwards and forwards, and thus fills up the whole space between the two jaws, irrespective of their degree of separation. An effectual strainer is thus interposed between the sides of the cavity of the mouth and the external water, which prevents the food swallowed from escaping, while the water taken in at the same time has full means of escape upon the closure of the mouth. The tongue is of very large size, and fills up the cavity between the two series of baleen plates when the mouth is shut; and the stranded prey left upon its surface after the completion of the straining process is swallowed at leisure. The large lower lip, rising up at the sides above the extremities of the baleen, prevents them from being borne outwards by the rush of water as the mouth is closing.

The general colour of the Greenland whale is black, but there is frequently more or less white about the throat, flippers, and in front of the flukes, while some individuals are pied all over. A rough prominence at the extremity of the muzzle, known as the "bonnet," is frequently present. In some individuals, at least, the tail is more constricted in advance of the flukes than is the case in our figure, while the flukes themselves are wider.

The Greenland whale attains usually a length of about 50 feet, but specimens have been recorded exceeding 60 feet, and it is probable that when the species was more numerous its average size was greater. These whales usually yield about 130 barrels of oil, but specimens were formerly killed from which as much as from 200 to 280 barrels has been obtained. The product of baleen may vary from 1000 to over 3000 lbs. The price of this commodity in 1881 was as much as £1100 per ton, but in ten years it had risen to upwards of £2800 for the best quality, the average price being then about £2520 per ton.

Distribution. If we follow Sir W. H. Flower in regarding the so-called bow-head whale of Behring Strait and the Okhotsk Sea as not specifically distinct, the range of the Greenland whale will be circumpolar. In the North Atlantic the southern limits of this species may be approximately indicated by a line drawn from the coast of Lapland, in latitude 70°, to the southern point of Iceland, and thence to the coast of Labrador, in latitude 55°. In Behring Sea it is but seldom seen south of latitude 55°, while in the Sea of Okhotsk it ranges about 1° further south. With regard to the northern limits of this whale, there is some

degree of uncertainty. Captain Feilden is, however, of opinion that no whale could inhabit the frozen sea lying to the north of Robeson Channel, above Baffin Bay, in latitude 82° N., and that none would be found in the neighbourhood of the pole. This species undertakes annual migrations of considerable extent, always travelling northwards in summer as the ice breaks up. Captain Scammon states that "everything tends to prove that *Balæna mysticetus* is truly an 'ice-whale,' for among the scattered floes, or about the borders of the ice-fields or barriers is its home and feeding-ground. It is true that these animals are pursued in the open water during the summer months, but in no instance have we learned of their being captured south of where winter ice-fields are occasionally met with."

Habits. The huge size of the mouth and the enormous development of the baleen in this species is in correlation with the nature of the food, which is composed mainly of small shrimp-like crustaceans and swimming molluscs belonging to the group known as pteropods; a vast number of such minute creatures being necessary to afford sustenance to an animal of the dimensions of the Greenland whale. When feeding, these whales swim near the surface of the water, with the nostrils and a portion of the middle of the back showing above. Captain Scammon, writing about twenty years ago, says "they are often met with singly in their wanderings; at other times in pairs or triplets, and scattered over the surface of the water as far as the eye can discern from the masthead. Toward the end of the season they are seen in large numbers, crowded together. These herds are called 'gams,' and they are regarded by experienced whalemen as an indication that the whales will soon leave the ground. Their manner of respiration is to blow seven to nine times at a 'rising,' then 'turning flukes' (elevating them six to eight feet out of the water), they go down and remain twelve or fifteen minutes." Captain Gray states, however, that he has known a whale when harpooned stay under water for fifty minutes.

There is still some degree of uncertainty as to the breeding-habits of the Greenland whale. Dr. R. Brown states that the pairing-season is from June to August, and that the young are born in the following March, April, and May. Some other writers have, however, considered that the period of gestation is thirteen or fourteen months. The single offspring is believed to be suckled for about a year, during which time the baleen is gradually developed. The affection of the female parent for her young is most intense, and if she be captured there is little difficulty in securing her offspring.

The Greenland whale is a peaceful and timid animal, and appears never to attack the boats of its pursuers. The accidents which occur in hunting this species are mainly due either to its descending suddenly to great depths when first wounded, whereby the boat may be swamped or dragged under water, or by a too close approach to the animal when in its last terrible death-struggle, or "flurry," as it is called by the whalers. The ordinary speed of a Greenland whale, whether swimming at or below the surface, is estimated by Captain Gray at about four miles an hour, while when the animal is frightened or wounded its rate of progress will be accelerated to about eight miles.

Whaling. The Greenland whale has for more than a century been systematically hunted by British whalers, whose headquarters are the ports of

Peterhead and Dundee. From information given by Capt. Gray to Mr. T. Southwell, it appears that between the years 1788 and 1879 no less than four thousand one hundred and ninety-five whales were killed by the Peterhead vessels; while between 1790 and 1879 four thousand two hundred and twenty were accounted for by those sailing from Dundee. When we add to these the numbers killed by the whalers of other nations, it is not surprising to learn that the Greenland whale has now become a comparatively scarce animal. In the year 1891 only seventeen whales were captured by the Scotch whalers, and these were of comparatively small size, yielding whalebone of less than six feet in length. It has, indeed, been supposed that the species is either well-nigh exterminated, or has been driven northward beyond its ancient haunts. Neither of these suppositions appear, however, to be true, for it is now ascertained that the whales have not altered their original lines of migration, while so late as 1891 considerable numbers were seen in the Greenland seas. Writing on this subject, Mr. Southwell expresses his belief that the want of success experienced of late years by the whalers is "mainly owing to the introduction of steam, which enables the modern ships to follow the whales in localities where formerly they would have been safe from molestation. The rattle of the screw also, which can be heard by the whales for long distances, is now to them a well-known sound; above all, the eagerness with which they are followed up—all the vessels consorting together—has at length rendered them so wild as to be practically unapproachable. Even now, however, it appears quite possible that a vessel approaching their haunts alone, and in the quiet manner which prevailed before the introduction of steam, might be rewarded by the success of old. Certainly the fishery appears to be in a hopeless condition at present (1892); but it is possible that a few years' rest might restore the confidence of the whales, and that, if then pursued with due caution by a limited number of vessels, paying cargoes might again be obtained."

The method of capturing whales has been so frequently described, that it will be unnecessary to do more than briefly allude to it here. In former days the actual pursuit of the whale was always made in open boats, and the harpoon, with the line attached, thrown by hand; the animal being subsequently despatched by long sharp weapons known as lances. Later on, a harpoon-gun was substituted for the thrower; while at the present day the ships themselves are in some cases used in the attack, and the employment of open boats dispensed with. The vessels thus employed are mounted with a massive and elaborately constructed gun fixed in the boat upon a swivel support. The gunner takes his stand upon a platform, which is furnished with wings overlapping the small angle of the bows, and thus allowing him plenty of room to move freely. The projectile is a harpoon, armed with movable flukes, and containing an explosive in the head. When fired, the flukes lie flat on the sides of the harpoon, but on entering the flesh of the whale they open out so as to form a grapnel in its body; while the act of expansion also fires the explosive, by which the animal, if hit anywhere near a vital part, is generally killed outright.

Southern Whale. Although the whale of the North Atlantic has been separated as a distinct species from the one inhabiting the southern part of that ocean, while those of the North and South Pacific have likewise received

distinct names, it is, on the whole, probable that all these indicate only local races of a single widespread species, which may be known as the southern right-whale (*B. australis*). This species differs from the last by its relatively smaller head, in which the contour of the lower lip is much more highly arched, and the baleen considerably shorter; while the number of ribs is fifteen in place of twelve. It is also of smaller size and yields less blubber. In its movements this whale is said to be quicker, more active, and more violent than the other, and is thus more difficult and dangerous to kill. In the North Atlantic it was still not unfrequent in the latter part of the eighteenth century, and ranged as far north as Iceland and Norway; but it is now all but exterminated in these regions. Several instances of whales, probably belonging to this species, having been seen or captured off the British Coasts previous to the commencement of the present century are on record; and it is highly probable that whales seen off Peterhead in 1806 and 1872 were likewise of the same kind. An example was captured in the harbour of San Sebastian in 1854, a second in the Gulf of Taranto in 1877, and a third on the Spanish Coast in the following year. The practical extermination of this species in European waters, appears to be due to the Basque fishermen of the Biscayan ports, by whom it was persistently hunted from the tenth to the sixteenth century. It was known to them as the sletbag, and had become exceedingly scarce on the discovery of Spitzbergen in 1596, when the Basque whalers turned their attention to the far more valuable Greenland species.

On the western side of the Atlantic, where it is known as the black whale, examples are occasionally met with. In the North Pacific it occurs in Japanese waters; and it likewise frequents the Australian and New Zealand seas, as well as the regions around the Cape of Good Hope. The southern limits of the southern right-whale are not yet definitely known, but the species certainly does not penetrate the icebound Antarctic Ocean.

Fossil Right-Whales. Several species of right-whales have left their remains in the Pliocene deposits of Belgium and the east coast of England. One of these extinct forms appears to have been allied to the Greenland, and a second to the southern whales, while the other two are smaller species unlike any now living.

The Pigmy Whale.

Genus *Neobalæna*.

A rare whale (*Neobalæna marginata*), from the New Zealand, Australian, and South American seas, is the smallest representative of the family, and while most nearly allied to the right-whales, presents certain peculiarities in structure which entitle it to rank as the representative of a distinct genus. It derives its common name of pigmy whale from its comparatively small size, the length never exceeding 20 feet, and being sometimes only 15 or 16 feet. Although agreeing with the right-whales in having the skin of the throat smooth, and all the vertebræ of the neck united into a solid mass, the pigmy whale differs by having a small fin on the back, by the baleen, which is of great length and slenderness, being white, and also by the small and narrow flipper containing but three digits in its skeleton. The

ribs are very broad and flattened, and are seventeen in number. The whalebone of this species is more flexible, more elastic, and tougher than that of any other; and if it could be obtained in any quantity would fetch a higher price in the market than that of the Greenland whale.

The Grey Whale.

Genus *Rhachianectes.*

The grey whale of the North Pacific (*Rhachianectes glaucus*), taking its name from the bluish grey colour of its skin, is also the single representative of its genus. This species serves as a kind of connecting link between the right-whales on the one hand and the humpback and finners on the other, and is in all probability a very ancient and generalised type. It agrees with the humpback in the absence of a fin on the back and the narrowness of the flippers, but resembles the finners in the relatively small size of the head, the elongated form of the body, the shortness and brittle nature of the whalebone, and in the almost complete separation of all the vertebræ of the neck. A further approximation to the humpback and finners is made by the presence of a single pair of flutings in the skin of the throat, The male attains a length of from 35 to 42 feet, and the female from 40 to 44 feet, the length of the flippers being about 6½ feet. The general colour is a mottled bluish grey, becoming very light in some individuals, while in others it is nearly black. The whalebone is relatively shorter than in any other species, scarcely exceeding 18 inches in length, and is yellow in colour.

In the skeleton the ribs are remarkable for their shortness and great width, and the consequent narrowness of the spaces between them; while the first two are more or less completely united together to form a solid shield of bone. In the flippers the joints of the digits are very short and thick, and appear to be less numerous than in the finners. The blubber is solid and tough, with a reddish colour, and yields comparatively little oil.

Distribution. At the present day the grey whale is confined to the North Pacific, and does not range further south than the 20th parallel of north latitude. From the evidence of certain bones found in the superficial deposits of the British Islands, and described under the name of *Eschrichtius*, it is, however, not improbable that it formerly frequented the Atlantic.

Habits. It is a migratory species, appearing on the coasts of California and Oregon for the purpose of breeding from November to May, and going northwards for the rest of the year. Captain Scammon says that in its regular migrations from the hot southern latitudes to within the Arctic Circle this whale follows the general trend of an irregular coast so closely that it is exposed to attack from the savage tribes inhabiting the seashores, who pass much of their time in their canoes, and consider the capture of this singular wanderer a feat worthy of the highest distinction. As it approaches the waters of the torrid zone, it presents an opportunity to the civilised whalemen to practise their different modes of strategy, thus hastening the period of its entire disappearance. This species of whale manifests the greatest affection for its young, and seeks the

sheltered estuaries lying under a tropical sun, as if to warm its offspring into activity and promote its comfort, until grown to the size nature demands for its first northern visit. When the parent animals are attacked, they show a power of resistance and tenacity of life that distinguish them from all other Cetaceans. This species has of late years become very rare, and is now in considerable danger of extermination.

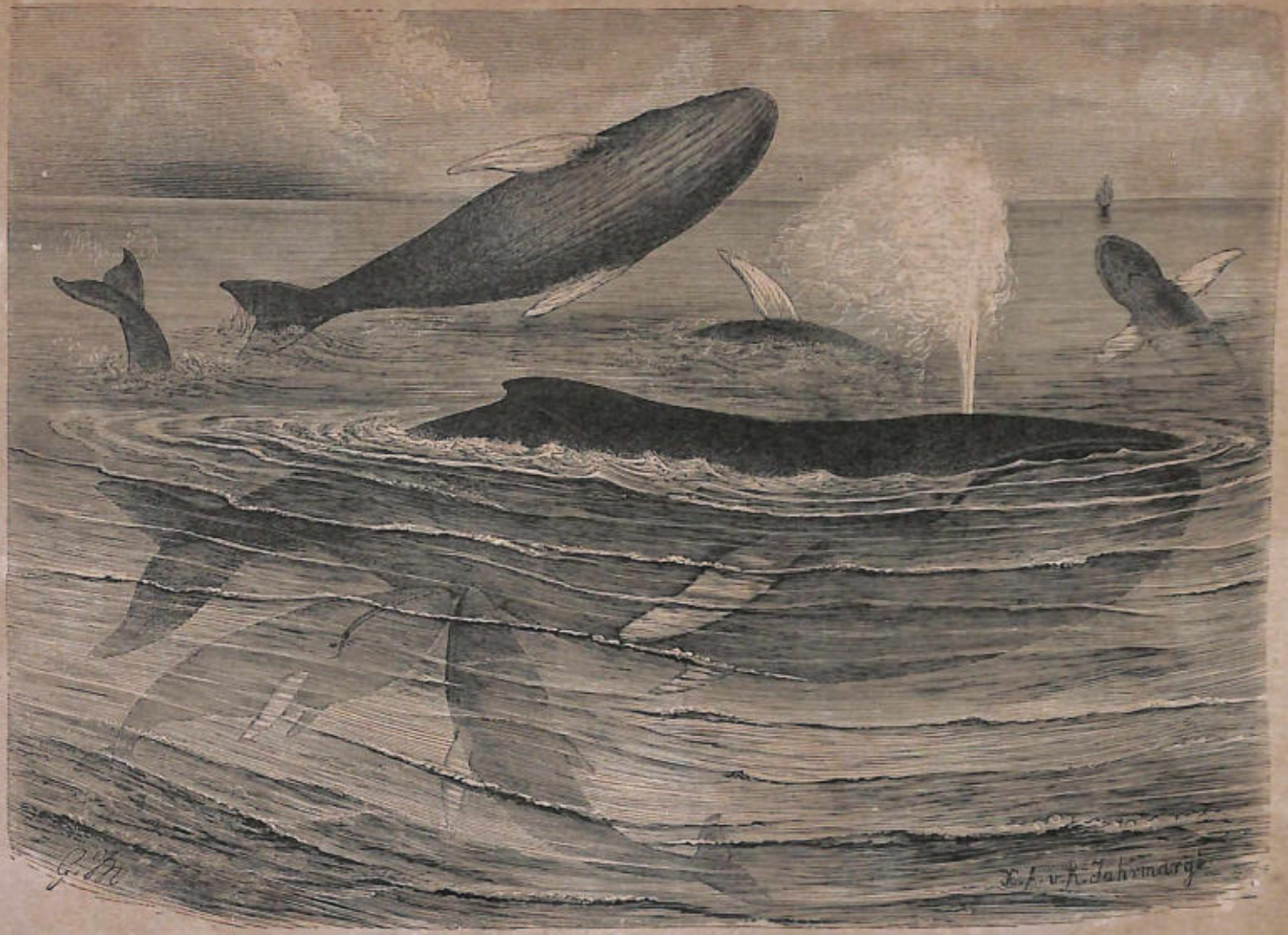
The Humpback Whale.

Genus *Megaptera*.

The humpback whale (*Megaptera böops*) belongs to the group characterised by the presence of a number of longitudinal flutings in the skin of the throat, and of a fin on the back. It is distinguished from the finners (described below), by the comparatively large size of the head, the short and deep body, the small size of the fin on the back, and the enormous length of the flippers. The flukes are relatively large, and the flippers are characterised by their scalloped margins. As in the grey whale and finners, the vertebræ of the neck are relatively longer than in the right-whales, and remain perfectly separate from one another throughout life. The whale-bone, which is of a deep black colour, is short and broad, and of a coarse and but slightly elastic structure. In length the humpback varies from 45 to 50 feet; the flippers measuring from 10 to 14 feet in length. The general colour of the body is black above, but often more or less marbled with white below, while the flippers may be either entirely white, or black above and speckled with white below. The skeleton of the flippers has four digits, with a great number of joints.

The name humpback, according to Captain Scammon, is derived from the prominence on the back which carries the fin, but there appears to be considerable individual variation in regard to the degree of its development. Captain Scammon, from whose figures our plate is taken, makes this prominence at least as high as any other part of the back, while in the position assumed by the suckling female in the lower half of the plate it is the highest point of all. In a figure given by Sir W. H. Flower the whole back is made more arched, with the highest point only a short distance behind the base of the flippers; possibly, however, there may be individual differences in this respect. It may be mentioned here that when a whale leaps out of the water, as in the topmost figure of our plate, it is said to "breach"; when a fin is shown out of the water, as in the two right upper figures, the action is termed "finning"; while, when the flukes alone are exposed, as on the left side of the plate, it is called "lob-tailing."

Distribution. Humpbacks are found in nearly all seas, and at present it appears impossible to distinguish more than a single species, although some writers maintain that the one inhabiting the Persian Gulf is distinct from the common form. Although they are said to be not uncommon off the eastern coast of Scotland during the summer, but few examples have been taken in the British Seas. One was, however, captured at Newcastle in 1839, a second at the mouth of the Dee in 1863, a third in Wick Bay, Caithness, in 1871, and a fourth in the Tay during the winter of 1883–84.



HUMPBACK WHALES DISPORTING.

Habits. As regards the habits of the humpback, Captain Scammon states that this whale generally prefers "to feed and perform its uncouth gambols near extensive coasts or about the shores of islands, in all latitudes between the Equator and the frozen oceans, both north and south. It is irregular in its movements, seldom going a straight course for any considerable distance; at one time moving about in large numbers, scattered over the sea as far as the eye can discern from the masthead, at other times singly, seeming as much at home as if it were surrounded by hundreds of its kind, performing at will the varied actions of 'breaching,' 'rolling,' 'finning,' 'lob-tailing,' or 'scooping,' or, on a calm sunny day, perhaps lying motionless on the molten-looking surface, as though life were extinct." On the coasts of Norway, although generally found in small numbers, Mr. Collett states that it is occasionally very numerous—so much so that in one instance a steamer had to exercise great care in steering, in order to avoid coming into collision with these whales. They were met with in great profusion by Captain Gray in 1880 to the north of Ireland, accompanied by numbers of the lesser fin-whales. Two young are frequently produced at a birth.

Products. The amount of oil yielded by a humpback is very variable, a female with a large young one having scarcely any blubber. Captain Scammon states that he has known the amount of oil taken from some individuals not to exceed eight or ten barrels, while in others the yield has been as much as seventy-five.

Fin-Whales, or Rorquals.

Genus *Balænoptera*.

The remaining living representatives of the whalebone whales are known as fin-whales, or rorquals, or sometimes fin-backs or razor-backs, and include four well-defined species. These whales are distinguished from the humpback by their more elongated and slender form and proportionately smaller head, which measures from one-fifth to one-fourth the total length, and also by the comparative shortness of their flippers. The latter are narrow and pointed, and vary from one-seventh to one-eleventh of the total length. The small and recurved back-fin is placed about two-thirds of the distance from the head to the flukes, and the latter are smaller than in the humpback. The whalebone is short and coarse, and the lateral line of the mouth is consequently nearly straight, and does not rise above the level of the eye.

Fin-whales are the most common and widely distributed of all the larger Cetaceans, and are far more active and speedy in their movements than right-whales; and since their yield of blubber is relatively small, while the shortness and inferior quality of their whalebone renders it of much less value than that of the right-whales, they were formerly but little molested by whalers. The yearly increasing scarcity of the Greenland whale, and the enormous advance in the price of whalebone, coupled with the invention of harpoon-guns, which renders the capture of these animals far less difficult than in the old days, have, however, led to both humpbacks and finners being regularly hunted. Fin-whales are found in nearly all seas except those of the Antarctic regions, and the four well-defined

species have an almost cosmopolitan distribution; but there is some evidence that the Indian seas possess two other species with a much more limited distribution.

Most of the fin-whales feed mainly on fish, the larger species consuming an enormous quantity of cod.

Lesser Fin-Whale.

The smallest representative of the group is the lesser fin-whale, or rorqual (*Balænoptera rostrata*), frequently known, from its pointed muzzle, as the pike-whale. It is represented in the accompanying figure. The average length of this species varies from 25 to 30 feet, and a length of 33 feet is but very seldom exceeded. The general colour of the upper-parts is greyish black, while the whole of the under surface, inclusive of the flukes, is white. The most distinctive characteristic of the species is, however, the broad band of white running across the upper part of the outer surface of the flippers, which forms a striking contrast to the black of the remainder. The flippers measure about one-eighth the entire length of the animal, and the number of pairs of ribs is eleven. The whalebone is nearly white.

This whale is by no means rare on the British coast; and an example was captured off the Scilly Islands so lately as 1887, while two were taken in the Firth



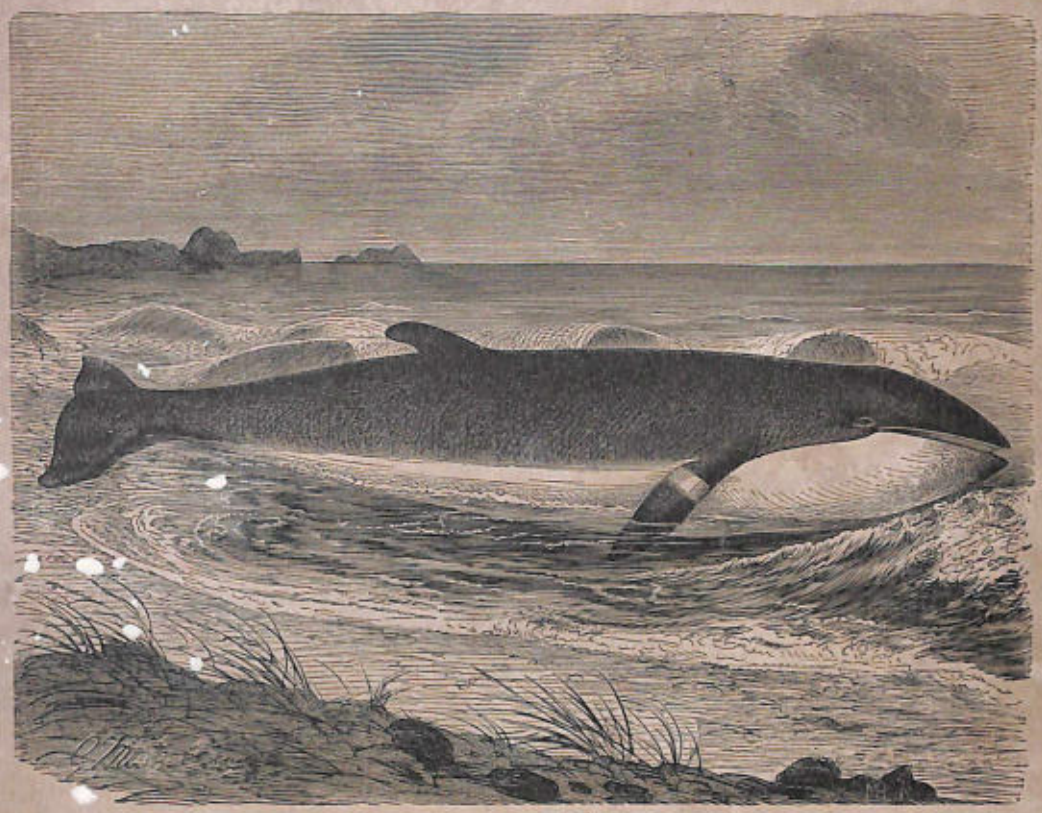
SKELETON OF FIN-WHALE.

of Forth in the year following. It is more common on the shores of Norway, where it is frequently captured in the bays and fjords; the natives stretching a net across the mouth, after one or more whales have entered, and then despatching them with spears. Its habits in North American waters, where it is known as the sharp-nosed finner, are described by Captain Scammon. He writes that this whale "frequently gambols about vessels when under way, darting from one side to another beneath their bottoms. When coming to the surface, it makes a quick, faint spout, such as would be made by a suckling of one of the larger Cetaceans, which plainly accounts for whalemen taking it to be the young of more bulky species. At sea the sharp-headed finners are seldom seen in pairs, but wander solitarily along, frequently changing their course in the depths below, and meandering along the whole continental coast of the North Pacific, occasionally visiting the large estuaries about the shore. They pass through Behring Sea and Strait into the Arctic Ocean where they appear to be as much at home as their superiors in size." The writer then goes on to say that, like the Pacific grey whale, "they thread the icy floes, and frequently emerge through the narrow fissures bolt upright, with their heads above the broken ice, to blow. When roaming about the inland waters of lower latitudes, they often shoot along the shallow waters of the bays in search of the myriads of small fry on which they mainly sustain themselves."

Eden's fin-whale (*B. edeni*), from the Indian seas, is only known by skeletons, and appears to be closely allied to the present species, but attains somewhat

larger dimensions, and is believed to have a few more vertebræ in the backbone.

Rudolphi's Fin-Whale. The next species in point of size is Rudolphi's fin-whale (*B. borealis*), which attains a length of from 40 to 45, or occasionally as much as 52 feet. In colour it is bluish-black above, with oblong white spots, while the under-parts are more or less white; the under-surface of the flukes, as well as both sides of the flippers are, however, coloured like the back. The back-fin is smaller, and placed further back than in the lesser finner: while the



THE LESSER FIN-WHALE (1/5 nat. size).

flippers are very small, equalling only one-fourteenth of the total length. There are thirteen pairs of ribs; and the whalebone is black.

This species is much rarer than the other rorquals, and does not appear to have been recorded from the Pacific. It ranges as far south as Biarritz, and migrates northward in summer as far as the North Cape; and either this or a closely-allied species occurs in the seas around Java. Of specimens recorded from the British Islands, the first was stranded on the shores of the Firth of Forth in 1872; the second was caught in the river Crouch, in Essex, in 1883, a third in 1884 in the Humber, a fourth in the Thames at Tilbury in 1887, and a fifth in the Medway in 1888. On the coasts of Finmark the numbers of this whale are very variable, and while it is a constant summer visitor on the Western seas, it only occasionally

resorts to these on the East. In 1885 the coasts of that country were visited by enormous numbers of this species, while the larger finners and humpbacks which usually resort there did not appear at all; and during that summer no less than 771 specimens were killed.

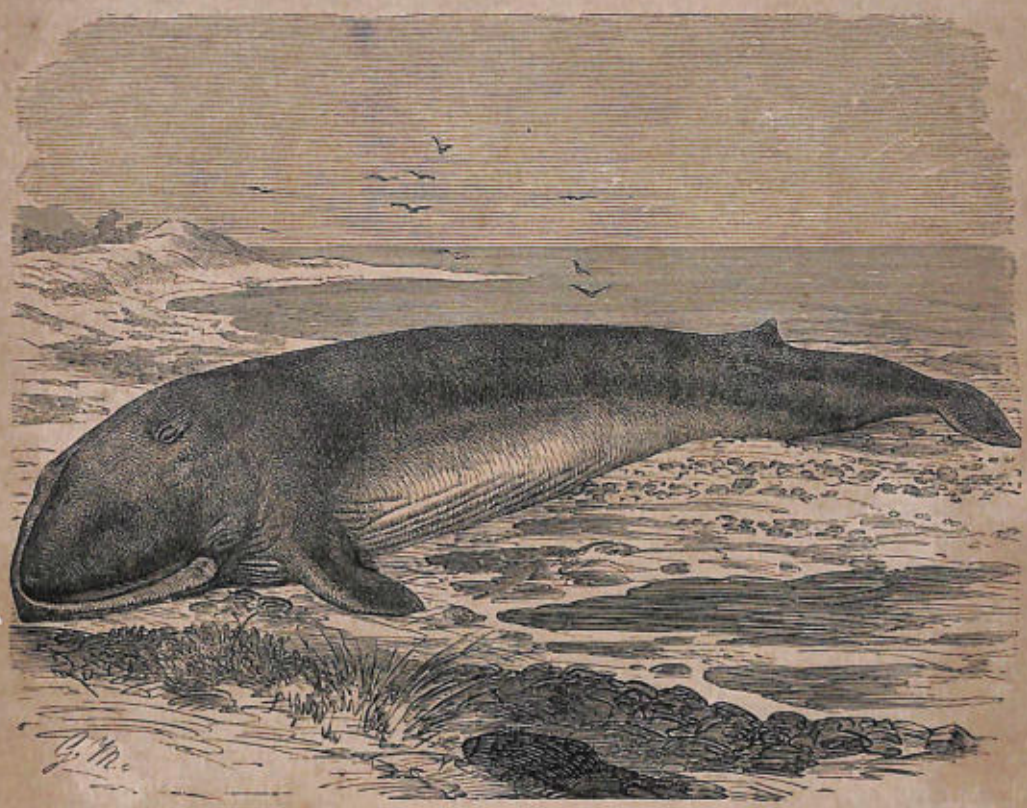
Rudolphi's whale, according to the observations of Mr. Collett, differs from the other finners in feeding entirely on minute crustaceans, never touching fish; and, in accordance with this difference in its diet, the edges of its whalebone are more frayed out and curling than in the other species. On the Finmark coast these whales appear sometimes singly, but more generally in schools of varying size, which may occasionally include some fifty individuals. When migrating, or not engaged in feeding, they swim rapidly, and do not require to breathe so frequently as the other species. When they come up to blow, they make but one or two respirations, while the others take five or six. When swimming under water, their course can be traced by the bubbles of air continually rising to the surface; and when gorging on the swarms of crustaceans found in the northern seas these whales swim quite slowly, with the muzzle and half the back above water. Rudolphi's whale never appears to utter any sound; and is timid and inoffensive in disposition. The occasional accidents that happen to boats engaged in the pursuit of this whale appear to be caused unintentionally during the death-throes of the animals. As a rule, but a single young is born at a time, but Mr. Collett records one instance of twins. The whalers of Finmark believe that this whale, like the two larger species of the genus, can remain under water when resting for upwards of eight or twelve hours; such periods of repose often occurring at particular hours of the day. Mr. Collett states that the yield of oil varies from fifteen to thirty barrels, and that the value of one of these whales ranges from £27 to £33, or about half that of the common fin-whale.

Common Fin-Whale. The common fin-whale, or rorqual (*B. musculus*) averages from 60 to 65 feet in length, and rarely exceeds 70 feet. It is very elongated in form, with moderately long jaws; the flippers measuring one-ninth of the total length. The colour of the upper-parts and the left side of the lower jaw is slaty grey; while the right side of the lower jaw and the under-parts, including the inferior surface of the flukes and flippers, are white. The whalebone is slate coloured at the ends, with the first two or three rows white.

The common rorqual is found rarely in the Mediterranean, but abundantly throughout the more northern seas of Europe, ranging as far as the 70th or 75th parallels of latitude. It is likewise widely distributed in American waters, where it is commonly known as the fin-back; and it appears that the so-called southern fin-whale of New Zealand is not specifically separable. It is not uncommon off the British coasts, two dead specimens having been found floating in the Channel in 1885, while another was stranded at Skegness in 1887.

The common fin-whale swims with great rapidity and strength, being second in this respect only to the next species; and is consequently taken with difficulty, except when explosive harpoons are used. Its habits appear to be generally very similar to those of the lesser fin-whale; and it is described as playing around vessels under way in the same manner. These whales are frequently found alone, but occasionally assemble in schools of from ten to fifteen or twenty individuals.

When these animals come up to breathe, they inhale the air so rapidly as to produce a sharp sound which may be heard at a considerable distance, and is said to be perfectly distinguishable from that produced by any other species. When about to descend, Captain Scammon says that this finner "assumes a variety of positions, sometimes rolling over nearly on its side, at other times rounding, or perhaps heaving, its flukes out, and assuming nearly a perpendicular attitude. Frequently it remains on the surface, making a regular course and several uniform 'blows.'"



THE COMMON FIN-WHALE, FROM A STRANDED SPECIMEN ($\frac{1}{15}$ nat. size).

The food of the species is mainly fish; and the quantity of cod it consumes is enormous.

Sibbald's Fin-Whale. The gigantic Sibbald's fin-whale (*B. sibbaldi*)—the 'sulphur-bottom' of the American whalers—enjoys the distinction of being the largest of living animals. It is a somewhat stouter-built species than the last, and commonly attains a length of from 70 to 80 feet, and occasionally reaches 85 feet, or perhaps more. The general colour is dark bluish grey, with some white spots on the chest, the lower edges and under surface of the flippers being white. In American specimens at least, there is, however, a more or less marked yellowish tinge on the under surface of the body, which has given origin to the popular name. The flippers are longer than in either of the other species, measuring one-seventh of the entire length; and the jaws are also of more than usual proportionate size. The back-fin is small, and situated comparatively near the tail. The whale-

bone is black; and there are usually sixteen pairs of ribs, against fifteen in the preceding species.

This finner has a wide distribution, and in the northern hemisphere, after passing the winters in the open sea, migrates northwards in the spring towards the coasts for the purpose of breeding. In the Bay of Bengal and Arabian Sea, Sibbald's whale is represented by a closely-allied species or variety (*B. indica*), which attains a length of upwards of 90 feet, and is said to have a somewhat more slender lower jaw than the European form. Whether this whale be a distinct species, or, as is more probable, a local race, it differs somewhat in habits, as it has been observed in the warm Indian seas during the summer months when the true Sibbald's whale is visiting the cool shores of Norway. In the Pacific this species is to be found at all seasons on the coasts of California, thus tending to show that the Indian finner is not specifically distinct. Examples of Sibbald's whale have been taken in the Firth of Forth.

During the period of their sojourn on the Norwegian coasts, these whales subsist exclusively on crustaceans, and when in pursuit of these small creatures they may frequently be seen swimming on their sides. At other times, however, they feed largely on sardines, sprats, and other fish. When near the shore, they may sometimes be seen playing around vessels at anchor, but as a rule they do not exhibit the same boldness as the common rorqual, although they will occasionally follow in a ship's wake for long distances. In one instance it is recorded that a whale of this species, in spite of having been repeatedly fired upon, pursued a vessel for upwards of twenty-four days. Sibbald's whale is considered to be the fastest of all the larger Cetaceans; it but seldom "breaches," yet when it does so, it exhibits its splendid proportions and its marvellous activity to the fullest degree. Captain Scammon writes that, "in contemplating this, the greatest whale of the ocean, one can but admire its prominent characteristics, which are its enormous, yet symmetrical proportions, and the muscular development which enables it to excel in velocity all its congeners, while its whole bearing indicates its superiority to all the other Cetaceans. It glides over the surface of the ocean, occasionally displaying its entire length. When it respires, the volume of its vaporous breath ascends to a height which reveals at once to the observer the presence of that leviathan of the deep, whose capture baffles the practical skill of the most experienced whalers. When 'rounding' to descend to the depths below, it throws its ponderous flukes high above the waves, with a swoop that is well in keeping with its matchless strength and vigour." The invention of explosive harpoons propelled from powerful guns has now rendered the capture of Sibbald's whale a comparatively easy task, and it is regularly hunted from the factory at Hammerfest. A specimen measuring 85 feet in length yielded ninety barrels of oil.

Fossil Fin-Whales. The Pliocene deposits of Belgium and the eastern coast of England yield remains of several kinds of fin-whales, and likewise of a humpback, all of which appear to be more or less closely related to the various living species. Other whales from the Pliocene deposits of Europe constitute an extinct genus—*Cetotherium*—which, while evidently nearly allied to the rorquals, exhibits certain peculiar features in the structure of the skull whereby it departs less widely from the ordinary mammalian type.

CHAPTER XXX.

CETACEANS,—*continued.*

THE TOOTHED WHALES, OR ODONTOCETES.

THE whole of the remainder of the existing Cetaceans form a group distinguished from the preceding one by the absence of whalebone, and the presence of permanent teeth in at least the lower jaw. This group, comprising existing families, is known as the *Odontoceti*, or Toothed Cetaceans, in contradistinction to the *Mystacoceti*, or Whalebone Whales.

In addition to the presence of teeth, the group is also characterised by the following distinctive features. The two nostrils unite before they reach the surface, and thus open by a single aperture, which usually takes the form of a crescentic valvular slit placed transversely to the long axis of the head. In the skull the bones of the upper surface are arranged unsymmetrically on the sides; the nasal bones in existing forms being reduced to nodules, taking no share in roofing over the cavity of the nostrils. The two branches of the lower jaw are nearly straight, and of great vertical extent behind, while in front they come in contact with one another by flattened surfaces of larger or smaller extent, as is ordinarily the case among mammals. The ribs are more firmly joined to the rest of the skeleton than in the whalebone whales, several of the anterior pairs articulating with the bodies as well as with the horizontal transverse processes of the vertebræ, while below they are joined to the breast-bone by the intervention of so-called chest-ribs; the breast-bone itself usually consisting of several distinct portions, placed one behind the other. In all cases the flippers have five digits.

SPERM-WHALES AND THEIR ALLIES.

Family *PHYSETERIDÆ.*

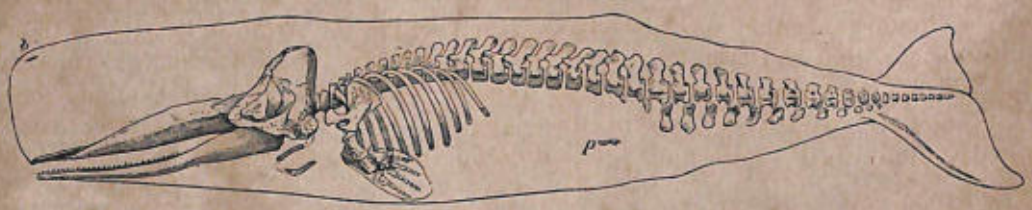
The well-known gigantic sperm-whale is the typical representative of a family characterised by the total absence of any functional teeth in the upper jaw; those of the lower jaw being either numerous or reduced to a single pair. These characters are sufficient to distinguish the members of this family from those of the two others now existing, but it may be added that the skull is much elevated in the hinder region, so as to form a high prominence or crest behind the aperture of the nostrils.

The members of this family include the largest of the toothed Cetaceans, and the whole of them are exclusively oceanic in their habits; their food consisting mainly or solely of squids and cuttles.

The Sperm-Whale.

Genus *Physeter*.

The sperm-whale, or, as it is frequently called from its French title, cachalot (*Physeter macrocephalus*), is one of the largest of the Cetaceans, fully rivalling in size the Greenland whale. As with many other species, its dimensions have, however, been considerably exaggerated; although, on the other hand, it is quite probable that when the species was more abundant than at present, some individuals attained a size which is now never reached. Be this as it may, the male sperm-whale is definitely known to attain a length of from 55 to 60 feet; but females are said not to reach much more than half these dimensions, while their form is proportionately more slender. The essential generic characteristics of the sperm-whale are to be found in the great proportionate size of the head, which equals about one-fourth of



SKELETON OF SPERM-WHALE.

the total length of the animal, and in the number of the teeth being from twenty to twenty-five on each side of the lower jaw.

Form. In appearance the sperm-whale is ungainly and ugly in the extreme, this being chiefly due to the great height and abrupt truncation of the enormous muzzle, upon the summit of which is situated the S-shaped aperture of the nostrils, somewhat to the left of the middle line. The mouth, which is of great length and capacity, opens below, and at some distance behind the extremity of the muzzle. On the upper surface of the skull, as seen in our figure of the skeleton, is a huge cavity, bounded behind by a tall vertical wall of bone; this cavity being filled in the living animal with the substance known as spermaceti, of which more anon. In front of this hollow protrudes the long rostrum of the upper jaw; the gum of which contains rudimentary teeth. The lower jaw is very long and slender; its two branches being united in the middle line for about half their total length. The teeth are implanted in the lower jaw in a long groove, partially divided into sockets by incomplete bony partitions. These teeth are of large size, and, when unworn, are pointed and recurved at their tips. They are composed solely of ivory, and the pulp-cavity at their base remains open for a long period, although generally more or less completely closed in adult life, when the whole base of the tooth becomes much flattened from side to side. The tongue and interior of the mouth are of a glistening white colour; and the diameter of the throat is very large. The eye is placed somewhat above the angle of the mouth, and a short distance behind it is the minute aperture of the ear, which is said not to exceed a quarter of an inch in diameter.

At the junction of the head with the body there is a distinct prominence in the middle line of the back; while half-way between this and the tail, is a larger projection, followed by a number of smaller ones, and technically known as the "hump." There is no back-fin. The flippers are placed a little behind and below the eyes, and seldom exceed 6 feet in length by 3 in width; while the maximum diameter of the flukes is about 15 feet. In colour the sperm-whale is generally either black or blackish brown on the upper-parts, becoming rather lighter on the sides and under surface, and passing into silvery grey on the chest. Occasionally, however, piebald individuals are met with; and old males frequently become grey in the region of the muzzle and crown of the head.

Distribution. The sperm-whale is essentially an inhabitant of the open seas, the individuals that appear on the British coasts being either stragglers or such as have been carried after death by the Gulf Stream. The range of the species extends over all the warmer oceans, but does not include the polar seas; and that the sperm-whale is in the habit of travelling immense distances is proved by the circumstance that specimens have been killed in the Atlantic bearing in their bodies spears that had been fixed there during a sojourn in the Pacific. Formerly, this whale was much hunted in the Bay of Bengal and around Ceylon; but it is now comparatively rare in these regions, while its numbers have been greatly diminished by constant persecution in its favourite haunts in the South Pacific.

Size. Captain Scammon states that a very large sperm-whale, captured off the Galapagos Islands in 1853, yielded eighty-five barrels of oil. This quantity was, however, exceeded by one caught in the year 1817 in the same region by the ship *Adam*, belonging to a great-uncle of the present writer; the yield in that case being one hundred barrels. A tooth taken from this whale is stated by Sir R. Owen, to have measured 9½ inches in length, and 9 in girth, with a weight of 3 lbs.; and there is another nearly equally large tooth in the British Museum which formerly belonged to the writer, and not improbably came from the same whale. As no sperm-whales killed at the present day have teeth of these dimensions, it seems not improbable that the old statements as to specimens of 80 feet in length, may not have been so far from the truth; and it is possible that the one killed by the crew of the *Adam* may have been the largest individual of which there is any record.

Habits. Sperm-whales are gregarious animals, and assemble in "schools," which in former days might comprise from fifteen to twenty to several hundred individuals. Although for a part of the year some of the largest and oldest males live by themselves, the "schools" generally comprise individuals of both sexes and all ages, and are led by two or three old males. The females display much solicitude for the safety of one another and likewise for that of their offspring; and when one female out of a party is killed, it is generally easy to capture several others. The young males, which are found associated together in herds at certain times of the year, are however, according to Captain Scammon, far less chivalrous in disposition, and will at once leave a wounded companion to its fate.

The sperm-whale, as recorded by Beale in 1838, is distinguished from all other

Cetaceans by the regularity with which it comes to the surface to breathe, although there is some variation in this respect according to age. "When emerging to the surface," writes Captain Scammon, "the first portion of the animal seen is the region of the hump, then it raises its head and respires slowly for the space of about three seconds, sending forth diagonally a volume of whitish vapour, like an



THE SPERM-WHALE ($\frac{1}{12}$ nat. size).

escape of steam; this may be seen from the masthead at a distance of three to five miles. In respiring at its leisure, the animal sometimes makes no headway through the water; at other times it moves quietly along at the rate of two or three miles an hour, or, 'if making a passage' from one feeding-ground to another, it may accelerate its velocity. When in progressive motion, hardly an instant is required for inspiration; when the animal dips its head a little and momentarily disappears, then it rises again to blow as before, each respiration being made with

great regularity. The number of its spoutings, when in a state of quietude, depends on the size of the animal. The same may be said as to the time it remains upon or beneath the surface of the ocean. With the largest bulls the time occupied in performing one expiration and one inspiration is from ten to twelve seconds, and the animal will generally blow from sixty to seventy-five times at a rising, remaining upon the surface of the sea about twelve minutes. As soon as 'his spoutings are out' he pitches head-foremost downward, then, 'rounding out,' turns his flukes high in the air, and, when gaining a nearly perpendicular altitude, descends to a great depth, and there remains from fifty minutes to an hour and a quarter." During the spouting there is no sound heard. When swimming in the ordinary manner, with the hump just showing above the surface, Beale believes that sperm-whale can attain a speed of about seven miles an hour, but when swimming with the head alternately in and out of the water he estimates the speed at from ten to twelve miles in the hour.

When at the surface, sperm-whales frequently indulge in what appear to be mere sportive gambols. At one time they will violently beat the water into foam with their flukes, this action being known to whalers as "lob-tailing," while at others they will leap completely out of the water. Beale states that the way in which the sperm-whale performs this action of "breaching" "appears to be by descending to a certain depth below the surface, and then making some powerful strokes with his tail, which are frequently and rapidly repeated, and thus convey a certain degree of velocity to his body before it reaches the surface, when he darts completely out. When just emerged and at its greatest elevation, his body forms with the surface of the water an angle of about forty-five degrees, the flukes lying parallel with the surface; in falling, the animal rolls his body slightly, so that he always falls on his side. He seldom 'breaches' more than twice or thrice at a time or in quick succession." It is added that the "breaching" of a sperm-whale is discernible at a distance of six miles from the masthead on a clear day. It is believed by some authorities that these actions of the sperm-whale are not gambols, but are undertaken to rid its body of certain parasites. If frightened, the animal can sink suddenly to the bottom, even when lying horizontally.

The female cachalot, according to Beale, breeds at all seasons of the year, and there is generally but a single young one produced at a birth, although twins are not unknown. At birth the length of the young sperm-whale is said to vary from 11 to 14 feet.

Food. The chief food of the sperm-whale consists of squids and cuttles, but considerable quantities of fish—comprising rock-cod, albicore, and bonito—are likewise consumed. All these different kinds of food are procured at a considerable depth below the surface of the water, but the mode of capture is at present unknown. It has indeed been suggested that, when below the surface, the whale remains stationary and drops its lower jaw nearly perpendicularly, thus revealing the glistening white interior of the capacious mouth. This, it is alleged, serves to attract the various animals upon which the creature feeds, and when a sufficient number have entered the trap, the lower jaw is suddenly closed. Although the suggestion is ingenious, it is one that scarcely admits either of proof or disproof.

Products and Hunting. The sperm-oil yielded by the thick layer of blubber investing the body, and the spermaceti contained in the cavity of the head, are the two products for which the sperm-whale is hunted; and since the former fetches a far higher price than ordinary whale-oil, this animal is one of the most valuable of all the Cetaceans. The spermaceti exists in the form of oil in the living animal, and is ladled out in buckets from the skull when the carcase is cut up. The spermaceti of commerce is produced by a process of refining. The use of this enormous mass of oil in the skull does not appear to be ascertained.

In addition to sperm-oil and spermaceti, the substance known as ambergris is also a product of the sperm-whale. It is not, however, usually taken from the animal, but is found floating in the sea, and has been ascertained to be formed in the intestines. This substance always contains a number of the beaks of the squids and cuttles upon which the whale has fed. Although formerly employed in medicine, it is now used exclusively in perfumery.

In the old days of sperm-whale-hunting (of which alone we shall speak) the vessels engaged in the trade were from three hundred to four hundred tons burden, and were equipped for a three years' voyage; their usual destination being the South Seas. They each had a crew of from twenty-eight to thirty-three officers and men, and carried six whale-boats. These boats were about twenty-seven feet in length, with a beam of four feet, and were built sharp at both ends. Four boats took part in the chase, each being furnished with a pair of two hundred fathom harpoon-lines, and carrying a crew of six men. The crew comprised a boat-steerer in the bow, four hands, and the headsman in the stern. It was the business of the boat-steerer to harpoon the whale, and when this was accomplished he changed places with the headsman, whose duty it was to kill the animal with the lances. When a whale was harpooned, immediately after its first struggles, and when it was lying exhausted from its endeavours to escape, the boat was pulled close alongside, and the headsman began the work of destruction by thrusting his lance into the vital parts behind the flipper. As soon as the whale was lanced, the boat was backed with all possible speed. When first struck the whale frequently "sounded," or descended to immense depths, sometimes taking out nearly the whole of the eight hundred fathoms of line carried by the four boats. Subsequently, however, when weakened by loss of blood, it kept on or near the surface, towing after it one or more of the boats. By hauling in the line, the boat or boats were once more pulled up alongside, and the monster finally destroyed either by darting or thrusting the lances.

Whaling, as thus carried out, was full of danger, and there are hundreds of accounts of hairbreadth escapes from death, and of feats of daring. In the southern seas Maories were not unfrequently shipped by British whalers as harpooners, and the following narrative of the daring of one of these men is related by Dr. A. S. Thomson in his *History of New Zealand*. "One morning," writes the narrator, "a lone whale was seen on the placid Pacific; the boat was pulled up to it, and the New Zealander, balancing himself on the gunwale, darted the harpoon at the creature and missed. After several hours' chase, under a tropical sun, the whale was approached a second time, and the New Zealander darted two harpoons at him, but again missed. Then the bitterest disappointment

arose among the tired boat's crew, which they expressed in curses deep and loud. These taunts maddened the Maori: and no sooner was the boat again pulled up to the whale than he bounded on the animal's back, and for one dizzy second was seen there. The next, all was foam and fury, and both were out of sight. The men in the boat shoved off, flung over a line as fast as they could, while ahead nothing was seen but a red whirlpool of blood and brine. Presently a dark object swam out, the line began to straighten, then smoke round the loggerhead, and the boat sped like an arrow through the water. They were fast, and the whale was running. But where was the New Zealander? His brown head was on the boat's gunwale, and he was hauled aboard in the very midst of the mad bubbles that burst under the bows."

When harpooned or lanced, females and young males generally make the most frantic efforts to escape; and being very active in their motions, give the most trouble to despatch. The larger whales, yielding eighty or more barrels of oil, being less active animals, are in most cases killed more easily. This is however, by no means always so; and there are many instances on record where large sperm-whales have turned with the utmost fury upon their pursuers, and destroyed every object that came in their way, either by blows from the enormous flukes, or by attacking with the head and lower jaw. There are, moreover, well-authenticated instances, not only of sperm-whales demolishing the boats of a whaling-ship, but actually attacking and sinking the vessel itself; and Captain Scammon thinks it probable that many ships which have perished without leaving any clue as to their fate, have been wrecked by these whales. In 1820 the *Essex* was destroyed in the South Pacific by an infuriated cachalot, which made two deliberate charges at the vessel, the first of which produced a considerable leak, while the second stove in the bows. Again, in 1851, the *Ann Alexander* was sunk in a similar manner off the Peruvian coast. Whether the ship *Union*, which was wrecked in 1807 by striking a sperm-whale in the night, was actually attacked by the animal, or whether this was a case of accidental collision, can never be ascertained. As an instance of the ferocity of these whales, it may be mentioned that in 1851, when the ship *Citizen* was whaling in the Atlantic, a wounded cachalot, after attacking and demolishing one boat, made for a second, from which it was only diverted by its attention being transferred to a third. This third boat only escaped with difficulty, and the whale thereupon headed straight for the vessel itself, which was then approaching under full sail. By putting the head before the wind, the rush of the whale was, however, avoided; and before the animal could gather itself for a second charge, it was seized with its death-throes and expired. In another case a sperm-whale, not content with having smashed a whale-boat, actually seized the timbers in its jaws and chewed them into match-wood.

Extinct Sperm-Whales.

Sperm-whales, belonging mostly to extinct genera, were abundant in the Pliocene period, their remains occurring in the crag deposits of England and Belgium, and likewise in Australia. Some of these forms (*Eucetus*) were of large size, and appear to have been allied to the living species; but others (*Scaldicetus*) were distinguished by having the summits of the teeth surmounted with a cap of grooved enamel. A third type is considered to be closely allied to the whale described below.

Lesser Sperm-Whale.

Genus *Cogia*.

The lesser sperm-whale (*Cogia breviceps*) is a little-known species, differing widely both in size and form from the sperm-whale; and more resembling a porpoise in both these respects. It agrees, however, with the sperm-whale in having no functional teeth in the upper jaw and a full series in the lower. The rudimentary upper teeth are reduced to a single pair, or may be wanting; and there are only from nine to twelve pairs of teeth in the lower jaw. These teeth, which are rather long and slender, with curved summits, differ from those of the sperm-whale in having a coating of enamel; and the two branches of the lower jaw are united for less than half their length. The upper surface of the hinder part of the skull is hollowed, with a thick elevated rim behind and at the base; and the rostral portion of the skull is shorter and more rapidly tapering than in the larger species. This whale attains a length of about 10 feet; and, as already said, is not unlike a porpoise in general appearance. The head is about one-sixth the total length, and has a bluntly-pointed muzzle, with the small mouth opening on the under surface, far behind the extremity. The back carries a large fin. The colour of this species is glistening black above, becoming paler beneath.



THE WATER-WORN SKULL, WITHOUT THE LOWER JAW, OF A WHALE ALLIED TO THE BOTTLENOSE.
(From Sir W. H. Flower, *Proc. Zool. Soc.*, 1882.)

The lesser sperm-whale is known only from a comparatively small number of individuals obtained from such widely-separated areas as the Indian and Australian seas, the Cape of Good Hope, and the North Pacific; and we may accordingly assume that it has probably an almost cosmopolitan distribution. Nothing has at present been ascertained in regard to its habits.

The Bottlenose-Whale.

Genus *Hyperoödon*.

The bottlenose-whale (*Hyperoödon rostratus*), which is one of the most common Cetaceans stranded on the British shores, is the first representative of a group of four allied genera distinguished from the sperm-whales by the functional teeth being reduced to a single pair, or in one case two pairs; these

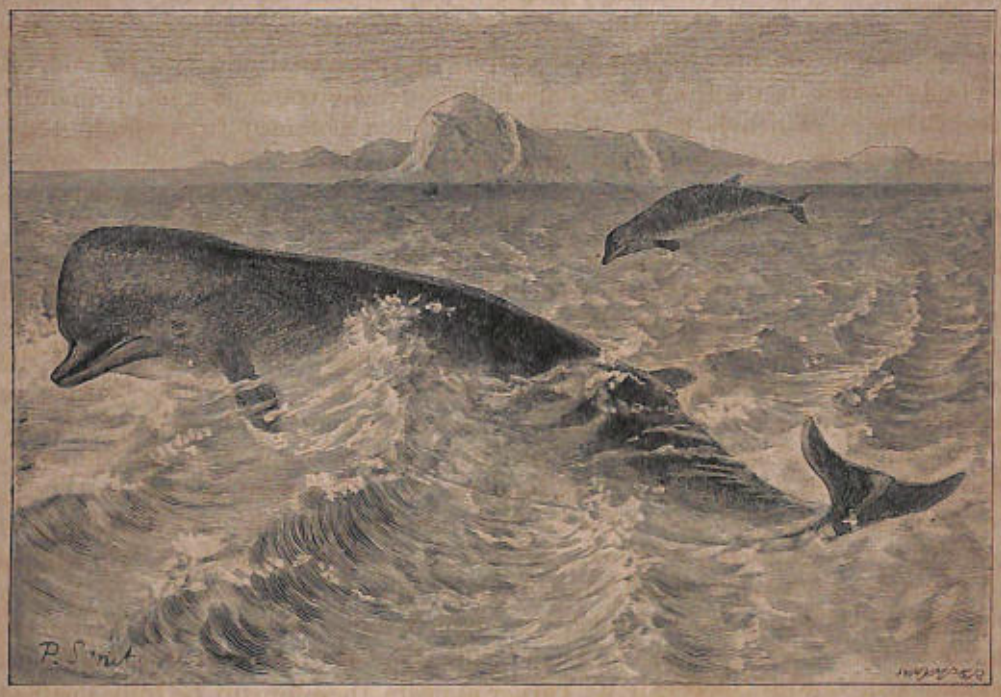
teeth, more especially in the males, sometimes attaining very large dimensions. The muzzle is produced into a longer or shorter beak or rostrum, behind which there is a marked and sudden elevation caused by the presence of a fatty cushion on the top of the head in front of the blowhole; the latter having a crescent-like form, and being situated in the middle line. With the exception of one species, the whales of this group are characterised by the (premaxillary) bones situated in the skull behind the opening of the nostrils being raised into a pair of crests overhanging the latter; these two crests, as shown in the accompanying figure, being unsymmetrically disposed, and one larger than the other. All the members of the group agree in having a curved back-fin, placed considerably behind the middle of the body; and they also display the common feature of possessing flutings in the skin of the throat, which are close together in front and diverge as they pass backwards.

Habits. Like the sperm-whales, the members of this group are inhabitants of the open sea, and feed almost entirely upon squids and cuttles. Except the bottlenose, most of them are known mainly by stranded specimens; and when any of these whales approach the shore, they seem to have no idea of saving themselves, but are almost invariably stranded. In this respect they resemble the sperm-whales; and it would thus seem that whales accustomed to live in the open seas and to seek their food at considerable depths, become confused and helpless when they reach the neighbourhood of a coast. Most of them go about in pairs or alone; but the bottlenose frequently associates in schools of considerable size.

Characters of Bottlenose. The bottlenose derives its name from the elevation of the upper surface of the head above the rather short beak and in front of the blowhole into a rounded abrupt prominence. The lower jaw has merely a pair of small conical teeth at the extremity, which in the living state are totally concealed by the gum. In the skull the crests behind the aperture of the nostrils are greatly developed; and in addition to these there are a pair of longitudinal bony crests lying on either side of the base of the beak, which in old males becomes of great size, with their front surfaces broad and flat. This excessive development of the crests in the adult males produces a great difference in the appearance of the two sexes when adult; the females (like the young) having the beak distinctly projecting, whereas in the males it is almost buried beneath the elevated and flattened surface of the upper part of the head, which has a disc-like form when seen from in front. The flukes are not notched. In length the male bottlenose may reach as much as 30 feet, but the female does not exceed 24 feet. The young individuals are black above, but with advancing age they gradually pass to a light brown tint; the under-parts being greyish white. Very old individuals turn almost yellow, with a white band round the neck, and the front of the head and beak also white.

Distribution and Habits. The bottlenose is a migratory species, confined to the North Atlantic. During the summer it ranges as far northwards as Spitzbergen, but how far southward it travels in winter is not yet ascertained. In the early autumn some specimens are usually stranded on the coasts of Britain, and the countries bordering the British Channel and North Sea; but none are recorded from the shores of Spain, Western France, or the Mediterranean countries. The

majority of such specimens, according to Sir W. H. Flower, are solitary and generally young individuals, although occasionally an adult female with her offspring is taken. The best account of the habits of the bottlenose is given by Captain D. Gray, of which the following is a summary. In the early spring these whales are to be met with occasionally after leaving the Shetland Islands, and thence northward to the borders of the polar ice, where they are more numerous. They also frequent the seas around Iceland, Greenland as far north as latitude 77°, Western Spitzbergen, and Davis Strait, and it is highly probable that they may range as far as Novaia Zemlia. Although they do not venture in among the ice itself, they frequent the open bays along its margin for the shelter thus afforded from the open sea. They



BOTTLENOSE-WHALE.

are generally to be found in herds comprising from four to ten individuals: but many different herds may be in sight at the same time. The adult males are frequently solitary: but sometimes one of them may be seen leading a herd. These whales exhibit little fear of ships, swimming around them, and beneath the boats, till their curiosity is satisfied. The herd remain around a wounded companion till its death, upon which they immediately desert. If, however, a second individual be harpooned before the death of the one first struck, and this process continued, a whole herd may be killed at once. They exhibit great endurance of wounds and tenacity of life, old males taking out from three hundred to four hundred, and occasionally as much as seven hundred, fathoms of line. Captain Gray describes their activity as very great, stating that they are able to leap out of the water many feet high in the air, and while so doing have time to turn their heads

to look about them. When descending, they re-enter the water head first, instead of falling helplessly on their sides like the larger whales. Their ordinary food, according to the same observer, consists of a bluish white cuttle-fish, 6 inches long and 3 inches in circumference, and pointed towards the tail. The stomachs of those whales that were examined contained nothing but remains of these cuttles. In their search after food it appears that the bottlenose-whales descend to great depths, as they remain under water for a long period, and blow very heavily upon reaching the surface. When wounded, they will sometimes remain below for as much as two hours at a time, after which they will come up apparently untired.

Products. The bottlenose yields spermaceti, and an oil very similar to sperm-oil and capable of being used for the same purposes. An adult male will produce about two hundred weight of spermaceti and two tons of oil. The protuberance on the front of the head of the female contains a small quantity of colourless oil which is twice the density of that obtained from the blubber; while in the male the same region is composed of solid fat.

A fossil bottlenose-whale, apparently closely allied to the living species, has left its remains in the Pliocene crag deposits of the eastern coast of England.

Cuvier's Whale. The rare Cetacean, known as Cuvier's whale (*Ziphius cavirostris*), differs from the bottlenose in having a pair of well-developed conical teeth at the extremity of the lower jaw, which are directed forwards and upwards. In the skull there are but slight indications of the longitudinal bony crests of the bottlenose; while the beak is longer and much more solid in structure, owing to the ossification of certain cartilages and their fusion with the adjacent bones. When viewed from above, their beak is triangular in form, gradually tapering from its broad base to its narrow extremity. A further point of difference from the bottlenose is to be found in the circumstance that only the first three, instead of the whole seven, of the vertebræ of the neck are united together. The colour is believed to be black above and white below. This whale appears to be known only from stranded specimens, which have been obtained from regions as remote from one another as the Shetland Islands, the Cape of Good Hope, Eastern South America, and New Zealand. Sir W. Turner appears, therefore, to be fully justified in his opinion that its distribution is as extensive as that of the sperm-whale.

The Beaked Whales.

Genus *Mesoplodon*.

The beaked whales derive their English name from the great development of the rostral portion of the skull, which is long and narrow, and formed of extremely solid and ivory-like bone; while they take their scientific title from the presence of a pair of teeth generally situated near the middle of each side of the lower jaw. Each of these two teeth is pointed and much flattened, sometimes being elongated into a strap-like form, so as to overhang the beak of the skull; their position is variable, but generally some distance behind the extremity of the jaw. The skull has the same curving crests over the aperture of the nostrils as in the bottlenose,

but has no sign of the longitudinal crests. Usually only the first two or three of the vertebræ are united together. The massive rostrum of the skull is not unfrequently picked up on the shores of regions where these whales are common; and similar rostra are among the commonest of Cetacean remains found in the Pliocene crag deposits of the Sussex and Essex coasts, thus indicating that beaked whales formerly abounded in the English seas. These rostra are, perhaps, the most solid bones found among the Vertebrates, their material being as dense as ivory. In some cases a row of minute functionless teeth are present in the upper jaw, and thus serve to show that the whales of this group are descended from ancestors possessing a full set of teeth in both the upper and lower jaws. In the Crag period seven species are recognisable; in these days the beaked whales are represented by at least two species; and they range over most seas, although they appear more common in the Southern than in the Northern Hemisphere. Nothing is known as to their habits.

Sowerby's Whale.

The best-known species of the genus is Sowerby's whale (*Mesoplodon bidens*), of which, according to Sir W. Turner, eighteen



SKULL OF SOWERBY'S WHALE.

specimens have been taken between the years 1800 and 1889 in the North Atlantic and its inlets, all but two of which occurred on the coasts of Europe. Seven of these were captured between 1880 and 1888; the one taken in 1885 having been stranded at the mouth of the Humber, and being the only known English example. The first specimen known to science was captured off the coast of Elgin in 1800. By its describer, after whom it is now named, it was then called the two-toothed cachalot, on account of the feature so well shown in our illustration.

This whale usually attains a length of about 15 feet, and its teeth are of comparatively small size, and sometimes only project slightly from the sides of the mouth when the jaws are closed. Above the nearly straight beak the head rises gently into a marked prominence in front of the blowhole, behind which is another prominence, with the level of its summit continued backwards into the line of the back. The opening of the ear is so small as to admit only of the passage of a fine bristle. In a specimen stranded in 1888 on the shores of the Firth of Forth the colour of the upper-parts was bluish slate, while that of the

under-parts was a light slate. The body was also marked with a number of whitish spots, which were most numerous on the sides; these spots being in some places connected by narrow streaks. Other individuals are described as being nearly black above, while in others the tint becomes more decidedly blue. A specimen captured at New Jersey in 1889 measured 12½ feet in length.

Whether Sowerby's whale ranges into the seas of the Southern Hemisphere is not definitely ascertained, although, as already mentioned, the genus is more abundantly represented there than to the north of the equator; and it is still a question whether many of the southern forms, to which separate names have been received, are entitled to rank as distinct species, or whether they should be regarded as merely varieties of the European one.

Layard's Whale. Layard's whale (*M. layardi*), from the Cape of Good Hope and the seas of the other parts of the Southern Hemisphere, is, however undoubtedly a very well-marked species, characterised by the enormous development of the strap-like teeth, to which allusion has already been made. The late Prof. Moseley, in describing a skull of this species obtained at the Cape during the voyage of the *Challenger*, observes that "these two teeth in the adult animal become lengthened by continuous growth of the fangs into long curved tusks. These arch over the upper jaw or beak, and crossing one another above it at their tips, form a ring round it, and lock the lower jaw, so that the animal can only open its mouth for a very short distance indeed. The tusks are seen always to be worn away in front by the grating of the confined upper jaw against them. How the animal manages to feed itself under these conditions is a mystery. It is remarkable that the main mass of each tusk is made up of what appears to be an abnormal growth of the fang. The actual conical tooth, that is the original small cap of dentine [ivory] of the tooth of the young animal, which corresponds to the part of the teeth showing above the gum in other whales, does not increase at all in size, but is carried up by the growth of the fangs, and remains at the tips of the tusks as a sort of wart-like rudimentary excrescence." That these enormous teeth can be of no possible advantage to their owner appears perfectly clear; and they must probably be regarded as affording an instance of semi-monstrous development analogous to the one displayed by the tusks of the babirusa.

A specimen stranded at the Cape was said to be black above and white beneath, with the division between the two tints sharply defined. One measuring something over 16 feet in length yielded eighty gallons of oil of a superior quality. The species appears excessively rare; and the known examples have been stranded.

Arnux's Whale. The last representative of this group is Arnux's whale (*Berardius arnuxi*), from the New Zealand seas, which attains a length of about 30 feet. It differs from all the other forms in having two pairs of teeth near the front of the jaw; the first pair being placed close to the tip of the jaw and larger than the second pair. They are of moderate size, flattened from side to side, pointed at the tips, and inclined directly forwards. The skull lacks the high crests above the opening of the nostrils characteristic of the three preceding genera; and the long and narrow beak is less solidly ossified than in the beaked whales.

Ancestral Sperm Whales.

Family *Physodontidæ.*

Teeth of a whale from the Pliocene deposits of Europe, described under the name of *Physodon*, have been long known; but it is only recently that a specimen



SKULL OF THE PHYSODON.

from Patagonia has shown that teeth were present in both jaws. These whales seem, therefore, to represent a distinct family group, from which the existing forms have probably taken origin.

The Fresh-Water Dolphins.

Family *Platanistidæ.*

Three species of Cetaceans, two of which are entirely confined to fresh-water, while the third is estuarine, differ so markedly from all other living members of the order as to constitute a family by themselves. They are all of relatively small size, and agree with the true dolphins in having a numerous series of small teeth in both jaws. They differ from them in that the two branches of the lower jaw are united by more than half their length; while the head is marked off from the body by a slightly constricted neck. They are also characterised by the ribs articulating with the vertebræ in a manner very similar to that we have seen in ordinary mammals; and the whole of the vertebræ of the neck remain separate from one another.

In some respects these Cetaceans are less specialised than the other living representatives of the order, and are, therefore, probably more nearly allied to the ancestral stock. This leads Sir W. H. Flower to suggest that Cetaceans originated in fresh-water from land animals; but Mr. Blanford considers it more probable that

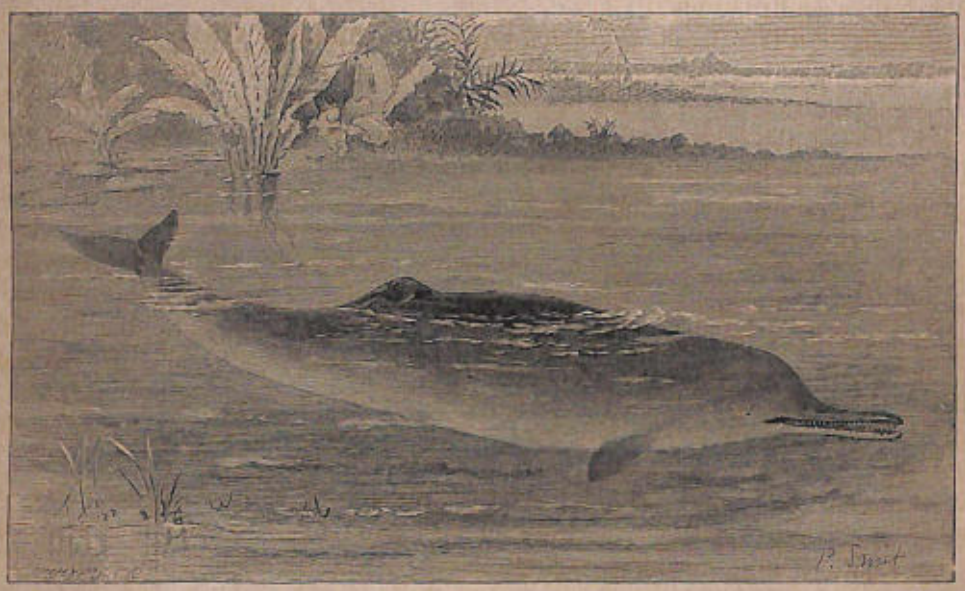
the existing fresh-water dolphins may have been derived from a family which was originally widely distributed and marine, and that they have managed to survive solely by having taken to a fresh-water life. The isolated distribution of the three living species is somewhat in favour of the latter view.

The Gangetic Dolphin. The Gangetic dolphin, or susu (*Platanista gangetica*) is the typical representative of the family, and inhabits the Indus, Ganges, and Bramaputra Rivers, with their larger tributaries, from the regions where they leave the mountains to the sea. It is characterised by its long and compressed beak, which is slightly enlarged at the extremity; by the back-fin being rudimentary and replaced by a low ridge; by the flippers being triangular and fan-shaped; by the eye being very minute and rudimentary; and by the blowhole forming a longitudinal slit. The conical and cylindrical teeth are rather large; and while they are sharply pointed in the young, in the adult they become much worn down by use. Towards the extremities of the jaws they are so closely placed as to be almost in contact with one another. The skull is characterised by the development of enormous crests at the root of the beak, which almost meet in the middle line above the latter. In the males the beak is much shorter than in the females; and there are generally about thirty teeth on each side of the jaws. The colour of the animal is blackish throughout. Females are larger than males; the usual length of adults varies from 7 to 8 feet, but a specimen from the Jumna is said to measure upwards of 12 feet.

Habits. The Gangetic dolphin is perfectly blind; and, indeed, as Mr. Blanford observes, sight would be perfectly useless to it in the turbid waters of the Indus at all seasons, and in the Ganges and Bramaputra at most periods of the year. It is never seen out at sea; but appears to be to a certain extent migratory in the rivers, since none are observed in the Hughli at Calcutta during the hot season from March to June, although they are commonly visible in the cold months from October to March. That they also remain in the tidal waters of the river during the rainy season from June to October is proved by the circumstance that they are then frequently caught in fishing-nets, although the animals rarely show themselves above water. "This fact," writes Dr. Anderson, to whom we are indebted for a full account of the habits of this interesting Cetacean, "may be accounted for on the supposition that the strength of the current is so great when the Hughli is full that the dolphin is prevented from rising to the surface in the marked manner it does during the cold weather, when the current has slackened and there are comparatively quiet reaches in which it can disport. The disturbed state of the river when it is swollen doubtless renders the presence of the dolphin very difficult of detection, for at such times it will simply expose its blowhole—too restricted a surface to be noticed on the troubled waters. In the cold weather its presence can easily be detected, without its being seen, by the blowing sound it makes when it rises to breathe; but, during the rains, the rush of water effectually drowns this means of becoming aware of its existence." This dolphin has been obtained one thousand miles above Calcutta; and its upward range appears to be only checked by the presence of rocky barriers and the diminishing depth of the water of the river, aided perhaps by the increasing lowness of the temperature of the latter.

Although this Cetacean does not collect in herds, several individuals may often

be observed within a small area in the more placid reaches of the Indian rivers. Dr. Anderson writes that "it is difficult to say whether the Gangetic dolphin confines itself to limited areas when there is no disturbing cause at work, such as the rains, leading it to disperse itself over other channels and branches of the river, which are not accessible to it in the dry weather. In rising to breathe, the platanista may either simply expose the upper surface of its head, sufficiently to bring its blowhole above water, or, what is more common, plunge out of the water upwards, forwards, and downwards, first exhibiting its long snout, followed by two-thirds of its back. At such times it emits a short, blowing sound, which doubtless has given rise to the term [susu] generally applied to it along the Ganges and Bramaputra. During the cold months, in the quiet reaches, it even becomes



THE GANGETIC DOLPHIN.

at times extravagant in its movements, and will leap altogether out of the water with the tail curved downwards. As a rule, however, its respiratory visits to the surface are leisurely executed. I have had the rare opportunity of narrowly observing the respiratory movements of this dolphin from having had one alive for ten days in captivity. In its place of confinement this individual rose slowly to the surface, exposing the blowhole and a portion of its back. The blowhole opened whenever it reached the surface of the water, the characteristic expiratory sound was produced, and so rapid was inspiration that the blowhole seemed to close immediately after the expiratory act, and then the animal slowly subsided. The respirations were tolerably frequent, occurring at intervals of about one-half or three-quarters of a minute, and the whole act did not take more than a few seconds for its fulfilment."

Food.

The food of the Gangetic dolphin consists principally of fish and prawns; many of the fish consumed by it being mud-haunting species

belonging to the cat-fish group (*Siluridæ*). These are doubtless captured by the dolphin probing for them in the mud with its long snout. The captive specimen above mentioned fed on the fish with which it was supplied only during the night, but careful observations made on these dolphins in their native state prove that they feed by day as well as by night. Sometimes they may be seen among the shipping in the Hughli at Calcutta, in search of their favourite prawns during the daytime. The grain which is sometimes found in the stomachs of these animals appears to be swallowed unintentionally.

Young. The young are born from April to July, and it is but very rarely that there is more than one at a birth. The period of gestation is believed to be from eight to nine months. It is said that the young will hold on by its mouth to the base of one of the flippers of its parent; but such a remarkable habit requires confirmation.

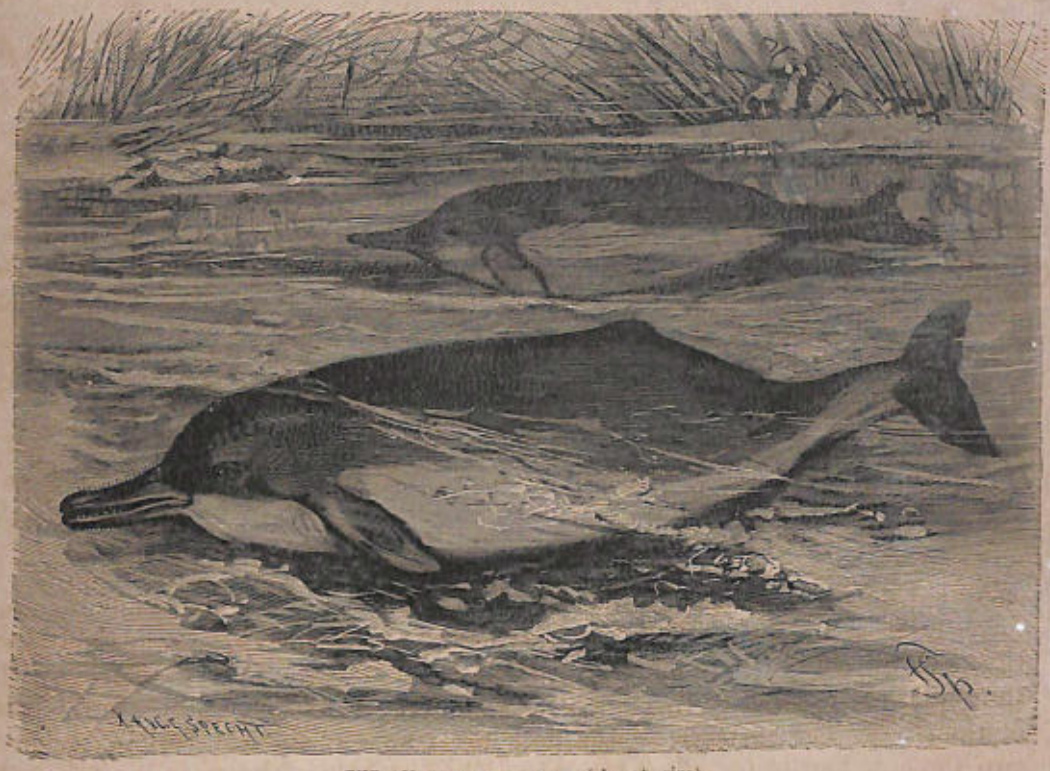
The Amazonian Dolphin. The fresh-water dolphin of the Amazons (*Inia geoffroyensis*) more resembles a porpoise in general appearance than the last species. The long cylindrical beak, which carries from twenty-six to thirty-three teeth on each side of the jaws, is peculiar in being furnished with a number of sparsely distributed bristle-like hairs. The teeth are characterised by having a distinct tubercle on the inner side of the base of their crowns; and the back-fin is represented merely by a low ridge. The males attain a length of about 7 feet, while the females are little more than half the size. In general, the upper-parts are blackish, and the under-parts reddish; but individuals are found which are either entirely blackish or wholly reddish. The eye is well developed; and the flippers have not the fan-like shape characterising those of the Gangetic dolphin. In the skeleton, the breast-bone is short and broad, and composed only of a single piece; while the horizontal transverse processes of the vertebræ of the hinder portion of the trunk are remarkable for their great width.

Distribution and Habits. The inia, or bouto, as the animal is called in various parts of South America, is entirely fluviatile, and inhabits the upper portions of the Amazons and its affluents; ranging over the area of country included between the 10th and 17th parallels of south latitude. In addition to the bouto, there are the other species of dolphins, belonging to the family *Delphinidæ*, found in certain parts of the Amazons. One of these, called the tucuxi (a species of the genus *Sotalia*), when it comes to the surface to breathe rises, according to Bates, horizontally, showing first its long, low back-fin. It then draws an inspiration, and finally dives gently, head-foremost, down. On the other hand, when the bouto rises, "the top of the head is the part first seen; it then blows, and immediately afterwards dips head downwards, its back curving over, exposing successively the whole dorsal ridge. It thus seems to pitch heels-over-head, but does not show the tail-fin. Besides this peculiar motion [which seems to be very similar to that of the Gangetic dolphin], it is distinguished from the tucuxi by its habit of generally going in pairs. Both species are exceedingly numerous throughout the Amazon and its larger tributaries, but they are nowhere more plentiful than in the shoaly water at the mouth of the Tocantins, especially in the dry season. In the upper Amazon, a third pale flesh-coloured species is also abundant.[1] In the broader

[1] *Sotalia pallida*, p. 62.

parts of the Amazon, from its mouth to a distance of fifteen hundred miles in the interior, one or other of the three kinds here mentioned are always heard rolling, blowing, and snorting, especially at night, and these impressions contribute much to the impression of sea-wide vastness and desolation which haunts the traveller."

As the native inhabitants of Amazonia have a great objection to kill the fresh-water dolphins, specimens are only procured with difficulty.



THE AMAZONIAN DOLPHIN ($\frac{1}{15}$ nat. size).

The La Plata Dolphin. The small La Plata dolphin (*Stenodelphis blainvillei*), from the estuary of the Rio de la Plata, differs from the preceding forms in the presence of a well-marked back-fin and the extreme elongation of the jaws, which carry from fifty to sixty teeth on each side. The blowhole, instead of forming a longitudinal slit, is crescent-shaped and placed transversely. In the skeleton the breastbone is long and composed of two distinct pieces. This species does not attain a greater length than 5 feet, and in some respects serves to connect the other members of the family with those of the one following.

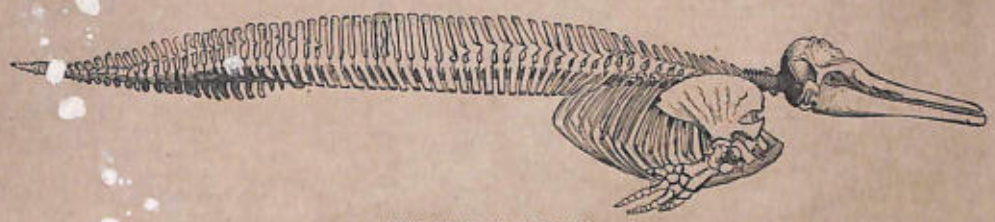
Allied Extinct Dolphins. The remains of a number of extinct dolphins have been discovered in the Tertiary deposits of various parts of the world, which appear more or less closely related to the existing members of this family. Among these, two species from Argentina, respectively named *Pontistes* and *Saurodelphis*, approach the living *Stenodelphis*; while a third (*Argyrodelphis*) from Patagonia is noteworthy from having the nasal bones well developed and roofing over the hinder part of the nasal cavity in the manner characteristic of whalebone whales.

More remarkable, however, is the occurrence of another nearly-allied form (*Iniopsis*) in the Tertiary of the Caucasus, which serves to confirm the view that the *Platanistidæ* were a very ancient and widely-distributed family. Numerous other extinct dolphins, some of which approach those of the next family, have been described from North America and Europe, and referred to the present group.

The Porpoises and Dolphins.

Family *Delphinidæ*.

The whole of the remaining members of the existing Cetacea, including those commonly known as narwhals, porpoises, grampuses, and dolphins, are referred to a single family, which contains a far greater number of species than any of the others. All the members of this family are of small or medium size, and, with the exception of the narwhal and Risso's dolphin, are furnished with a numerous series of teeth in both the upper and lower jaws, the jaws themselves being either



SKELETON OF DOLPHIN.

elongated or short. They are distinguished from the preceding family by the union between the two branches of the lower jaw being always considerably less than half the entire length of the jaw itself, and likewise by the manner in which the ribs are articulated to the backbone, as well as by certain features in the base of the skull. The vertebræ of the neck are generally characterised by the first two, three, or four being united together. The blowhole is always in the form of a transversely-placed crescent, with its two horns directed forwards.

Habits. The majority of the dolphins (as it is convenient to term collectively the whole of the members of the family) are of marine habits, but many of them frequent estuaries and ascend tidal rivers, while a few are more or less exclusively fresh-water. They have been divided into a considerable number of genera, but many of these are very closely allied, and mainly distinguished by differences in the skeleton.

The Narwhal.

Genus *Monodon*.

The strange-looking animal commonly known as the narwhal (*Monodon monoceros*) differs from all other members of the family by the enormous spirally-twisted tusk projecting from one side of the upper jaw of the male. This tusk is nearly always that of the left side, its fellow on the opposite side being only a few inches in length, and lying entirely concealed within the bone of the jaw, while in

the females both tusks remain in a similar rudimentary condition. The developed tusk of the male is composed solely of ivory, and its spiral twist always runs from left to right. In form it is cylindrical, and tapers more or less markedly from root to tip. Not unfrequently the tusk attains a length of from 7 to 8 feet, or more than half that of the entire animal. Very rarely narwhals are met with in which the right tusk is developed as well as the left, but there appears to be no known instance of the right tusk being developed while the left remains rudimentary; and it is noteworthy that when the right tusk is developed it has the same left-to-right



A SCHOOL OF NARWHALS (⅛ nat. size).

twist as its fellow. A fine narwhal's skull with two tusks is preserved in the Cambridge Museum. Apart from a few small rudimentary ones, which are irregular in their occurrence, the male narwhal has no teeth except the tusk, while the female—save for similar rudiments—is toothless.

Although the presence of the tusk in the male narwhal, and the practically toothless condition of the female, are alone sufficient to distinguish the genus from all other dolphins, it is necessary to say something further regarding the form and structure of this singular animal. In the first place, the narwhal belongs to a group of dolphins characterised by their blunt and rounded heads, in which the muzzle shows no sign of being produced into a beak. A special character of the animal is to be found in the absence of a back-fin, which is represented merely by a low and

ill-defined ridge. The flippers are short, wide, and rounded. In colour the narwhal is dark grey or dusky above and white beneath, the back and sides being irregularly mottled with various shades of grey. The entire length may vary from 12 to about 16 feet. A tusk measuring 8 feet in length had a basal girth of 7½ inches.

Distribution. The narwhal resembles the Greenland whale in being an inhabitant of the icy polar seas, and like that species is circumpolar in its distribution; it is, however, apparently local in its range, being, according to Captain Scammon, but rarely found in the seas accessible to the whalers who pass through the Behring Strait. Although seldom occurring to the south of the 65th parallel of north latitude, there are three instances (one in 1648, a second in 1800, and a third eight years later) of narwhals visiting the British coasts. From the extreme rarity of such occurrences, there is, however, no doubt that the individuals in question had been carried by currents out of their proper habitat. From constant persecution, the numbers of the narwhal have been greatly reduced in the more accessible portions of its habitat; and according to Baron Nordenskiöld, it is now never seen on the coasts of Novaia Zemlia. It is, however, more common at Hope Island, and large herds are reported from the seas between Spitzbergen and Novaia Zemlia. It is noteworthy that fossil remains of the narwhal have been found in the so-called forest-bed of the Norfolk coast,—a deposit laid down before the great cold of the glacial period, but when the temperature may have been steadily lowering, whereby Arctic animals were enabled to leave their more northerly haunts.

Habits. Of the habits of narwhals, unfortunately very little is known. They are generally found in small schools, comprising from fifteen to twenty individuals; and were described long ago by Scoresby as being extremely playful in their disposition. Much has been written as to the use of the characteristic tusk, but nothing very definite has yet been ascertained with regard to it. That it is not employed for the purpose of procuring food, is perfectly evident from the fact of its absence in the female. A more probable suggestion is that it is used by the males in combats among themselves for the possession of the females; in which case it should be regarded as a sexual appendage, analogous to the antlers of the deer. The food of the animal is stated to be mainly composed of cuttles and various crustaceans, together with small fishes. As a rule, but a single young is produced at a birth, but an instance of twins is on record.

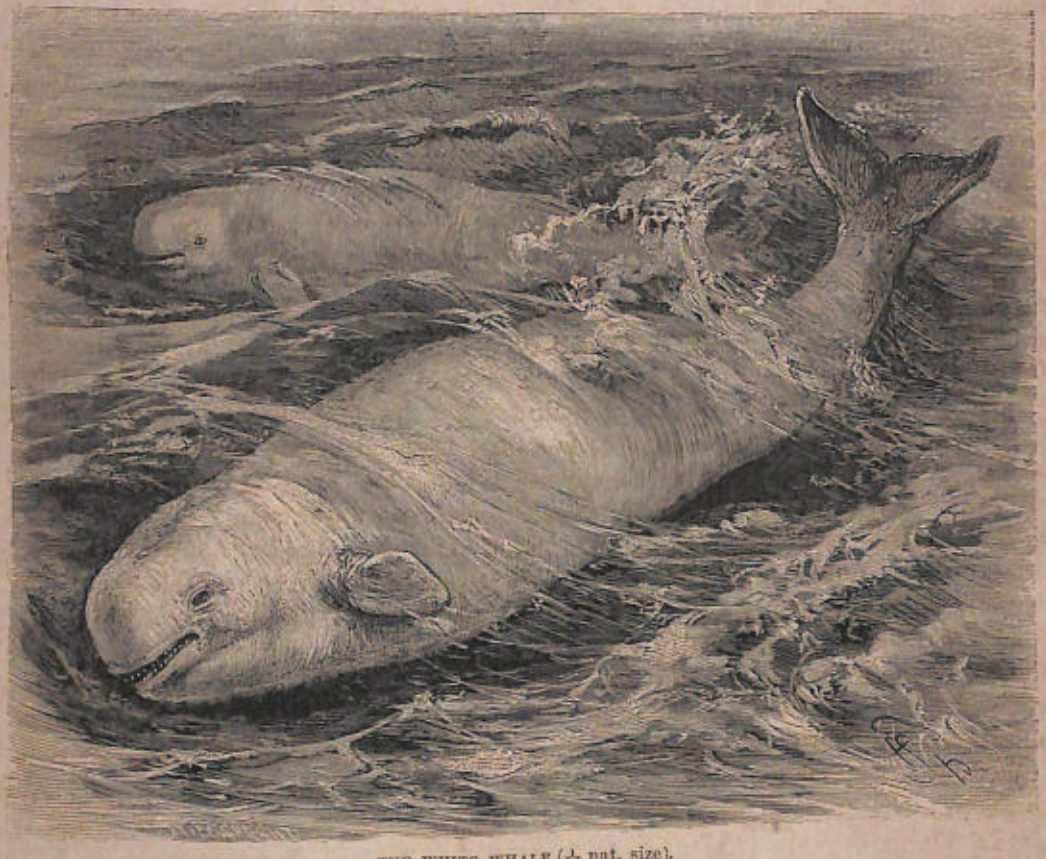
Products. The narwhal is valued both for its ivory and its oil; the latter being of superior quality to ordinary whale-oil. The ivory of the tusk is very dense in structure, and of a pure creamy-white colour; but since the tusk is hollow throughout the greater part of its length, its value is much less than it would be otherwise. The price of narwhal tusks, although very variable is, however, considerable.

The White Whale.

Genus *Delphinapterus*.

Nearly allied to the narwhal is the white whale, or beluga (*Delphinapterus leucas*), which is likewise an Arctic species. It resembles the narwhal in having

the back-fin represented merely by a low ridge; and it also agrees with that animal, and thereby differs from the other members of the family, in having all the vertebræ of the neck separate. The flippers are short, very broad across the middle, and bluntly pointed; and the short and rounded head is separated from the body by a slight constriction indicating the neck. The teeth are usually nine or ten in number on each side of the jaws; but vary in size, and are often irregularly and obliquely implanted. The white whale attains a length of 16 or 16½ feet. In colour the young are light greyish brown; but the skin of the adult is a



THE WHITE WHALE (1/7 nat. size).

pure glistening white. Baron Nordenskiöld says that the adult animal is singularly beautiful, the glistening white hide scarcely even showing a spot, scratch, or wrinkle.

Distribution. The white whale ranges as far northward as latitude 81° 35′, while it occasionally straggles as far southward as Cape Cod, in Massachusetts, and the Scottish coasts. It occurs in large herds on the coasts of Spitzbergen and Novaia Zemlia, and especially frequents the neighbourhood of the mouths of rivers, up which it will ascend for considerable distances. Five instances of the occurrence of this species on the coasts of Scotland have been recorded; the last of these being in the summer of 1879, when a specimen was found near Dunrobin, Sutherlandshire, at ebb-tide, with its flukes caught between two short

posts, to which a net was fastened. Near by lay a salmon, which the white whale was supposed to have been pursuing when it was caught in this manner.

Habits. In regard to its habits, Captain Scammon writes that, like most of the other members of the family, the white whale "is fond of gathering in troops, yet we have observed that it generally advances in lines of seldom more than two or three abreast, or more frequently in single file; spouting irregularly, and showing little of its form above water. When undulating along in this manner, it often makes a noise at the moment of coming to the surface to respire, which may be likened to the faint lowing of an ox, but the strain is not so prolonged. Sometimes these animals will gambol about vessels as porpoises do; but at the slightest noise upon the water, or at the discharge of firearms, they instantly disappear." This species is fairly rapid in its motions, more especially in pursuit of the fish which constitute its chief food. When pursuing fish like halibut and flounders, the beluga frequently enters shoal-water, in which it can scarcely float; but in such situations it is said to exhibit no alarm, and to make but slight efforts to reach deeper waters. In addition to fish, the white whale also consumes cuttles and various crustaceans.

In captivity the beluga is easily tamed, and exhibits considerable docility. A specimen was shown alive at the Westminster Aquarium in 1877, and another in 1878; but neither lived long.

Products. The white whale is killed for its blubber, flesh, and hide; a specimen measuring 16½ feet in length, yielded one hundred gallons of oil. To give some idea of the commercial importance of this animal, it may be mentioned that in 1871 the Tromsoe whalers captured no less than 2167 individuals, each of which was worth about £3; the catch that year appears, however, to have been considerably above the average. The Greenlanders dry the flesh for winter use, and in parts of Siberia the Eskimo dogs are mainly fed on this meat. The fat is considered a luxurious dish in winter. In Russia, white whale skin is used for reins and traces; and it is now imported in some quantities into England under the name of porpoise-hide. In some of the Siberian rivers, white whale are harpooned and lanced in the ordinary manner; but in other districts they are taken in nets from June to September.

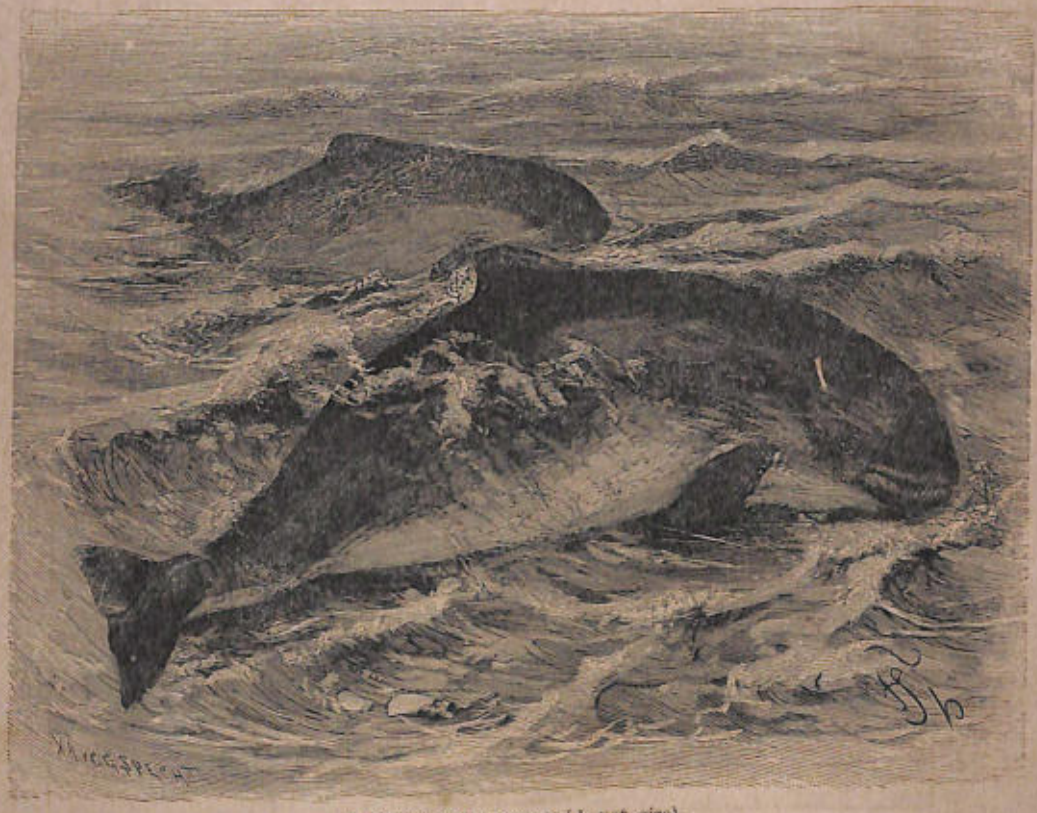
Porpoises.

Genus *Phocæna*.

The common porpoise (*Phocæna communis*), of the European seas, is the best-known representative of a genus readily distinguished from all the others by the characters of the teeth. These are from sixteen to twenty-six in number on each side of the jaws, and are very small, with flattened spade-like crowns separated from the roots by a distinct neck; sometimes the upper border of the crown is entire, but in other cases it is divided into two or three distinct lobes. In size, porpoises are small; and the head has a rounded muzzle, without a beak. There is generally a fin on the back, although this is wanting in one species. The skull has a very broad palate, and the union between the two branches of the lower jaw is very short. There are

frequently one or more rows of horny tubercles on the front edge of the back-fin, or of the ridge which takes its place.

Common Porpoise. The common porpoise is by far the best-known of all the Cetaceans frequenting the British coasts, generally keeping near the shores, and often ascending the larger rivers to considerable distances. It is characterised by having twenty-five to twenty-six teeth on each side of the jaws, by the sloping head, the equality in the length of the upper and lower jaws, and by the length of the mouth exceeding half that of the flipper. There is a large fin on the back, which is triangular in shape, and situated somewhat in advance of the middle of the total



THE COMMON PORPOISE (⅛ nat. size).

length of the animal. In length, the common porpoise measures about 5 feet, or rather more. The colour of the upper-parts is dark slate, or blackish, while the sides become gradually lighter till the colour fades into the pure white of the under-parts. In some cases there is a yellowish or pinkish tinge on the flukes.

Distribution. The distribution of this species is extensive, comprising the North Atlantic and North Pacific Oceans, the North Sea, and the coasts of Europe. In Davis Strait it extends as far northwards as latitude 67° or 69°, and it also occurs on the Alaskan coasts; while southwards it extends in America to the shores of New Jersey and Mexico. In the Mediterranean it is comparatively rare.

Habits. Porpoises associate in shoals or herds of considerable size; and their sportive gambols are probably familiar to most of our readers.

Few sights are, indeed, more interesting than to watch a shoal of these animals diving and sporting round a vessel, whether it be making rapid headway, or lying at anchor. At one moment will be seen the roll of the arched back, surmounted by the fin, as the porpoise swims along in a series of gentle curves; while at another the white belly will flash in the sunlight as the creature turns on its side, or leaps completely out of the water. In the ordinary undulating mode of swimming, the porpoise just brings its blowhole to the surface, breathes without checking its course,



PORPOISE DIVING.

and then dips downwards, to expose the back-fin in the manner represented in our second illustration; this elegant motion being continued without intermission. Throughout its course, the flukes are the propelling instrument; the flippers being laid close against the sides during the onward movement, and only spread out to check its speed when the animal desires to stop. The food of the porpoise apparently consists exclusively of fish; mackerel, pilchards, and herrings, being its especial favourites, although it also consumes salmon. On the British coasts porpoises may frequently be seen in pursuit of shoals of mackerel and herrings, and when thus engaged are often caught in the nets set for the latter. The pairing-season is said to be in the summer, and it is believed that the single offspring is

produced after a period of six months' gestation. Three porpoises which were enclosed by a fence in the Wareham River in Dorsetshire, many years ago, are reported to have incessantly uttered the most distressing cries, which were continued by night as well as by day.

Porpoise-Hunting. Formerly porpoises were esteemed in England for their flesh, but they are now taken mainly for their oil, although the skin is also sometimes used. The leather commonly known as porpoise-hide is, however, as we have already had occasion to mention, generally made from the skin of the white whale. On parts of the coast of North America, porpoise-shooting is regularly practised by the Indians; and this pursuit affords to the Passamaquody tribe their chief means of support. The average yield of oil will be about three gallons, and in a good season an Indian may kill from one hundred to one hundred and fifty porpoises. "To make a successful porpoise-hunter," writes Mr. C. C. Ward, "requires five or six years of constant practice. Boys, ten or twelve years of age, are taken out in the canoes by the men, and thus early trained in the pursuit of that which is to form their main support in after years. Porpoise-shooting is followed at all seasons and in all kinds of weather—in the summer sea, in the boisterous autumn gales, and in the dreadful icy seas of mid-winter. In a calm summer day, the porpoise can be heard blowing for a long distance. The Indians, guided by the sound long before they can see the game, paddle rapidly in the direction from which the sound comes, and rarely fail to secure the porpoise. They use long smooth-bored guns, loaded with a handful of powder, and a heavy charge of double-B shot. As soon as the porpoise is shot, they paddle rapidly up to him and kill him with a spear, to prevent his flopping about and upsetting the canoe after they have taken him aboard. The manner of taking a porpoise on board is to insert two fingers of the right hand into the blowhole, take hold of the pectoral fin with the left hand, and lift the creature up until at least one half of his length is above the gunwale of the canoe, and then drag him aboard. This is comparatively easy to accomplish in smooth water, but when the feat is performed in a heavy sea, one can hardly realise the skill and daring required. In rough weather, with a high sea running, the Indian is compelled to stand up in his canoe when he fires, otherwise he could not see his game. In such work as this, one would suppose that upsets would be unavoidable; but, strange to say, they seldom happen, and only under circumstances where the Indian's skill or foresight is unavailing."

Indian Porpoise. Although Mr. True believes that there are two other species of porpoise with back-fins inhabiting American waters, it will be unnecessary to allude further to them here; and we accordingly pass on to the Indian porpoise (*P. phocænoides*). This species is readily distinguished by the absence of the back-fin, and the reduced number of the teeth, of which there are about eighteen on each side of the jaws. Of small size, it is less than 4 feet in length, and is of a uniform black colour. It inhabits the shores of the Indian Ocean, from the Cape of Good Hope to Japan; and has been taken in many of the tidal rivers of India, and in the Yang-tse-Kiang, at a distance of nearly one thousand miles from its mouth.

Habits. The following account of the habits of this species is given by Mr. F. W. Sinclair, who states that it "frequents the tidal creeks,

not ascending very far, and the sounds among the reefs and islands. It feeds chiefly on prawns, also on small cephalopods and fish. It does not appear to herd in schools, more than four or five, being rarely, if ever, seen together. Usually it is solitary; the pairs seem to consist of female and calf, more often than male and female. The young (one in number) are born, apparently, about October. The roll of this porpoise is like that of *P. communis*. It does not jump or turn somersaults, and is, on the whole, a sluggish little porpoise." It appears to be found only in shallow water.

Heaviside's Dolphin.

Genus *Cephalorhynchus*.

Heaviside's dolphin (*Cephalorhynchus heavisidei*), from the Cape of Good Hope, is the typical representative of a genus which, according to Mr. True, includes four species, all inhabiting the warmer seas of the Southern Hemisphere. These dolphins are of small size, and remarkable for their peculiar coloration.



HEAVISIDE'S DOLPHIN.
(From True, *Bulletin of the U.S. National Museum*, 1889.)

The head is conical, without any distinct beak; and the teeth are small and sharp, varying in number from twenty-five to thirty-one on each side of the jaws. The back-fin is triangular or ovate; and, except in one species, the flippers have a characteristic elliptical form. The coloration is black above and white below; the white of the under-parts terminating posteriorly in a trident-shaped form, with the lateral prongs of the trident extending obliquely upwards on the sides. The total length of Heaviside's dolphin is about 4 feet; the number of teeth being from twenty-five to thirty. The white-fronted dolphin (*C. albifrons*), from New Zealand, is a rather larger species, with thirty-one teeth on each side. Nothing seems to be recorded as to the habits of these species.

The Irawadi Dolphin.

Genus *Orcella*.

The upper waters of the Irawadi River are tenanted by a rather large dolphin or porpoise (*Orcella fluminalis*), which, together with a closely allied species, or variety (*O. brevirostris*), from the Bay of Bengal and its estuaries, as well as Singapore and Borneo, constitutes a distinct genus. These dolphins are characterised by their globe-like head, without beak, and their comparatively few and small teeth, which occupy nearly the whole length of the jaws, and number from thirteen

to seventeen in the upper, and from twelve to fifteen in the lower jaw. In form the teeth are conical and pointed, and they are set close together; those in the front of the jaws of old animals being directed outwards. The back-fin is small and hook-like, while the flippers are of moderate size, broad at the base, and subovate in form. These dolphins attain a length of from 7 to 7½ feet, and are of a slaty or blackish colour. In the Irawadi dolphin the colour is pale slaty above and whitish below, with numerous irregular streaks on the sides; but in the one inhabiting the Bay of Bengal the colour is uniformly blackish without any streaks. The latter form, whether it be specifically distinct from the dolphin of the Irawadi, or merely a variety, appears never to ascend the rivers beyond the distance influenced by the tides, while the Irawadi dolphin never descends to the estuaries.

Habits. The following account of the habits of the Irawadi dolphin is taken from Dr. J. Anderson, who writes that it "has much the character of its marine fellows, being generally seen in small schools, which frequently accompany the river steamers, careering in front and alongside of them, as is the custom of the dolphins of the sea. Occasionally, however, a solitary individual may be observed, but this is the exception, as two or three are usually associated together, hence this may be considered as a gregarious form. In the defile below Bhamo, where the river runs for ten miles over a deep bed forty to sixty fathoms in depth, and from two hundred to five hundred yards in width, and defined by high, wooded hills on either side, numerous troops of dolphins may be observed passing up and down, rising every minute or two to the surface to emit the short blowing sound, which ends in the more feeble one of inspiration, and all night through this sound may be heard. They never leave the deep water; and when they rise to breathe (which they do in periods varying from sixty to one hundred and seventy seconds, although occasionally exceeded) the blowhole is first seen, then at the end of the inspiration the head disappears and the back comes into view, and is gradually exposed as far as the dorsal fin, but the tail-flippers are rarely visible. The act of breathing is rapid, so much so indeed that it requires a very expert marksman to take aim and fire before the animal disappears. I have observed some of them disporting themselves in a way that has never yet been recorded of Cetacea, as far as I am aware. They swam with a rolling motion near the surface, with their heads half out of the water, and every now and then fully exposed, when they ejected great volumes of water out of their mouths, generally straight before them, but sometimes nearly vertically . . . On one occasion I noticed an individual standing upright in the water, so much so that one-half of its pectoral fins was exposed, producing the appearance against the background as if the animal was supported on its flippers. It suddenly disappeared, and again, a little in advance of its former position, it bobbed up in the same attitude, and this it frequently repeated. The Shan boatmen who were with me seemed to connect these curious movements with the season—spring—in which the dolphins breed." The food of this dolphin apparently consists exclusively of fish. Dr. Anderson adds that "the fishermen believe that the dolphin purposely draws fish to their nets, and each fishing-village has its particular guardian dolphin, which receives a name common to all fellows of his school; and it is this superstition which makes it so difficult to obtain specimens of this Cetacean."

The Killer, or Grampus.

Genus *Orca*.

One of the largest, and at the same time the most ferocious, of all the dolphin family is the killer, or killer whale, frequently also known as the grampus (*Orca gladiator*). It is characterised as a genus by its large size, and the conical and depressed head, devoid of a beak. The back-fin is of great length, especially in the males; and the flippers are large and broadly ovate. The teeth (as shown in our figure) are comparatively few in number, varying from ten to thirteen on each side of the jaws, and are much larger than in any dolphins yet noticed, being often an inch or more in diameter, and having an oval-section. The coloration is striking, the upper-parts and fins being black, while the lower jaw, chest, and under-parts are whitish. The white area of the under-parts does not, however, extend to the flukes, but ends posteriorly in a trident, of which the lateral and shorter prongs extend obliquely upwards on the flanks. There is a large white streak above and behind the eye; and frequently at least a purple crescentic area extends across the back behind the fin. The killer attains a length of at least 20 feet.



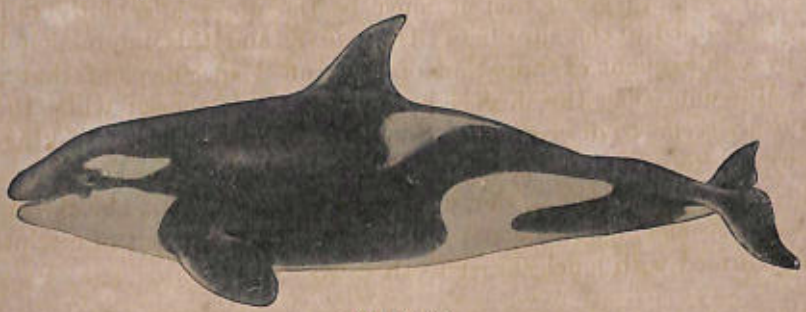
THE FIRST SIX UPPER TEETH OF THE KILLER. (From Sir W. H. Flower.)

Distribution. In spite of many nominal species having been recognised, there can be little doubt that the killer has a cosmopolitan distribution: ranging from Greenland in the north to the coasts of Australia in the south. Although chiefly keeping to the open sea, killers occasionally ascend tidal rivers: and three specimens were observed in the Thames in the spring of 1890. These individuals entered the river during the night, and on the following morning were seen swimming up and down the reach between Battersea and Chelsea Bridges. After continuing there for several hours, they at length headed for the sea, which they probably reached, as there is no record of their having been attacked.

Habits. When at sea, killers may always be recognised by their tall and nearly vertical back-fin. They generally associate in small parties, and subsist not only on fish, but likewise on the flesh of other members of their own order, as well as on that of seals. Captain Scammon writes that "the killers exhibit a boldness and cunning peculiar to their carnivorous propensities. At times they are seen in schools, undulating over the waves,—two, three, six, or eight abreast,—and, with the long, pointed fins above their arched backs, together with their varied marks and colours, they present a pleasing and somewhat military aspect. But generally they go in small squads,—less than a dozen,—alternately showing themselves above the surface of the water, or gliding just below, when nothing will be visible but their projecting dorsals; or they disport themselves by rolling, tumbling, and leaping nearly out of the water, or cutting various antics with their flukes. At such times, they usually move rapidly over the surface of the sea, and soon disappear in the distance." It appears that at times both the

long-finned males and the shorter-finned females may be found in the same school, while at other times the two sexes keep apart. The swiftness of the killer is very great, as it is able to overtake the smaller dolphins, which it swallows alive. Its voracity is apparently insatiable; Eschricht stating that one of these animals was known to swallow four porpoises in succession, while from the stomach of another individual, whose length did not exceed 16 feet, were taken fourteen seals.

Whales attacked by Killers. Like the other larger members of the order, the Greenland whale is sometimes attacked by a party of killers. Writing on the subject of these attacks Captain Scammon says that "three or four of these voracious animals do not hesitate to grapple with the largest baleen-whale; and it is surprising to see those leviathans of the deep so completely paralysed by the presence of their natural, although diminutive enemies. Frequently the terrified animal—comparatively of enormous size and superior strength—evinces no effort to escape, but lies in a helpless condition, or makes but little resistance to the assaults of its merciless destroyers. The attack of these wolves of the ocean upon their



THE KILLER.
(From True, *Bulletin of the U.S. National Museum*, 1889.)

gigantic prey may be likened in some respects to a pack of hounds holding a stricken deer at bay. They cluster about the animal's head, some of their number breaching over it, while others seize it by the lips and draw the bleeding monster under water; and when captured, should the mouth be open, they eat out its tongue. We once saw an attack made by three killers upon a cow whale and her calf, in a lagoon on the coast of California in the spring of 1858. The whale was of the California grey species, and her young was grown to three times the bulk of the largest killers engaged in the contest, which lasted for an hour or more. They made alternate assaults upon the old whale and her offspring, finally killing the latter, which sank to the bottom, where the water was five fathoms deep. During the struggle the mother became nearly exhausted, having received several deep wounds about the mouth and lips. As soon as their prize had settled to the bottom, the three killers descended, bringing up large pieces of flesh in their mouths, which they devoured after coming to the surface. While gorging themselves in this wise, the old whale made her escape, leaving a track of gory water behind."

On the 9th of September 1893, when off the coast of Minas Geraes, Brazil, at no great distance from the islands of Los Abrolhos, in long. 39° W., lat. 18° S., the attention of the present writer was attracted by the appearance of a whale and some other creatures at a distance of apparently something less than a quarter of

a mile from the ship. The whale was a finner, or humpback, of no very great size, and was seen spouting, and again descending. Immediately after its first descent there appeared above the surface of the sea what seemed to be the tail-fin of some animal unknown. This supposed fin was raised in a vertical position, where it remained vibrating for some seconds and then suddenly disappeared. In colour it was a pure glistening white; while in form it appeared to be laterally compressed, with sharp edges and an acute termination. It gave the impression of belonging to some animal which was engaged in attacking the whale beneath the surface; and I should estimate its height above the water approximately at 5 or 6 feet. Soon after the disappearance of this strange white object, the broad black head of what I presume to have been a killer was seen above the water; and in a few seconds the whale itself again rose to spout. That these black animals, which appeared to be harrassing and attacking the whale, were killers, I have no reasonable doubt; but the question arises as to the nature of the animal to which the strange white tail-like object seen standing above the water could have belonged. My impression at the time was that it must be the upper lobe of the tail of some enormous shark allied to the threshers (*Alopecias*); and this impression has been confirmed by a subsequent examination of the stuffed specimens of that genus in the British Museum. The thresher is, however, a black shark; while the minute size of its teeth seems to discredit the common accounts of its attacking whales. Unless, however, it could have been the flipper of a humpback, I am at a loss to imagine to what other animal the aforesaid white tail-like object could have belonged, save to some gigantic shark allied to the thresher, but of a white colour, and probably armed with much larger teeth.

The Lesser Killer.

Genus *Pseudorca*.

An adventitious interest attaches to the Cetacean known as the lesser killer (*Pseudorca crassidens*) owing to its having been originally described on the evidence of a skull dug up in the Lincolnshire fens, which was for a long time regarded as pertaining to an extinct species. This animal is distinguished from the killer by its smaller back-fin, the pointed flippers, and the cylindrical roots of the teeth, as well as by certain features in the structure of the skull. In colour the lesser killer is entirely black; and it attains the length of about 14 feet. There are generally eight teeth in the upper jaw on each side, and ten in the lower jaw. This species appears to be cosmopolitan, having been met with in small herds on the coast of Denmark, and also in Tasmania. Its habits are probably somewhat similar to those of the killer.

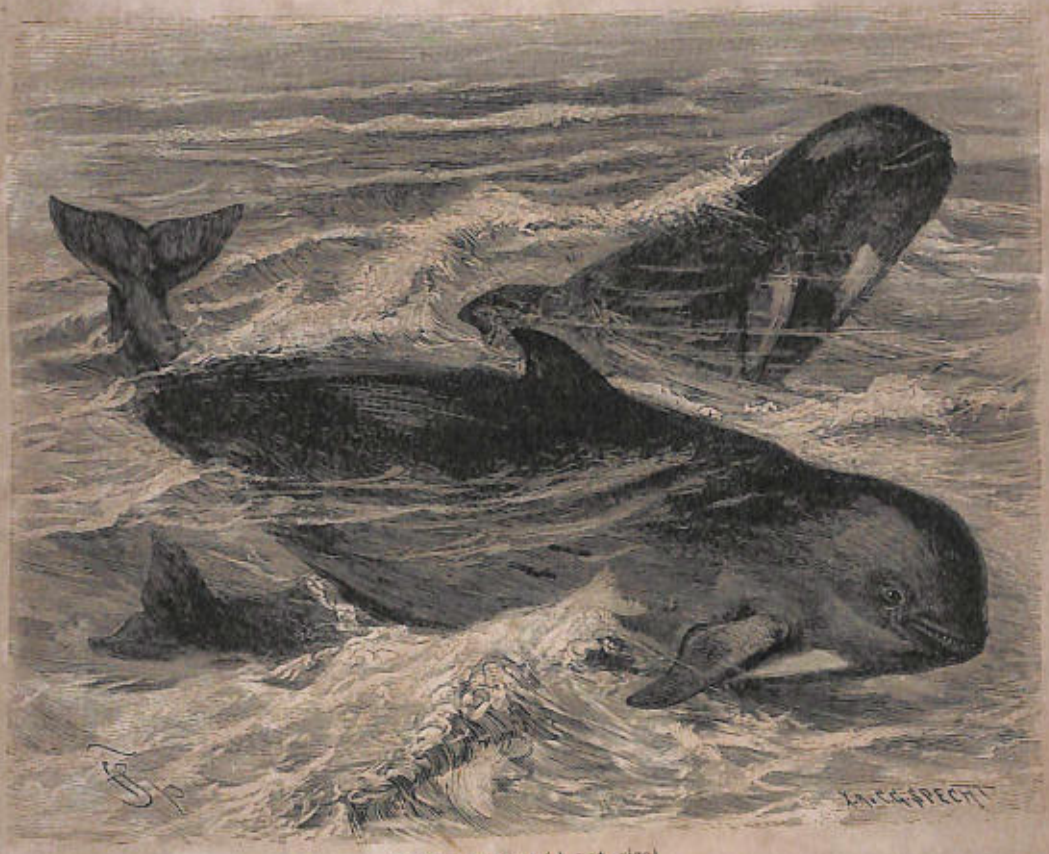
The Blackfish.

Genus *Globiocephalus*.

The blackfish (*Globiocephalus melas*) derives its English name from its nearly uniform black coloration, while its generic title refers to the characteristic globular

form of the head. In size this species is one of the largest representatives of the family, attaining a length of about 20 feet.

In addition to its beakless globular head, the blackfish is characterised by the long, low, and thick back-fin, the long and narrow flippers, and the small size and number of the teeth, which are confined to the front of the jaws. The usual number of the teeth is from eight to twelve on each side of the jaws, but in a distinct variety or species from the Bay of Bengal they are rather fewer. The skull is very broad and much depressed; and the union between the two branches of the



THE BLACKFISH (⅛ nat. size).

lower jaw very short. In the typical form there is a large spear-shaped white area on the chest, extending from the corners of the mouth to the flippers. This white area is, however, absent in certain forms, which have been regarded as indicating distinct species.

Distribution. The ordinary blackfish has a wide distribution, having been obtained from the coasts of Europe, the Atlantic coast of North America, the Cape of Good Hope, and New Zealand. Mr. True considers, however, that the blackfish of the North Pacific (*G. scammoni*), and also the one found on the Atlantic coast to the south of New Jersey, are distinct species; and there is also some evidence of the existence of a fourth in the Bay of Bengal. In Europe

the blackfish or, as it is often called, the pilot-whale, or ca'ing whale, is a frequent although irregular visitant to the British coasts; and it occasionally extends as far north as Greenland. In the Mediterranean it appears to be rare.

Habits. The blackfish is the most gregarious of all the Cetaceans, assembling in herds which frequently comprise from two hundred to three hundred individuals, and occasionally include as many as one thousand or even two thousand. The members of a herd always blindly follow a leader, after the manner of a flock of sheep, and from this strange habit the species derives its names of pilot-whale and ca'ing (=driving) whale. Curiously enough, if the leader of a herd happen to run into shoal-water and become stranded, the other members follow suit; and in this way large numbers are often captured by the inhabitants of Iceland and the Faroe, Orknèy, and Shetland Islands. In disposition this species is mild and gentle, and thus offers a marked contrast to the killer. Its chief and favourite food is cuttle-fish, but it is said also to eat fish. The young, of which there is generally but one at a birth, are said to be born in the late summer, and suckled throughout the winter.

Capture. Regarding their capture in the islands of the North Sea and Atlantic, the late Prof. Bell writes that, on the appearance of a herd, "the whole fishing squadron of the neighbourhood is put into requisition, each boat being provided with a quantity of stones. The first object is to get to seaward of the victims, then the boats are formed into a large semicircle, and the whole herd is driven into some bay or creek. The stones are thrown to splash and frighten the whales if they try to break back; and in Faroe ropes are stretched from boat to boat, with wisps of straw hung at intervals. Should one whale break through the line all is lost, as the rest will follow it in spite of every exertion of the fishermen. But if they are forced into shallow water, they plunge wildly on till they strand themselves, and then the whole population rush upon them, armed with harpoons, spears, hatchets, picks, spades,—any weapon that comes to hand,—and the cries and dying struggles of the poor animals, the shouts of the men, the clash of the weapons, and the bloody and troubled sea combine to form an extremely exciting, if somewhat revolting scene." It is stated that in this manner no less than 1110 blackfish were captured in Iceland in the winter of 1809–10, while upwards of 2080 were taken in Faroe within a period of six weeks during the year 1845.

Risso's Dolphin.

Genus *Grampus*.

Risso's dolphin (*Grampus griseus*) is a rare and rather large species, which appears to be the only representative of its genus, and is easily recognised by the peculiar striped character of the skin; the arrangement of the stripes and the general coloration presenting a large amount of individual variation. It is distinguished from all other dolphins, except the female narwhal, by the total absence of teeth in the upper jaw; while in the lower jaw there are only from three to seven small teeth on each side, and these confined to the anterior region of the jaw. In general external characteristics Risso's dolphin approaches very closely to the

blackfish, but the front of the head is less completely globe-like, and the length of the flippers somewhat less. The mouth is obliquely placed, and the lower jaw shorter than the upper; while the back-fin is high and pointed. The flukes are very narrow. The general colour is slaty grey, mottled, and very irregularly streaked. As a rule, the back, with its fin, and the flukes are dark grey or blackish, more or less tinged with purple; while the flippers are blackish, mottled with grey. The head and fore-half of the body are light grey, of varying tint, and more or less tinged with yellow; the under-parts are greyish white; and the whole body is marked with a number of irregular and unsymmetrically arranged light striæ. In the young the colour is dark grey above, and greyish white below, with the head yellowish white; and the flukes marked with five or more narrow and nearly vertical lines, placed at almost equal distances from one another. In length the animal measures about 13 feet when full grown.

Distribution.

Risso's dolphin appears to have an almost world-wide distribution, although not occurring in the polar seas. It has been recorded from



RISSO'S DOLPHIN.
(From True, *Bulletin of the U.S. National Museum*, 1889.)

the North Atlantic and North Pacific Oceans, the North Sea, the Mediterranean, the Cape of Good Hope, and Japan. Several examples have been taken on the British coasts. One of these was killed at Puckaster, Isle of Wight, in 1843; while a second was captured in a mackerel-net near the Eddystone Lighthouse in 1870. A third specimen sold in Billingsgate market in the latter year was probably taken in the Channel; and a fourth, also caught in the Channel, near Chichester, was kept alive for a day in the Brighton Aquarium in 1875. The fifth example was caught in 1886 in the same manner, and near the same locality as the second. In the autumn of 1889 a shoal of nine of ten or these Cetaceans were observed off Hillswick, Shetland, of which six were captured by fishermen; and in 1892 a single specimen was taken in the Solway. Beyond the fact that its chief food consists of cuttle-fish, nothing definite appears to be known as to the habits of this species.

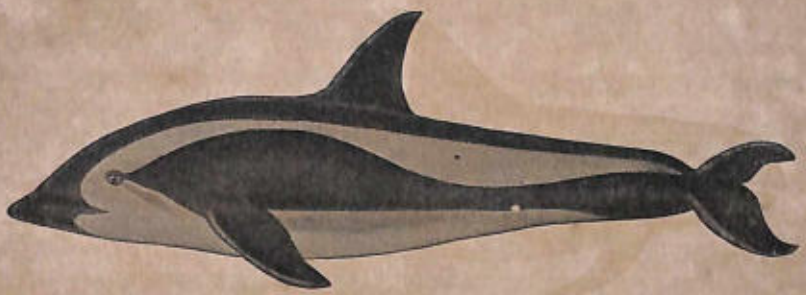
The Short-Beaked Dolphins.

Genus *Lagenorhynchus*.

Under the general title of short-beaked dolphins may be included a group of several small species, serving to connect the beakless forms with those furnished

with distinct beaks, and remarkable for their strongly-contrasting coloration. They are generally characterised by the head having a short and not very well-defined ploughshare-like beak, although in one species the head is pointed and beakless. The fin and flippers are of moderate size; and the tail has very prominent ridges. The teeth are variable in size and number; the beak of the skull is flat, and not longer than the hinder part of the same; and the union between the two branches of the lower jaw is short. The coloration takes the form of two light-coloured areas of variable size on the sides, separated from one another by irregular, oblique dark bands. Representatives of this genus are found in most of the temperate and tropical seas, and two species have been taken off the British coasts.

White-Sided Dolphin. Of the two British species, the white-sided dolphin (*Lagenorhynchus acutus*), is blackish grey above, and white beneath, with a broad band of yellowish brown between the two, in the middle of which is a large white patch; while a narrow black band extends from the flukes nearly to the line of the back-fin, and another runs from the base of the flipper to a point



THE PACIFIC SHORT-BEAKED DOLPHIN.
(From True, *Bulletin of the U.S. National Museum*, 1889.)

between the eye and the mouth; the eye being surrounded by a black ring. The length varies from 6 to 8 feet. This species inhabits the North Atlantic and the North Sea. It is very rare on the British coasts, although said to be not unfrequently seen off the Orkneys.

Pacific Short-Beaked Dolphin. The species figured to represent this genus (*L. crucigera*) is one from the Pacific, which is selected on account of the marked contrasts of black and white. It has a short beak, only slightly marked off from the skull. In colour, the muzzle, the forehead, the back, and the fin, flippers, and flukes are black; while a broad black band runs from the eye and the base of the flipper along each side to the flukes; the other parts of the body being a more or less pure white.

White-Beaked Dolphin. The second species of this genus which has been met with on the British coasts is the white-beaked dolphin (*L. albirostris*); this species resembling the white-sided dolphin in general form, but having a more swollen head, a narrower and more sloping back-fin, and longer flippers. It takes its distinctive name from the fact of the muzzle, including the extremities of both jaws, being white, more or less tinged with grey. The upper-parts are black, the sides greyish, and the under-parts white, frequently of a creamy hue; while there are three more or less distinctly defined whitish areas on the flanks, placed one

behind the other, and more or less mottled with darker tints. There is also a similar light area behind the blowhole on the back, and another near the root of the flukes. There is, however, considerable individual variation in regard to the coloration. When freshly-stranded specimens come under observation, the black of the back is often seen to be shot with a rich purplish tint, and the whole coloration is then exceedingly beautiful. There are usually about twenty-six teeth on each side of the jaws; and the length attained by adults is from 8 to 9 feet. The white-beaked dolphin inhabits the North Atlantic, the North Sea, and the Baltic, ranging as far northward as Greenland and Davis Strait. Between the years 1834 and 1885, a total of nineteen specimens of the dolphin had been taken in British waters; and since the latter date a specimen was taken on the Irish coast in 1887, and a third in the river Colne in 1889.

The True Dolphins.

Genus *Delphinus*.

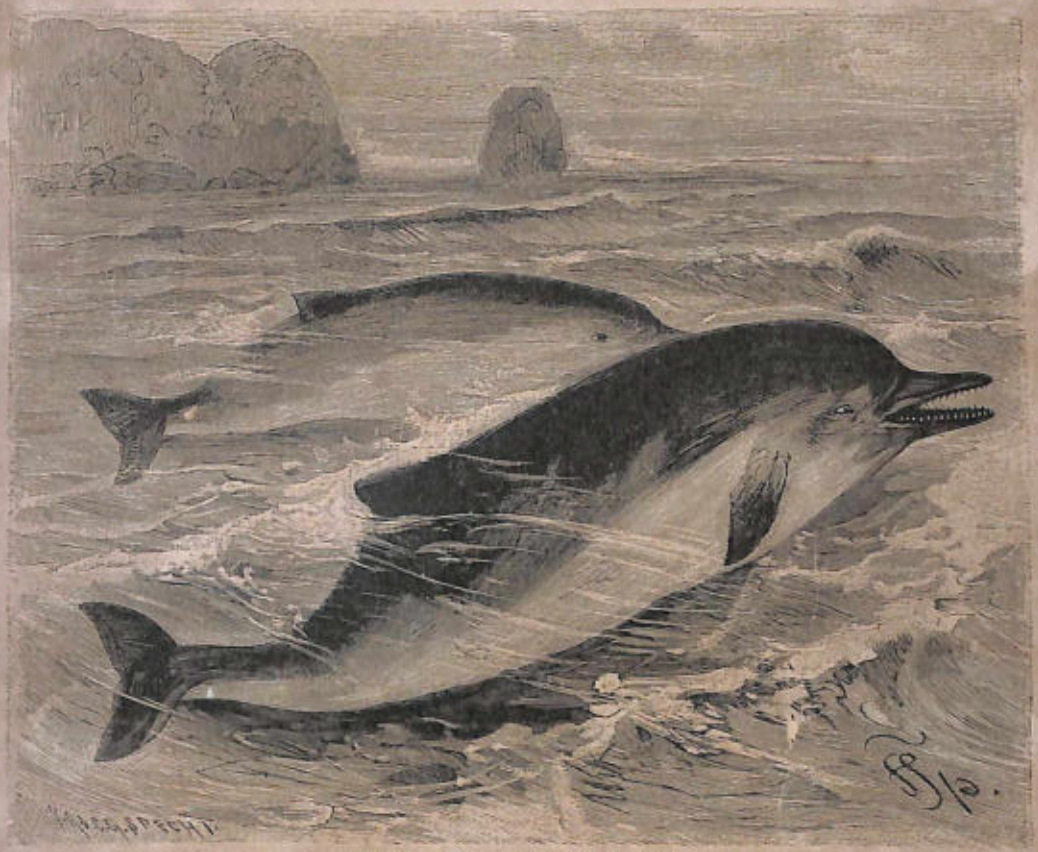
The true dolphins bring us to the first genus of the second great group of the family, which includes all the forms with distinct beaks, except the short-beaked dolphins just described. The beak is generally distinctly marked off from the forehead by a V-shaped groove; and in the skull the beak considerably exceeds the brain-cavity in length. In the skeleton the first two vertebræ of the neck are united, but the other five remain separate. All the members of the group are of comparatively small size, most of them not exceeding 10 feet in length. Dolphins associate in shoals, and feed mostly on fish, although some of them at least also consume crustaceans and molluscs.

Common Dolphin. The common dolphin (*Delphinus delphis*), which apparently frequents all temperate and tropical seas, is the typical representative of the genus *Delphinus*, which presents the following characteristics. The beak is long, and the back-fin and flippers are elongated and falcate. In the skull the bony beak is long and narrow, and generally about twice the length of the region of the brain-case. The jaws are furnished with a numerous series of teeth, varying from about forty to sixty-five on each side, which are sharply pointed, with their bases oval in section. The bony union between the two branches of the lower jaw is short.

The common dolphin has a slender body and small head; the beak being long and narrow, and the flippers about three times as long as broad, with their extremities pointed. There is considerable individual variation in colour, but usually the back is dark grey, the under-parts white or whitish, and the flanks marked by varying bands of grey or fulvous. The length of the animal is about 7½ feet, and there are from forty-one to fifty teeth in the upper, and from forty-five to fifty-one in the lower jaw.

Habits. There seems no doubt that this species is the dolphin of the ancients, although the pictorial representations on old coins, and the descriptions of the habits of the animal which have come down to us from the writers of antiquity, are alike untrue to nature. The species is occasionally met

with around the coasts of Britain, but it is much rarer off Scotland than in the south. It is not uncommonly captured in fishing-nets, and examples have from time to time been exposed for sale in Billingsgate market. Like the other dolphins, this species associate in shoals. "The excessive activity and playfulness of its gambols," writes Bell, "and the evident predilection which it exhibits for society, are recorded by every mariner. Large herds of these animals will surround a ship in full sail with the most eager delight, throwing themselves into every



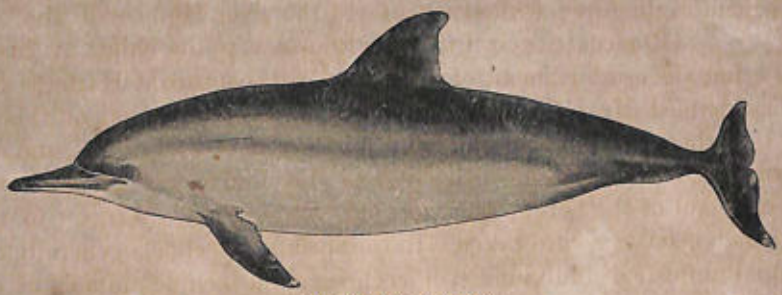
THE COMMON DOLPHIN ($\frac{1}{15}$ nat. size).

possible attitude, and tossing and leaping about with elegant and powerful agility, for no apparent purpose save mere pastime." In the British seas the chief food of this species is formed by herrings and pilchards. The dolphin is said to utter a low murmuring sound. A single offspring is produced at a birth, and is tended by the female parent with assiduous care. Formerly the flesh of the dolphin was eaten in England and other European countries.

Allied Species.

There are several other species more or less closely allied to the common dolphin, although some of them are still very imperfectly known. Such are Dussumier's dolphin (*D. dussumieri*), from the Malabar coast of India, and the Cape dolphin (*D. capensis*), from the Cape of Good Hope. The red-bellied dolphin (*D. roseiventris*), from the Moluccas and Torres Straits, is a

small species, not exceeding 4 feet in length, with forty-eight teeth on each side of the jaws, which has a skull intermediate between that of the common dolphin and the next species. The slender dolphin (*D. attenuatus*) may be taken as an



RED-BELLIED DOLPHIN.
(From True, *Bulletin of the U.S. National Museum*, 1889.)

example of a group of several species, distinguished from the common dolphin and its allies by the palate being nearly flat, instead of deeply hollowed on each side in its posterior portion. Most of them are further distinguished by the skin



THE SLENDER DOLPHIN.
(From True, *Bulletin of the U.S. National Museum*, 1889.)

being either spotted or marked with longitudinal bands. The slender dolphin is a spotted species from the Atlantic and the Cape of Good Hope; while the Malayan dolphin (*D. malayanus*), from the Indian Ocean, which attains a length of 6¼ feet, is uniform ashy grey.

The Bottle-Nosed Dolphins.

Genus *Tursiops*.

The bottle-nosed dolphin, or, as it is often incorrectly called, porpoise (*Tursiops tursio*), is the best known of three or four species constituting a genus distinct from *Delphinus*. The general form of these dolphins is stout, with the beak shorter and more tapering than in the true dolphins, and the number of teeth considerably less —not exceeding from twenty-two to twenty-six on each side of the jaws.

The bottle-nosed dolphin attains a length of from 9½ feet to 12 feet. In colour it is usually purplish grey above, passing gradually into pure white on the under-parts; but some specimens are black above and pale grey below, while others are grey all over.

Distribution. This species appears to range over all temperate and tropical seas, being occasionally met with on the British coasts. An example was taken at Holyhead in the autumn of 1868; a second was stranded in 1888 on the coast of Kirkcudbrightshire; while two entered the river Humber in 1889.

Habits. Till recently very little was known as to the habits of this species, but the establishment of a fishery for its capture at Hatteras, in North Carolina, has enabled Mr. F. W. True to gather some information on this subject. It appears that these dolphins are abundant off the coasts of Hatteras, and associate in schools of considerable size. On the 19th of May fourteen of these animals were secured at one haul of the nets in the morning, while in the afternoon of the same day no less than sixty-six were taken. In the spring the schools generally comprise a nearly equal number of individuals of each sex, and include animals of all ages; but later on in the season they are more uniform as regards sex and age, some herds consisting only of old males. It is believed that these dolphins migrate northward in the spring, and southward in the autumn, although a few remain at



BOTTLE-NOSED DOLPHIN.
(From True, *Bulletin of the U.S. National Museum*, 1889.)

Hatteras throughout the year. The breeding-season commences in the spring, but in the more northerly districts appears to be continued on into the summer. When the old ones were captured in the nets, the young would remain close alongside.

The largest specimen caught at Hatteras measured 12 feet in length and yielded twenty-four gallons of oil; but the average product during the winter is only about eight gallons. Some idea of the number of these dolphins frequenting the Carolina seas may be gathered from the fact that between 15th November 1884 and the middle of the following May, no less than twelve hundred and sixty-eight of them were caught at Hatteras.

The Rough-Toothed Dolphins.

Genus *Steno*.

The rough-toothed dolphin (*Steno frontatus*), from the Indian and Atlantic oceans, is the representative of a genus comprising several more or less nearly allied species, mostly confined to the warmer seas. They are distinguished by the great length of the beak, which is distinctly marked off from the head, and in the dried skull is very narrow and compressed; and also by the length of the bony

union between the two branches of the lower jaw, which exceeds one-quarter the total length of the jaw. The teeth vary in number from twenty to twenty-five on each side of the jaws; and are of rather large size, with the crowns often marked by vertical groovings. The colour is variable.

The rough-toothed dolphin attains a length of 8½ feet; and takes its name from its coarsely-fluted teeth. The colour of the upper-parts is purplish black, the sides being marked with rather large star-shaped spots, and the snout and under-parts white, tinged with purple and rose-colour, and ornamented with purple spots. The plumbeous dolphin (*S. plumbeus*) of the Indian Ocean, has an extremely long



THE ROUGH-TOOTHED DOLPHIN.
(From True. *Bulletin of the U.S. National Museum*, 1889.)

beak, and is of a uniform leaden-grey colour, with the exception of the extremity and under surface of the lower jaw, which are white. A third species from the Indian seas is the speckled dolphin (*S. lentiginosus*), which above is of a leaden-grey colour, with numerous long, drop-shaped spots, most of which are pure white, but others slaty or black; while below it is white, more or less mottled with grey.

Long-Beaked River-Dolphins.

Genus *Sotalia*.

Under the above title may be included several species of dolphins closely allied to those of the preceding genus, but distinguished by their fluviatile or estuarine habits, and the smaller number of joints in the backbone. Their teeth are always smooth; and the flippers very broad at the base. They must not be confounded with the fresh-water dolphins of the family *Platanistidæ*.

Amazonian Dolphins.

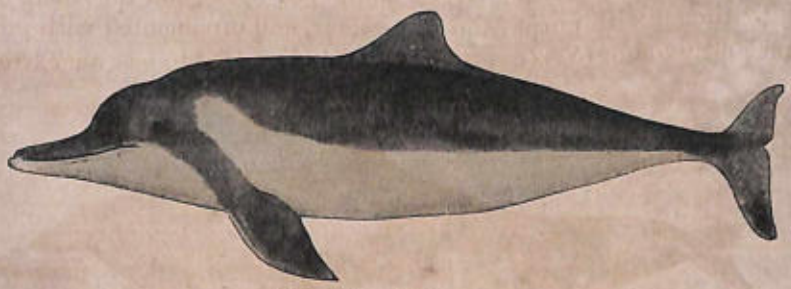
Dolphins of this group are abundant in the upper portions of the Amazon, but there is still great uncertainty as to whether these belong to one or to three species, or whether all or any of these are distinct from the Brazilian dolphin (*Sotalia brasiliensis*) of the bay of Rio de Janeiro. There is also a closely allied form (*S. guianensis*) from Cayenne. Of the Amazonian dolphins one is commonly known as the tucuxi (*S. tucuxi*), a second as the pale river-dolphin (*S. pallida*), and a third as (*S. fluviatilis*), which differ chiefly in coloration, the relative length of the fins, and the number of teeth. The pale dolphin, which is figured in the accompanying illustration, has the upper-parts and flukes yellowish white, and the under-parts and flippers white. A notice of some of the habits of the tucuxi has been given above on p. 39.

Chinese White Dolphin.

Another representative of this group is the Chinese white dolphin (*S. sinensis*), from Quemoy Island, in the harbour of Amoy, and the Foochow and Canton rivers. It is said to be characterised by its general milk-white colour, pinkish fins, and black eyes.

Camerun Dolphin.

The most interesting member of this group is, however, the recently described Camerun dolphin (*S. teuszi*) from the estuaries and



THE PALE RIVER-DOLPHIN.
(From True, *Bulletin of the U.S. National Museum*, 1889.)

rivers of the Camerun district of Western Africa, which is reported to be of herbivorous habit. If this alleged habit should be confirmed, this dolphin will differ not only from all the other members of the family to which it belongs, but likewise from all other living Cetaceans.

Squalodonts and Zeuglodonts.

Families *Squalodontidæ* and *Zeuglodontidæ*.

In addition to numerous extinct representatives of the existing Cetacean families, to some of which reference has been made above, there are two extinct groups which cannot be included in either of the existing families; one of these differing very much indeed from all modern Cetaceans.

Squalodonts.

The name of squalodonts (genus *Squalodon*) is applied to the members of the first of these two groups on account of the somewhat shark-like structure of their cheek-teeth. In the general characters of their skulls these Cetaceans approximate to the modern dolphins, from which they are, however, at once distinguished by the teeth being of different characters in different parts of the jaws, as in ordinary mammals. They have a total of fifteen teeth on each side of both the upper and lower jaws. Of these the first four are of simple structure, and correspond to the incisors and canines of other mammals; the next four, which are also comparatively simple, appear to represent the premolars; while the last seven have two roots, and laterally-compressed triangular crowns, with sharp cutting edges, upon which there are a number of cusps arranged in a saw-like manner. The squalodonts, which are found in Miocene and Pliocene formations, both in the Old and New World, clearly form one step between modern Cetaceans and ordinary mammals. And, so far as the structure of their teeth can be relied upon, they appear to suggest a kinship between Cetaceans and Carnivores.

Zeuglodonts.

Very different from the above are the still earlier forms known as zeuglodonts (genus *Zeuglodon*), which appear to be mainly or entirely confined to the Eocene Tertiary, and have been obtained from regions as far asunder as North America, Western Europe, the Caucasus, and Australia and New Zealand. So different, indeed, were these animals from all existing Cetaceans, that it has even been doubted whether they can be included within the limits of the same order. Some of them rivalled the larger whales in point of size, while the Caucasian species was not larger than an ordinary dolphin.

The zeuglodonts had teeth of the same general type as those of the squalodonts, but those of the cheek-series were fewer in number, the premolars and molars together being apparently only five on each side. The skull differs from that of ordinary Cetaceans in having elongated nasal bones, and the cavity of the nose placed more forwardly, as well as in certain other features; all these points of difference being in the direction of ordinary mammals. Unfortunately, we know but very little of the structure of the limbs. The humerus, or bone of the upper arm, is, however, proportionately much longer than in modern Cetaceans, although it has flattened articular surfaces at its lower end, showing that the bones of the fore-arm had scarcely any free motion, and thus indicating that the fore-limbs were modified into flippers. So far as they can be determined, the general characters of these zeuglodonts are such as we should expect to find in an ancestral group of Cetaceans; but it is remarkable that the body appears to have been protected by an armour of bony plates.



CHAPTER XXXI.

The Rodents,—Order Rodentia.

Squirrels, Marmots, and Beavers.

Under the common title of Gnawing or Rodent Mammals are grouped that extensive assemblage of small or medium-sized species which, like rats, porcupines, beavers, squirrels, and hares, are characterised by their habit of gnawing. At the present day these creatures are more numerously represented than in any other Mammalian order, both as regards individuals and species; the number of the latter being probably fully one thousand, while the swarms of individuals by which some species are represented are too well known to need more than passing mention. Nearly all the Rodents are inhabitants of the dry land, and a large proportion of them seek protection from enemies by living in subterranean burrows which they construct for themselves, and wherein they generally associate in larger or smaller colonies. Some, however, like the water-vole and the beaver, are aquatic; while others, like the squirrels and tree-porcupines, lead an arboreal life. A few, again, have acquired the power of spurious flight through the development of folds of skin along the sides of the body and limbs, by the aid of which they are enabled to take long flying leaps.

The Rodents are some of the most easily defined of all mammals, and are best characterised by the number and nature of their teeth—especially those in the front of the jaws. They are distinguished by the presence in each jaw of a pair of large chisel-like front or incisor teeth, which grow continuously throughout the life of their owners. As a rule, no other incisor teeth, save these two pairs, are developed, but in the hares and rabbits and their allies a second smaller pair occur behind those of the upper jaw. There are no tusks or canine teeth in either jaw, and in the cheek-series the number of premolars is always reduced below the normal four, very generally only one of these teeth being present, while in some cases even this may be wanting. In consequence of the reduced number of incisor teeth, coupled with the absence of canines and the reduction in the premolars, the skull of a Rodent is always distinguished by the presence of a long gap between the front and the cheek-teeth. Indeed, the presence in all Rodents of only a single pair of chisel-shaped and permanently-growing lower incisors, opposed to a corresponding pair in the upper jaw, the total absence of canines, the long gap between the incisors and the cheek-teeth, and the reduction in the number of the premolars, are of themselves sufficient to distinguish the Rodent order from all other mammals, with the exception of the aye-aye among the lemurs.

Among other distinctive characteristics of the group, the following may be

mentioned. The feet are usually furnished with five toes, which generally terminate in sharp claws, although they sometimes have broad nails. In walking, either the whole or the greater part of the sole of the foot is applied to the ground, so that these animals may be described as entirely or partially plantigrade. Rodents are nearly always furnished with collar-bones (clavicles), although these may be more or less imperfectly developed, and are thereby broadly distinguished from all living Ungulates. Their skulls are characterised by the condyle of the lower jaw being elongated from front to back, instead of from side to side, and thus permitting of that backwards-and-forwards motion of the lower upon the upper jaw, which is so noticeable when we watch a rabbit feeding; this character serving to distinguish Rodents alike from Ungulates and from Carnivores. Another point in connection with the skull is that the cavity for the eye is not separated behind by a bar of bone from the temporal fossa; this feature serving to distinguish the Rodents from the aye-aye, in which the eye-socket is surrounded by a bony ring.



SIDE VIEW OF THE SKULL OF THE PRAIRIE-MARMOT.

Teeth. The teeth being so important in the definition of the Rodents require somewhat fuller consideration. With regard to the incisors, it may be observed that these teeth are of great length, and curved nearly in the arc of a circle; their inserted portion extending far backwards in the jaws, so that in the upper jaw it comes nearly in contact with the base of the first of the cheek-teeth, while in the lower jaw it runs beneath the whole of the cheek-series. The lower incisors form a small segment of a very large circle (roughly speaking), while the upper ones constitute a much greater segment of a far smaller circle. In the great majority of Rodents the enamel on the incisor teeth is confined almost exclusively to their front surface, and is generally thicker on one side than on the other; but in the hares and rabbits it also extends somewhat on to the lateral surfaces. In cross-section these teeth are somewhat triangular; the front enamel-covered surface being broad and flattened, and the two lateral surfaces gradually converging to a rounded posterior edge. Whereas, however, the inner surface, which comes in contact with the tooth on the opposite side of the jaw, is nearly flat, the outer surface is convex. As a natural result of the front surface of these teeth being composed of the hard enamel (which is very frequently of an orange or reddish colour), whereas the remaining portion consists of much softer ivory, it follows that the effect of wear is to produce a sharp chisel-edge at their summits. Indeed, the structure of an incisor tooth of a Rodent is precisely analogous to a chisel: the hard enamel corresponding to the steel with which the latter is faced, and which forms the cutting edge, while the ivory represents the soft iron forming the support to the thin plate of steel. As these incisor teeth are continually growing, they always present the same chisel-like edges, which are worn away by use at a rate commensurate with that of the growth. It follows from this that if one

of these teeth be broken away during life, the corresponding tooth in the opposite jaw, having nothing to check its growth by wear, will continue to grow on uninterruptedly till it forms nearly a circle, when its point will enter the jaw of its unfortunate owner, and probably lead to a lingering death. Most museums possess specimens of the skulls of Rodents with such abnormally-developed teeth.

The cheek-teeth of Rodents may be either provided with distinct roots, or may grow throughout life and never develop such roots. In the cases of those with distinct roots, the crowns may carry mere simple tubercles; but in other instances they may have their summits or sides penetrated by infoldings of the enamel, thus producing a more or less complicated pattern when worn. On the other hand, the permanently-growing rootless molars always have complex crowns, which are sometimes interpenetrated by lateral infoldings of the enamel, and at others are divided into a series of parallel transverse plates. There is, indeed, a precise parallelism in this respect between the molar teeth of the Rodents and those of the mastodons and elephants; the molar tooth of a mouse, which has distinct roots, and a low crown with simple cusps, being exactly comparable to that of a mastodon, whereas the high-crowned, laminated, and rootless molar of a guinea-pig corresponds as closely with that of a modern elephant. Rodents are always furnished with milk-teeth, which, however, in some instances are shed before birth.

Mouth. The Rodents present a peculiarity in the structure of the mouth, which is quite unknown in any other mammals. In examining the mouth of any one of these animals—say a rabbit—it will be found that behind the upper front teeth the outer hairy skin of the face is continued inwards into the sides of the mouth, which by this means is divided into two distinct chambers, communicating with one another through a comparatively narrow orifice; the first chamber containing only the front teeth, while the cheek-teeth are included in the second chamber. It appears that this arrangement is designed to prevent the entrance of extraneous substances into the true cavity of the mouth when the creatures are engaged in their characteristic operation of gnawing. In addition to this peculiarity, the whole of the inside of the cheeks in the hares and rabbits is covered with hair; while the pouched rats and hamsters have large pouches inside the cheeks, which are also lined with hairy skin. On the other hand, the gophers have pouches in the cheeks which open externally instead of internally.

Distribution and Habits. The Rodents have a wider distribution than any other group of terrestrial mammals, being found in all parts of the globe except the extreme polar regions. With the exception of the bats, they include the only representatives of the placental mammals which are undoubtedly indigenous to Australia. They are, however, but poorly represented in that country, and likewise in the great island of Madagascar. On the other hand, the order attains an extraordinary development in South America, where its largest representatives occur, and which may be looked upon as its headquarters. In time, the Rodents certainly date from the upper portion of the Eocene division of the Tertiary period; but the whole of the extinct forms hitherto discovered present all the essential peculiarities of the existing representatives of the group, and we are, therefore, at present almost completely in the dark as to their relationship to other orders,

although it has been suggested that they are derived directly from the Marsupials. The number of genera of Rodents is great, that in a work like the present it is only possible to notice some of the leading and more generally interesting types.

The whole of the Rodents are almost entirely herbivorous in their habits; and they all of them obtain their food by gnawing. We have already noticed that while the majority are terrestrial and burrowing, some are arboreal, others aquatic, and a few endowed with the power of spurious flight; and it may be added that of the terrestrial forms the hares are among the fleetest runners of all mammals, while the jerboas and chinchillas are distinguished by their leaping powers. They are mostly harmless and inoffensive creatures, fleeing with the greatest terror and precipitancy from the smallest of foes; but a few, like the common rat, when driven to bay, will defend themselves desperately, and will then inflict comparatively severe bites with their powerful front-teeth.

Value. Many Rodents yield furs which are very largely used in commerce, although of less intrinsic value than those of many other mammals. The flesh of hares and rabbits is largely consumed in Europe, while that of other members of the order is also eaten in various parts of the world; but the strong odour which characterises many Rodents renders their flesh more or less unpalatable.

Coloration. As a whole, Rodents are characterised by their dull and frequently uniform coloration, although there are many exceptions to this. Indeed, many of the squirrels from the warmer regions of the globe, as well as one of the species of marmot, are among the most brilliantly coloured of all animals. In the brighter-coloured forms it does not appear that any rule can be laid down as to the plan of coloration. Thus while in many of the squirrels the brilliant colours take the form of distinct patches, distributed over various parts of the body, in the palm-squirrels and ground-squirrels there are light longitudinal stripes on a dark ground, and in the pacas there are light-coloured spots. It appears, however, that no Rodent exhibits transverse bars of different colours on the body, and in none is the tail ornamented with alternate light and dark rings.

Tail. The tail is very variable; being totally wanting in the guinea-pig, while in the jerboas it attains an enormous relative length.

The African Flying Squirrels.

Family *Anomaluridæ*.

The true flying-squirrels are confined to Asia, Europe, and North America, but Africa possesses a group of somewhat similar animals, which differ so decidedly in structure that they are assigned to a distinct family.

Before considering these animals in detail, a few words are necessary as to the leading characteristics common to all the Rodents treated of in the present chapter, which are collectively spoken of as the squirrel-like Rodents, or, technically, as the Sciuromorpha. Together with the mouse-like Rodents described in the following chapter, all these animals are characterised by the angular process of the lower

jaw[1] taking its origin from the root of the sheath of the incisor tooth. The squirrel-like Rodents are especially distinguished by having the two bones of the lower leg (tibia and fibula), as shown in the accompanying figure of the skeleton of the squirrel, quite distinct from one another. They are further characterised by the zygomatic or cheek-arch of the skull being slender, and mainly formed by the jugale or cheek-bone itself.[2] These distinctive characters, which are somewhat difficult for those not versed in anatomy to understand, may appear trivial and unimportant; but the fact is that all Rodents are so alike in general structure, that it is only by such slight points of difference that the various groups can be satisfactorily distinguished from one another.



SKELETON OF SQUIRREL.

The African flying squirrels (*Anomalurus*) are distinguished from the true flying squirrels by the parachute-like membrane running along the sides of the body being supported in front by a rod of bony cartilage arising from the elbow-joint (instead of from the wrist); and also by the presence of a row of overlapping horny scales on the under surface of the root of the long and thickly-haired tail. Their skulls also differ from those of the true squirrels by the absence of a bony projection from the frontal bones defining the hinder border of the socket of the eye. They have, moreover, but a single pair of premolar teeth in each jaw.



THE FULGENT AFRICAN FLYING SQUIRREL.

Most of these flying squirrels are confined to Western Africa, but one species (*A. pusillus*) occurs in Equatoria, while another is found on the east coast near Zanzibar. The fulgent flying-squirrel (*A. fulgens*), from the Gabun is one of the largest species, measuring 21 inches in total length, of

[1] This is the projecting process seen at the hinder extremity of the lower jaw in the skull figured on p. 66.

[2] In the same figure the zygomatic arch is the bar of bone beneath the socket of the eye, of which the front portion is formed by the jugale or cheek-bone.

which a third is occupied by the tail; its colour is bright tawny orange, with a white spot between the ears, and another on each side of the muzzle. On the other hand, in the pigmy African flying squirrel—the mboma of the natives—the length of the head and body is only 11 inches, and that of the tail 5¼ inches; the colour of the upper-parts being dark grizzled grey, while beneath it is yellowish white, with the tail uniform pale brown.

Habits. The habits of these animals appear to be very similar to those of their Asiatic allies. In climbing tree-stems, preparatory to taking their flying leaps, it is said that they use the scales at the root of the tail to aid in obtaining a hold on the bark.

The Squirrel Family

Family *Sciuridæ*.

The Squirrel family, which includes the true flying squirrels, ordinary squirrels, marmots, and susliks, is distinguished from the last by the absence of scales on the tail, and the presence of distinct bony (postorbital) processes defining the hinder border of the upper half of the socket of the eye. Moreover, when a parachute-like membrane is present, it is supported by a rod of cartilage arising from the wrist. The palate is broad; and there are generally two pairs of premolar teeth in the upper, and one in the lower jaw; but the first upper premolar is small, and may be shed or wanting. The molars have roots, and in the young state at least have their crowns surmounted by tubercles, but in the adult they often have deep wavy enamel-folds, forming transverse plates extending partially across the crown.

Till quite recently the members of the family were divided into two groups, or subfamilies, according as to whether they are arboreal or terrestrial in their habits; the first group including the true squirrels and flying squirrels, and the second comprising the susliks and marmots. From a careful study of their dentition, Dr. Forsyth-Major has, however, come to the conclusion that this arrangement is an artificial one; he accordingly classes them under three groups, of which the first includes the true squirrels, susliks, and marmots, the second the flying squirrels, and the third the Oriental pigmy squirrels.

The Groove-Toothed Squirrel.

Genus *Rhithrosciurus*.

According to the above-mentioned scheme, the first representative of the family is the Bornean groove-toothed squirrel (*Rhithrosciurus macrotis*), which is the sole member of a genus easily characterised by the presence of a number of vertical grooves on the front of the incisor teeth. Much larger than the common squirrel, this species has an enormous bushy tail, long tufted ears, and black and white bands along the flanks. The molar teeth are of a simpler type than in any other member of this family.

The Spiny Squirrels.

Genus *Xerus*.

In addition to being the home of a considerable number of true squirrels, Africa is the sole habitat of a group of squirrels constituting a distinct genus of the family. The typical representatives of these Ethiopian spiny squirrels are characterised by their coarse and spiny hair, the small size or total absence of the external conchs of the ears, and the comparative straightness of the long claws. According to the new classification, certain other Ethiopian species, formerly included among the true squirrels, may however find a place in this genus, which will be best characterised by the skull and molar teeth. As regards the skull, this is distinguished by its



THE ABYSSINIAN SPINY SQUIRREL (¼ nat. size).

elongate form, which is especially shown in the frontal bones, and the extreme shortness of the (postorbital) processes forming the hinder border of the upper part of the sockets of the eyes. The molar teeth, in place of the low-crowned, basin-shaped form characterising those of the true squirrels, have somewhat taller crowns, with more or less well-marked transverse plates; thus approximating to the corresponding teeth of the porcupines, and evidently indicating a specialised type.

Distribution and Habits.

The genus now includes a very large number of species, ranging from Abyssinia to the Cape: its typical representatives differing from the true squirrels in being entirely terrestrial, taking refuge either in clefts and holes among rocks, or in the burrows excavated by themselves. The Abyssinian spiny squirrel (*Xerus rutilus*), which is the species represented in our illustration, is of a uniform yellowish red colour, with distinct conchs to the ears; its size being comparable to that of the English squirrel, but rather larger. Mr. Blanford states that these animals may be commonly seen in the neighbourhood of Annesley Bay in rocky places, associating in parties of five or six individuals. The striped Abyssinian

spiny squirrel (*X. leucoumbrinus*) agrees with the last in having external ear-conchs, but differs in its longitudinally-striped body; in the latter respect it resembles the Cape spiny squirrel (*X. setosus*), of South Africa, in which, however, the conchs of the ears are wanting. The small spiny squirrel (*X. getulus*), which is also striped, is the most diminutive member of the group, and in size and appearance much resembles the Indian palm-squirrel. A fossil species of this genus occurs in the Miocene deposits of France.

The True Squirrels.

Genus *Sciurus*.

The common squirrel is the sole representative in Western Europe of an exceedingly large and widely-distributed genus, of which the following are the leading characteristics. The tail is very long and bushy; the ears are in most cases of considerable size, and may be surmounted with tufts of long hair; and in the fore-limbs there are only four functional toes, owing to the rudimental condition of the one corresponding to the human thumb. The claws are long, curved, and sharp; while the female may have either four or six teats. From that of the spiny squirrels the skull differs by its shortened form and the elongation of the backwardly-directed (postorbital) processes defining the hinder border of the sockets of the eyes. The molar teeth are low-crowned and of a simple type, those of the lower jaw having the grinding surface basin-shaped, with a longitudinal wall on the inner and outer side, and no transverse plates formed by infoldings of the enamel; and the first upper premolar, if present, is small, and may be shed at an early age.

While the common squirrel is of a uniform brownish red colour on the upper-parts, many of the tropical species are most brilliantly tinted with orange and other bright colours, while others, like the little Indian palm-squirrel, have their bodies ornamented with longitudinal light stripes on a dark ground. One of the Malayan species, which is ordinarily grey, assumes a brilliant orange-coloured dress during the breeding-season; and some of the North American species also undergo a seasonal change of coloration, one of them having a dark stripe along the sides of the body in summer, which completely disappears in winter. There is great difference in the size of the various species, the large Malayan squirrel (*Sciurus bicolor*) from India and the Malay region, measuring about 40 inches or more in total length, while the Indian palm-squirrel does not exceed a weasel in size.

Distribution. The true squirrels inhabit the temperate and tropical portions of the whole globe, with the exception of Madagascar and the Australasian region. The number of species probably does not fall far short of fifty or sixty, and these are most numerous in the Malayan region, which may be regarded as the headquarters of the group. There is, however, great difficulty in deciding as to the real number of species, since a large number of squirrels, especially those from North America and Africa, exhibit extraordinary local variation in coloration, so that it is almost impossible to say where varieties end and species begin.

European Squirrel. The common squirrel (*S. vulgaris*), as being the best known representative of the genus, may be selected for special notice, as the

habits of all the species appear to be very similar. Belonging to a group in which the first upper premolar is present, this little animal is so well known by appearance to all, that but few words need be devoted to its description. The general colour of the head and body is brownish red above, and white beneath; the whole tail being of the same hue as the back. In summer, the edges of the ears are smooth, but in winter they are tipped with a thick fringe of hair. In winter the squirrel in England is greyer than in summer; and in the more northern and eastern parts of its habitat, the grey tint, especially in winter, becomes much more marked, while in Japan the colour is nearly black. Drab-coloured squirrels occur in Siberia; and white or pied specimens are occasionally met with. In some parts of England the tail is not unfrequently cream-coloured in autumn. The total length of the animal,



THE EUROPEAN SQUIRREL (½ nat. size).

exclusive of the hairs at the end of the tail, is about 15½ inches, of which 7 inches are taken up by the tail.

Distribution. The geographical range of the European squirrel is very extensive, comprising almost the whole of Europe, Northern Africa, Asia Minor, and Asia north of the Himalaya, as far eastward as Japan. Indeed, Ireland and Japan respectively mark the western and eastern boundaries of its range; while its extreme northern and southern limits are indicated by Lapland and the north of Italy. In the south of the latter country, and likewise in the Caucasus and the Crimea, the squirrel is, however, quite unknown.

Habits. Like other members of the genus, this species of squirrel is mainly diurnal and arboreal in its habits, but seldom descending to the ground, and when aloft leaping from bough to bough with surprising agility. The extent of these flying leaps shows that the "flight" of the flying squirrels is but an ultra development of this mode of progression. Its chief food consists of nuts,

beech-mast, bark, buds, and young shoots of trees; but there is evidence that it is also not averse to a diet of birds' eggs, and perhaps insects. In feeding, all squirrels sit up on their hind-quarters, and hold their food to their mouths with the fore-paws. The shells of nuts are pierced by the sharp front teeth, and every fragment removed before the kernel is consumed. Stores of food are laid up by the common squirrel for winter use, but instead of being deposited in a single place they are hidden in several repositories. In England and the whole of its more northerly habit, the squirrel partially hibernates during the winter, but it wakes up at intervals to feed when the weather is mild, and again retires to slumber. Probably in more southern regions it is active throughout the year, as are the species inhabiting the warmer parts of the globe. Squirrels associate in pairs, apparently for life, and generally frequent the same tree or clump of trees from year to year. The nest, or "drey," in which the young are produced, is built either in the fork of a branch, or in some hole of the stem of a tree, and is composed of leaves, moss, and fibres, carefully intertwined. When placed in a fork, it so closely resembles the boughs in colour that its detection from below is difficult. In England the blind and naked young are born in June, and are usually three or four in number. They remain with their parents till the following spring; and if captured at a sufficiently early age form docile and affectionate pets. The squirrel can swim well; and its flesh is said to be good eating.

Squirrel-fur is extensively used for boas, linings, and trimmings. The quantity formerly imported into England was very great, the total number of skins in 1839 reaching 2,730,826; but of late years the imports have declined, the chief seat of the industry in this fur being now in Germany. The darker bluish grey skins are the most valued, most of these being obtained from Okhotsk by the Alaska Company; the number imported by that company into London being, according to Mr. Poland, 43,235 in 1891, but it is sometimes double as many.

North American Squirrels. In North America the place of the European species is taken by the red squirrel, or chickari (*S. hudsonianus*), and the grey squirrel (*S. carolinensis*); the former frequenting forests of all kinds, while the latter is chiefly restricted to those composed of deciduous trees. Dr. Hart Merriam, describing the habits of the red squirrel in the Adirondack Mountains, near New York, says that this species exhibits but little fear of man, and is the least wary of all its tribe. It is on the alert from dawn to sunset, and sometimes, especially when there is a moon, continues its rambles throughout the night; while whenever abroad it enlivens the solitudes of the forests with its continual chatterings. "Though an expert climber, delighting in long leaps from bough to bough, which he executes with grace and precision, he spends far more time on the ground than the other arboreal squirrels, sometimes even making his home in holes in the earth. Old logs, stumps, wood-piles, and brush-heaps, are favourite places of resort, and, by excavating burrows beneath, he converts them into the securest of retreats . . . As might be inferred from the boreal distribution of this animal, he is the hardiest of our squirrels. Not only does he inhabit regions where the rigours of Arctic winter are keenly felt, but refusing to hibernate, he remains active throughout the continuance of excessive cold; when running upon the snow he often plunges down out of sight, tunnels a little distance, and, reappearing, shakes the snow from

his head and body, whisks his tail, and skips along as lightly and with as much apparent pleasure as if returning from a bath in some rippling brook during the heat of a summer's afternoon." This squirrel is fond of a variety of fruits, and also sucks the eggs and kills the young of the smaller birds. The young are generally born early in April, and usually include from four to six in a litter.

This species is of small size, with a relatively short tail, and short tufts to the ears in winter; its usual colour being greyish, more or less mixed with yellowish or reddish above, and generally white below. It shows dusky markings on the back, and sometimes also on the under-parts. Its geographical range includes the northern half of North America.

The grey squirrel is a more southerly species, extending from the south of Canada to Mexico and Guatemala. In size it is superior to the last, and its tail is proportionately longer, while there are no ear-tufts. Its usual colour is whitish grey above, varied with fulvous, and white below; the flanks being marked with a pale fulvous line. There are, however, numerous varieties, one of which is dark olive-brown above, and grey beneath. In habits this species seems to be more like the common squirrel, being extremely wary and alert, and partially hibernating during the winter. It buries its stores of food just beneath the surface of the ground in various parts of the woods. In confinement these squirrels form charming little pets. There are at least seven other well-defined representatives of the genus in North and Central America, and several others in the southern half of the same continent.

Oriental Squirrels.

As already mentioned, squirrels attain their maximum development of size and species, as well as their most brilliant coloration, in the Oriental region, and especially in its Malayan portion.

In India and Burma Mr. Blanford recognises no less than twenty species of squirrels, three of which are of large size, measuring not less than a foot from the nose to the root of the tail, while eleven vary from 10 to 7 inches in length, and all the remainder are small striped species, averaging from 5 to 7 inches in length. The medium and smaller species retain the first premolar tooth of the upper jaw, which is usually lost in those of the largest groups. Among the two first groups some of the better known are the large Indian squirrel (*S. indicus*), with tufted ears, which is not known to the east of the Bay of Bengal, the large Malayan squirrel (*S. bicolor*), ranging from the eastern Himalaya to Borneo, the golden-backed squirrel (*S. caniceps*), already alluded to as the one which assumes a special breeding-dress, although this is confined to one variety of the species, and the nearly allied Irawadi squirrel (*S. pygerythrus*), in which the length of the head and body is about 9 inches, and the ears have no tufts.

Of the smaller striped species, the best known is the Indian palm-squirrel (*S. palmarum*), so commonly distributed in open districts throughout India and Ceylon, but unknown to the eastward of the Bay of Bengal, and never found in forests. The length of the head and body of this species is from $5\frac{1}{2}$ to 6 inches, and that of the tail rather more. The general colour of the upper-parts is some shade of brown, with three narrow whitish or slightly rufescent longitudinal stripes on the back; the under-parts varying from white to grey. This pretty little squirrel is one of the most familiar of Indian mammals, exhibiting scarcely any fear

of man, and uttering its bird-like chirp in every Indian garden. It is commonly found in groves, and on the rows of trees bordering the roads in most Indian stations; but, according to Mr. Blanford, exhibits no especial predilection for palms. It generally feeds on the ground in the neighbourhood of trees, and when alarmed seeks refuge in their boughs by darting up the stems with lightning-like rapidity. Dogs newly imported into India invariably take to hunting palm-squirrels, but usually give up the pursuit in a short time as being utterly hopeless. These squirrels frequently take up their abode in the roofs of houses, and will freely enter the rooms. In addition to the usual food of its kindred, this species will also consume white ants and other insects. The young—two to four in a litter—are produced in a large bulky nest of grass or wool, usually placed either in a tree or among the rafters of a house.



THE IRAWADI SQUIRREL.—After Anderson.

Extinct Squirrels. The European squirrel dates from the deposition of the Norfolk "forest-bed," belonging to the earliest series of the Pleistocene period; but extinct species of the genus are found in formations of Tertiary age down to the upper division of the Eocene.

The Ground-Squirrels, or Chipmunks.

The ground-squirrel of Siberia, portions of Eastern Europe, and North America, together with several other closely-allied North American species commonly known as chipmunks, constitute a group serving to connect the two squirrels with the susliks. Having molar teeth of the same type, the chipmunks are indeed so closely allied to the true squirrels that Dr. Forsyth-Major proposes to include them in the same genus. They differ, however, from both the spiny-squirrels and the true squirrels in the possession of pouches inside the cheeks; on which account they may, for the present at least, be allowed to stand under the generic title by which they are commonly known. They are further characterised by the sides, or the back and sides together, being marked by longitudinal white or greyish white stripes bordered by black bands. The ears are of medium size or small, and are never tufted with long hair; while the tail is shorter than the head and body,

flattened, and rather wide. The skull is generally like that of the true squirrels, but rather narrower and more slender; and the first premolar tooth in the upper jaw is either absent or very minute.

The common American chipmunk (*Tamias striatus*), together with its numerous varieties, is distinguished by having two white stripes, each bordered with black, and a simple black stripe running down the middle of the back; and has also two white stripes, separated by a black one, above and below the eye. It is about the size of the European squirrel, with which it also agrees approximately in the general ground-colour of the fur. There is, however, great local variation in this respect, specimens from the southern portions of the chipmunks' range being lighter in colour than those from the north. The distribution of this species extends from Canada and Manitoba to Georgia and Western Missouri. The long-eared chipmunk (*T. macrotus*), from California, differs from it in the much greater length of its ears.

On the other hand, the Siberian chipmunk (*T. asiaticus*), which, as we have said, is common to the Old and the New World, together with some other North American species, differs by having four light-coloured and five black stripes on the body. The tail is also relatively longer. In the Old World this species ranges from the shores of the Sea of Okhotsk westward over the whole of Northern Asia, extending in Russia as far as the river Dwina, and along the whole course of the Amur. Including under the specific name a large number of varieties, which some writers are disposed to regard as distinct species, the Siberian chipmunk ranges in North America from Lake Superior and the neighbourhood of the Barren Grounds to New Mexico and Arizona, and extends from the Atlantic to the Pacific seaboard.

Habits. Chipmunks are among the commonest of North American Rodents, and their habits are consequently thoroughly well known. As those of all of the species are probably nearly similar, the excellent account given by Dr. Hart Merriam of the habits of the common chipmunk will suffice for all. These animals are migratory, and may be very abundant in a certain district in one year, while in the next comparatively few will be seen; their relative abundance being dependent upon the supply of food. Chipmunks feed not only on nuts and beech-mast, but likewise on various kinds of corn and roots; and they are also partial to the larvæ of insects. When beech-mast is abundant in the Adirondack Mountains, it may be safely predicted that swarms of chipmunks will make their appearance in the autumn. In such seasons the forerunners arrive in September, while by October the woods are alive with these creatures. "Finding an abundance of food," writes Dr. Merriam, "they immediately establish themselves for the winter, and begin at once to hoard up large stores. They are the least hardy of our squirrels, commonly going into winter-quarters before the middle of November, and rarely appearing again in any numbers till the warm sun, in March or April, has caused plots of bare ground to appear between the snow-banks. Early thaws sometimes bring them out in February; and after having once emerged they often make little excursions over the snow during pleasant days, though the temperature may be several degrees below freezing. In running from tree to tree, even when not pursued, the length of their bound varies from twenty-five to thirty-four inches—a long leap for so small an animal." They commonly

leave the Adirondack region in July, since it is but seldom that there is a good crop of beech-nuts in two successive years. The young are born in the spring, and leave the nest by June.

Chipmunks collect an astonishing quantity of food for the winter, which is carried to its place of deposit in their capacious cheek-pouches. In addition to regular storehouses, these animals lay up a portion of their winter supply here and there beneath the leaves of the forest. In a hole tenanted by four chipmunks, Audubon and Bachman relate that in the nest itself they found about a gill of corn, and in the communicating galleries upwards of about a quart of nuts, a peck of acorns, about two quarts of buckwheat, and a small quantity of Indian corn and grass seeds. Generally the chipmunk keeps to the ground, although it will often run some few feet up the trunk of a tree, and when pursued, if its hole be not



THE COMMON CHIPMUNK (⅔ nat. size).

accessible, will take refuge among the branches. Instances are, however, on record where these animals have been observed regularly ascending tall trees in search of food; and they seemed perfectly at home among the boughs, although they never leapt from branch to branch after the manner of the true squirrels.

In regard to its general mode of life, Dr. Merriam observes that "the chipmunk establishes his headquarters in some log or stump, or in a hole excavated by himself in the earth, generally among the roots of a tree. He is partial to brush-heaps, wood piles, stone walls, rail fences, accumulations of old rubbish, and other places that afford him a pretty certain escape, and at the same time enable him to see what is transpiring outside. For, though by no means wary, he delights in these loosely sheltered hiding-places, where he can whisk in and out at will, peep unobserved at passers-by, and dart back when prudence demands. If suddenly surprised, he utters a sharp *chip-per, r, r, r*, and makes a sudden quick dash for his retreat, which is no sooner reached than, simultaneously with the disappearance of

his tail, out pops his head, his keen dark eyes gazing intently at the source of alarm. If not pursued farther, he is very apt to advance towards the supposed enemy, betraying his excitement by a series of nervous starts and precipitous retreats, till finally, making a bold rush, he dashes by the object of his dread, and in another instant is peering out from a hole beneath the roots of a neighbouring tree." The chipmunk does not appear to make an agreeable pet, as it is apt to be sulky and morose, and disposed to bite the fingers of any one who offers it food.

The Susliks, or Gophers.

Genus *Spermophilus*.

The suslik or sisel of North-Eastern Europe and Northern Asia, and the striped gopher of North America are the best known representatives of the fourth genus of the Squirrel family. Both in this and the two following genera the incisor teeth are not compressed, while the form of the body is generally stout, and the tail either short or of moderate length; the molar teeth being of a simple type. The whole of the species are confined to Europe, Asia Minor, Asia north of the southern flanks of the Himalaya, and North America.

The susliks, as the members of the genus *Spermophilus* may be collectively termed, are characterised by their somewhat slender and squirrel-like form, and the presence of large cheek-pouches. The external ears may be very small, or comparatively large and tufted; and the tail varies from a mere stump to 8 or 9 inches in length. In the fore-feet the first toe is rudimentary, but its nail is sometimes present. The skull approximates to that of the squirrels, but the first upper premolar is relatively larger; and the two rows of upper cheek-teeth are nearly parallel to one another. The coloration may be either uniform or striped, but never resembles that of the chipmunks.

Distribution. The susliks are mainly confined to the colder regions of the Northern Hemisphere, and have very nearly the same distribution as the chipmunks, although there is no species common to the Old and the New World. With the exception of Eversmann's suslik (*S. eversmanni*) of North-Eastern Asia, all the Old World species have short tails, while those of the New World are nearly all long-tailed, and approach more closely in form to the chipmunks. In North America no representatives of the genus occur to the eastward of the plains and prairies forming the centre of the continent, but they range westwards to the coast of the Pacific. In latitude the range of the genus extends from the shores of the Arctic Sea to the plains of Northern Mexico.

The common suslik (*S. citillus*), which is the species depicted in our illustration, is common in Central and Eastern Europe and Siberia, and is a uniformly-coloured animal, scarcely as large as the European squirrel, with a very short tail, and minute external ears. In America the commonest representative of the genus is the striped gopher (*S. tridecemlineatus*), which is some 7 or 8 inches in length, with a tail of about two-thirds that length, and small ears. In colour it is typically dark reddish brown above, with six to eight longitudinal light stripes, alternating with from five to seven rows of light spots; the under-parts being yellowish brown

in the middle line, bordered on the sides with yellowish, with a narrow black band running between the two tints. This species ranges from the Red River in Canada to Texas. The long-eared gopher (*S. grammurus*), ranging from Colorado to California, may be cited as an example of another group of the genus, in which the ears are very large, and often fringed with long hairs, while the tail is very long and bushy. Fossil remains show that susliks were more widely distributed in Europe during the Pleistocene period than they are at the present day; some of their remains having been discovered in the brick-earths of the Thames Valley.

Habits. All the susliks are social and burrowing animals, generally selecting open plains, with a sandy or clayey soil, for the construction of their domiciles, and studiously avoiding forests or swampy districts. The burrows of the common suslik are as much as from six to eight feet in depth, and have each



THE COMMON SUSLIK (½ nat. size).

but a single entrance. When, however, these animals retire to the depths of their burrows for their winter sleep, they excavate a second passage from the sleeping-chamber to within a short distance from the surface of the ground. On awakening in the spring, an exit is made through this second passage, and the original entrance blocked up; and hence the length of time that a suslik-burrow has been occupied is indicated by the number of these deserted entrances around it. Within the burrow a large quantity of food, such as roots, seeds, berries, etc., is accumulated in the summer and autumn for winter use. Susliks will, however, also eat mice and small birds and their eggs. The young are born in the spring, and usually comprise from four to eight in a litter. If captured sufficiently young, susliks can be easily tamed; and their flesh is much esteemed by the peasants of North-Eastern Europe and Siberia.

In America all the more northern species pass the colder portion of the year in a state of hibernation, but in the more southern portion of their range the period

of sleep is considerably shortened, while the species in the extreme south remain more or less active throughout the winter. The striped gopher seems to be more decidedly carnivorous in its habits than the common suslik, devouring not only field-voles and other mice, but also some of the smaller species of squirrels, which cannot even live in a district abounding with gophers. Dr. Hoy states that, when a squirrel is put into the same cage with a striped gopher, the latter "will in a moment be all animation and activity, darting at the intruder, inflicting a wound, and flying back with such rapidity as to leave but little chance of defence. As soon as it has disabled its antagonist, it seizes it by the back of the neck and instantly kills it." The gopher during the combat utters a low snarling growl, and after the death of its victim feasts on the brain and blood. This gopher also frequently robs hens' nests, while other species have been detected in carrying off young chickens and turkeys. More remarkable is the circumstance that Richardson's gopher (*S. richardsoni*) was formerly in the habit of feeding on the flesh of the innumerable carcases of bison left by the hunters on the prairies.

Writing of the habits of Parry's suslik (*S. empetra*), from the neighbourhood of Hudson Bay and Behring Strait,—a species closely allied to Eversmann's suslik of Siberia,—Sir J. Richardson observes that "it is found generally in stony districts, but seems to delight chiefly in sandy hillocks amongst rocks, where burrows, inhabited by different individuals, may be often observed crowded together. One of the society is generally observed sitting erect on the summit of the hillock, whilst the others are feeding in the neighbourhood. Upon the approach of danger, he gives the alarm, and they instantly betake themselves to their holes, remaining chattering, however, at the entrances, until the advance of the enemy obliges them to retire to the bottom."

The Prairie-Marmots.

Genus *Cynomys*.

In addition to being the home of several species of true marmots akin to those of the Old World, North America also possesses a closely allied, but somewhat more specialised genus of Rodents, which may be designated prairie-marmots, although they are often most inappropriately termed prairie-dogs, while they are likewise known as barking squirrels. In size these animals hold a position intermediate between the susliks and the true marmots. They have small ears, and generally short tails, while their cheek-pouches are much less capacious than those of the susliks. In their fore-feet the first toe is well developed and furnished with a claw nearly as large as that of the fifth. The skull is massive, with the large postorbital processes directed nearly outwards (as shown in the figure on p. 66); and the molar teeth are very stout, with three grooves on their grinding-surfaces, in place of the two characterising those of the other two genera of the group. A further peculiarity in connection with the upper molar teeth, is that the two series, in place of running nearly parallel, are convergent behind.

There are three species of prairie-marmots, two of which are confined to the prairies of the Rocky Mountain plateau, while the third inhabits Mexico. The common prairie-marmot (*Cynomys ludovicianus*) is confined to the drier districts

to the east of the Rocky Mountains, and is entirely an inhabitant of open plains. The length of the head and body usually varies from 11½ to 12½ inches, and that of the tail, inclusive of the hairs at the tip, from 4 to 5 inches. In colour the upper-parts are reddish brown varied with grey, and the under parts yellowish or brownish white, the tail being coloured like the back, but with a brownish black tip. The Columbian prairie-marmot (*C. columbianus*) is a smaller species distinguished by its much shorter tail, which is entirely white, and by the more yellow tinge of the fur of the body. It occurs in the regions to the west of the Rocky Mountains, ranging at irregular intervals from Columbia through Colorado



THE PRAIRIE-MARMOT (¼ nat. size).

and Arizona to the Sierra Nevada, and is a more mountain-dwelling animal than the preceding, occurring at elevations of as much as ten thousand feet above the sea. The Mexican prairie-marmot (*C. mexicanus*) is the largest of the three, and is distinguished from the common species of the plains by its much longer tail, in which the black at the tip is darker and extends for a greater distance.

Habits. In general habits the prairie-marmots very closely resemble the true marmots, but it is stated that there is a distinct difference in this respect between the common and the Columbian species; the burrows of the latter being unprotected by a raised funnel-shaped entrance which is so characteristic of those of the former. The following account of the habits of the Columbian prairie-marmot is taken from the travels of Lewis and Clark, who write that

"these animals form large companies, like those on the Missouri, occupying with their burrows sometimes two hundred acres of land. The burrows are separate, and each possesses perhaps ten or twelve of these inhabitants. There is a little mound in front of the hole, formed of the earth thrown out of the burrow; and frequently there are three or four distinct holes, forming one burrow, with their entrances around the base of these little mounds. These mounds, sometimes about two feet in height and four in diameter, are occupied as watch-towers by the inhabitants of these little communities. The marmots, one or more, are irregularly distributed on the tract they thus occupy, at the distance of ten, twenty, or sometimes from thirty to forty yards. When anyone approaches they make a shrill whistling sound, somewhat resembling *tweet, tweet, tweet*, the signal for their party to take the alarm and to retire into their intrenchments. They feed on the roots of grass, etc." In Kansas the common prairie-marmot appears only to retire for a few days at a time during the most inclement portion of the winter, having been observed in January as active as in summer. Farther to the north these animals doubtless, however, retire to their burrows for longer periods.

Some of the burrows of the eastern species are commonly tenanted by a small kind of owl, while others are occupied by rattlesnakes; and it is a common popular error that all these three animals live together in mutual association and harmony. This, however, is far from being the true state of the case. The owls, indeed, take up their abode in some of the deserted burrows, and do no harm to their former owners, their food consisting mainly of insects and crayfish. On the other hand, the rattlesnakes resort to the colony for the purpose of feeding upon the young marmots; and although they usually dwell in one burrow, from which they have expelled the rightful occupants, they enter others in search of food.

The True Marmots.

Genus *Arctomys*.

All who have travelled in the higher Alps or Himalaya, are familiar with the shrill, piercing, whistle-like screams of the marmots, uttered when they first catch sight of an intruder on their lonely domains, and preparatory to taking refuge in the security of their burrows. The true marmots, which are the largest members of the present group, are distinguished from prairie-marmots by their still stouter build, the absence of pouches in the cheeks, and the rudimentary condition of the first toe of the fore-foot, which has only a flattened nail in lieu of a claw. Their skulls are, moreover, still broader, with the two rows of upper molar teeth nearly parallel, and each molar tooth marked only by a pair of transverse grooves. The ears are small, like those of the prairie-marmots; and the tail is generally short, although occasionally equal to half the length of the head and body. In size marmots vary from about 15 to 25 inches in length, exclusive of the tail; the measurements of the latter ranging from 3 to about 12 inches. In general appearance, the stoutness of their bodies and the shortness of their limbs are their most obvious features. The head is wide and short, the small ears are more or less

rounded, the eyes large and full, and the tail bushy. Their fur is of moderate length and rather coarse and stiff; and their colour is some shade of golden or reddish brown, shading more or less decidedly into black along the middle line of the back and on the tail, the tip of the latter being invariably dark.

Distribution. Marmots inhabit the northern portions of both the Old and New World, but in the former have a much more extensive distribution than either susliks or chipmunks. In the more southern portions of their range in the Old World, these animals are found only at considerable elevations above the sea-level, but in more northern districts, like the Siberian steppes, they are found on the lowland plains. In North America the common marmot, or woodchuck, inhabits low elevations in districts where the winter climate is severe; but a second species is exclusively a mountain-dweller. None of them are found in forest districts; and, whether in the mountains or on the plains, they generally select open spaces with a sandy soil, and within easy distance of water, for the construction of their burrows.

Old World Marmots. In Europe there are two representatives of the genus, of which the first and larger is the Alpine marmot (*Arctomys marmotta*), now confined to the three disconnected mountain-ranges of the Pyrenees, Alps, and Carpathians; although, as attested by its fossil remains, during the Pleistocene period, when the climate was different, it was an inhabitant of the lowlands of Germany and other parts of the Continent. The length of this marmot is about 20 inches, exclusive of the comparatively short tail.

The bobac (*A. bobac*), of which a group is represented in our plate, is a smaller species, measuring only about 15 inches from the nose to the root of the tail, and with a much wider geographical range. This species has its present westerly limits on the frontier of Germany, and thence ranges eastwards through Galicia and Poland, across the steppes of Southern Russia, and so on to Amurland, Kamschatka, and Siberia; the climate of these regions being sufficiently cold to admit of the existence of marmots at low elevations. In Lapland and Scandinavia, marmots are quite unknown; but the southern limits of the bobac do not yet appear to be ascertained.

Central Asia and the higher ranges of the inner Himalaya are inhabited by numerous species of marmots, but the genus is quite unknown to the southward of the latter range. Of these Asiatic species, one of the best known is the short-tailed Himalayan marmot (*A. himalayanus*), which is nearly allied to the bobac, but of somewhat larger size. Its range extends from the mountains of Yarkand and other parts of Turkestan to Ladak and Eastern Tibet, where it is usually found at elevations of from twelve thousand to thirteen thousand feet. The largest and handsomest of the whole Old World group is, however, the long-tailed red marmot (*A. caudatus*), in which the length of the head and body is about 24 inches, and that of the tail fully half as much. This marmot is readily recognised, not only by its large size and the great length of the tail, but also by the deep rufous tinge of the fur, and the large amount of black in the region of the back. This fine marmot may be met with on the mountain-ranges to the north of the valley of Kashmir, and thence to Gilgit in one direction, and parts of Ladak in the other, while it is also said to extend far into Central Asia. Other kindred but smaller



A COLONY OF BOBAC MARMOTS.

species are the Cabul marmot (*A. dichrous*) from Northern Afghanistan, and the golden marmot (*A. aureus*) from the mountains to the west of Yarkand.

The districts inhabited by all the marmots of the Old World are desolate and barren; being in most cases scorched with fierce heat in summer, while in winter they are subject to intense cold. In the Himalaya, these animals are not met with until the traveller has crossed the wooded outer ranges, and entered the bleak Tibetan districts. The barren nature of the Siberian steppes is too well known to need more than passing mention. The occurrence of fossil remains of the Alpine marmot in many parts of Europe, such as Germany, the south of France, Italy as far south as Mentone, and Belgium, naturally leads to the conclusion that Western Europe had at one time a more or less steppe-like climate. As milder and more genial climatic conditions supervened, the Alpine marmot gradually retreated to the nearest mountain-ranges; and we thus have a complete explanation of its present isolated distributional areas.

Habits. The habits of all the marmots of the Old World appear to be very similar; all the species of these animals living in large companies, and excavating burrows in which they pass the whole of the winter buried in profound slumber. Indeed, marmots seem to be the most thoroughly hibernating of mammals, since their sleep is apparently unbroken, and they lay up no store of winter food. All the species are diurnal in their habits; and their food is purely of a vegetable nature, consisting mainly of roots, leaves, and seeds of various plants. In the Himalaya the burrows are very generally constructed beneath the shelter of a plant of wild rhubarb; and the tenants on a fine day take up their station on the mound at the entrance, or journey for a short distance in search of food. At the least alarm, they rush at once to the entrance of their burrow, when they sit up on their hind-quarters to survey the scene and detect the danger. If the enemy approach too close, the loud whistling scream is uttered, and the animal dives headlong into its burrow, to reappear after a time and see if the coast is clear. Both in the Alps and Himalaya marmot-warrens are situated in exposed situations, generally where there is a considerable open space, and which in winter are deeply buried in snow. In the case of the Alpine species, the winter-quarters are made in large burrows, each with a single entrance, and terminating in an extensive chamber lined with grass; such chambers, according to Prof. Blasius, frequently containing as many as from ten to fifteen occupants during the winter, all lying closely packed together. From two to four young appears to be the usual number in a litter of the Himalayan species.

The flesh of marmots is said to be of good flavour, and is largely consumed by the inhabitants of the Siberian steppes, who as soon as the bobac reappears in spring, after its winter sleep, organise a regular system of hunting. In shooting marmots it is essential that they should be killed at the first shot, as the sportsman is only able to come within range when they are sitting at the mouths of their burrows, and if only wounded, no matter how severely, they are well-nigh sure to have sufficient power left to struggle down. Marmots in the Himalaya will generally reappear after being fired at once, but after a second fright they are seldom seen again on that day. All the species appear to be readily tamed.



FLYING SQUIRREL.

excavation, the woodchuck will sometimes take up its abode in rocky ledges or in the hollow roots of trees. During the summer the greater number of these animals live in the open fields; but in the winter it appears that in the Adirondack region at least they retire for the winter to burrows situated close to, or actually within, the borders of woods. In the Adirondacks the woodchucks become very fat in the early autumn, and retire for their winter sleep—no matter what be the temperature or the state of the weather—about the equinox, from which they do not awake till the middle or latter part of March. Still more remarkable is the circumstance that the animal often retires when the weather is genial and food abundant, while at the time of its reappearance the ground is frequently deep in snow.

"Woodchucks," writes Dr. Merriam, "are both nocturnal and diurnal, the periods of feeding being determined, in a general way, by the time of the year, the weather, and the proximity of enemies. In summer, throughout the farming districts, they commonly leave their burrows early in the morning, late in the afternoon, and during moonlight nights; but may sometimes be found abroad at all hours. As autumn approaches, and they become more fat and sleepy, they usually appear only in fine weather, and then but for a few hours in the hottest part of the afternoon." Like the Old World species, the woodchuck when much hunted becomes exceedingly wary and difficult to approach; but it differs from all the latter in that it will sometimes ascend trees and shrubs—making these ascents sometimes for pleasure and at others to avoid foes. Woodchucks live either singly or in pairs; the young, which are born at the end of April or beginning of May in the Adirondack district, remaining with their parents only a few months. The number in a litter is usually from four to six. When the young first leave their parents they take refuge in stone walls, hollow logs, or even hollow trees—habits quite different from those of their Old World cousins, and showing a marked approximation towards the chipmunks.

In some parts of New Hampshire woodchucks are so numerous as to cause serious inconvenience to agriculturists, and rewards have consequently been offered by the State for their destruction.

Extinct Marmot-like Rodents. Remains of extinct species of susliks occur in the higher Tertiary rocks of Europe; in addition to which the Upper Eocene beds of France yield evidence of an extinct but apparently allied genus, known as *Plesispermophilus*. More primitive are the forms described as *Plesiarctomys*, which, while showing certain resemblances both to the marmots and the squirrels, have triangular three-cusped upper molar teeth, and no bony process defining the hinder limit of the upper border of the socket of the eye. These Rodents are found in the Middle Tertiary deposits both of Europe and North America.

The Flying Squirrels.

Genera *Sciuropterus*, *Pteromys*, and *Eupetaurus*.

The flying squirrels of the Northern Hemisphere, which are divided into the three generic groups named above, are sufficiently characterised by possessing a parachute-like membrane extending from the sides of the body to the toes, and

supported in front by a cartilage attached to the outer side of the wrist. There is also another membrane connecting the sides of the neck with the fore-limb; and there may be likewise one between the hind-legs and the root of the tail. The molar teeth are of a very complex type, and as their skulls differ considerably from those of all the preceding genera, the flying squirrels are now regarded as indicating a distinct subfamily. Moreover, as the group is known to be of considerable antiquity, it is not improbable that it has no generic affinity with any of the foregoing genera but that it traces its descent to some totally extinct group of the family. With the exception of one North American species, and a second from Siberia and Eastern Europe, the flying squirrels are confined to the Indian and Malayan regions. They are all exclusively nocturnal in their habits, and mainly inhabit forest regions, although one may frequent rocks alone. Their mode of flight and general habits appear to be very similar to those of the flying lemur; and when leaping from tree to tree they utter sharp piercing cries which are familiar to all who have travelled in regions where flying squirrels are to be found.

Lesser Flying Squirrels. The lesser flying squirrels, constituting the genus *Sciuropterus*, are those which have the lowest crowned molar teeth in the group, although there is considerable variation in the structure of these teeth. All the members of the genus are distinguished by the parachute-like membrane along the sides being of moderate width; and by the rudimentary condition of the membrane between the hind-legs, which does not include any portion of the tail. The fur, as in all other members of the group, is very thick and soft; but the tail differs from that of the other flying squirrels in being broad, and flattened from above downwards, in order, probably, to act as an aid in flight. In size these animals vary from 5 to 12 inches in length. The large size of their expressive eyes, and the beautiful silky softness of their fur, render them exceedingly attractive creatures. The North American species (*S. volucella*), which is the one represented in our illustration, has the fur of an ashy brown above, and creamy-white below.

Distribution and Habits. The lesser flying squirrels include a considerable number of species, one of which is an inhabitant of North America, and a second of Siberia and North-Eastern Europe, while all the others are confined to the Indian and Malayan regions, extending as far northwards as Afghanistan and Kashmir. The following notes refer mainly to the habits of the North American species, of which an excellent account is given by Dr. Hart Merriam. Like ordinary squirrels, these animals subsist mainly on nuts, seeds, and buds, but the American species also eats beetles, and probably other insects, and may be taken in traps baited with meat, while in confinement it will but seldom refuse flesh. The American flying squirrels construct nests in the hollow trees they haunt, and in the cold winters of the Adirondack region near New York they retire to these nests, and probably hibernate. The same habits will doubtless hold good for the species inhabiting Kashmir and Afghanistan, but those inhabiting India proper and the warm Malayan region remain active at all seasons. The Kashmir flying squirrel (*S. fimbriatus*), in some cases at least, produces four young at a birth.

In the daytime these squirrels remain concealed in hollow trees, and only issue forth at sunset in quest of food. Numbers frequently associate in one tree;

and if such a tree be discovered the creatures may be induced to come forth one after another by tapping the stem. With regard to the flying leaps of the American flying squirrel, Dr. Merriam observes that "the ease, grace, and rapidity with which it glides from tree to tree inspires the merest passer-by with wonder and admiration. Its ordinary mode of progression is by a series of alternate climbs and leaps. Upon reaching a tree, the first act is to ascend, for, being unable to sail horizontally, it must attain a considerable elevation before venturing to leap to the next. Instead of moving off in this way when disturbed, it sometimes runs up into the topmost branches of the nearest tree, and, curling itself into a surprisingly small compass, remains motionless until the intruder has taken his departure."

The earlier writers, Audubon and Bachman also describe very graphically the



AMERICAN FLYING SQUIRREL (½ nat. size).

movements of a colony of these animals they once encountered. "At times, they write, "one would be seen darting from the topmost branches of a tall oak, and with wide extended membranes and outspread tail gliding diagonally through the air, till it reached the foot of a tree about fifty yards off, when at the moment we expected to see it strike the earth, it suddenly turned upwards and alighted on the body of the tree. It would then run to the top and once more precipitate itself from the upper branches and sail back again to the tree it had just left. Crowds of these little creatures joined in these sportive gambols; there could not have been less than two hundred. Scores of them would leave each tree at the same moment, seeming to have no other object in view than to indulge a playful propensity." In America the flying squirrels breed early in April.

The American flying squirrel, if taken sufficiently young, can be readily and speedily tamed, and forms a most charming pet. Indeed, it is said that they become tame and thoroughly confiding much sooner than any other kind of wild

creature. When going to sleep, a specimen kept by Prof. F. H. King was in the habit of first placing its nose upon the table, or other surface upon which it happened to be standing, and then walking forwards and at the same time rolling itself up, until the nose almost protruded from between the hind-legs. The tail was then curved in a horizontal coil around the feet, so that the whole animal appeared to form a complete ball of soft fur.

One of the smallest representatives of these animals is the pigmy flying squirrel (*S. spadiceus*), from Arakan and Cochin-China, in which the length of the head and body is only about 5 inches, while the tail is half an inch shorter. This species is chestnut-red above, with the basal portions of the hairs black, and white beneath. The polatouche, or Siberian flying squirrel (*S. volans*) is about 6 inches in length, with the upper-parts of the body in summer tawny brown, and the under-parts pure white; the tail being greyish above and rufous beneath. Extinct representatives of these flying squirrels have recently been recognised from the middle Tertiary deposits of Europe, and it is probable that the genus is likewise represented in the corresponding rocks of North America.

Larger Flying Squirrels.

The larger flying squirrels (*Pteromys*), of which an example is represented in our coloured Plate, in addition to their superior dimensions, are distinguished from the preceding by the greater relative width of the flank-membrane, by the presence of a well-developed membrane connecting the hind-legs and embracing the upper part of the tail, as well as by the perfectly cylindrical form of the latter appendage. They are further characterised by the taller crowns and somewhat more complex structure of the molar teeth, which are nearly similar in all the species.

There are at least ten species of this genus, ranging from India, through Burma and the Malayan region to the south of China and Formosa, and also extending northwards into Eastern Tibet. One of the best known species is the Malayan flying squirrel, or taguan (*P. petaurista*) from the Malay Peninsula and Islands. Closely allied, is Hodgson's flying squirrel (*P. magnificus*), from the Nipal Himalaya and the ranges south of the Assam Valley, at elevations of from five thousand to six thousand feet. The length of the head and body of this species is 16 inches, and that of the tail from 18 to 22 inches. Its colour appears to undergo a seasonal change: the upper-parts, in what is considered to be the summer-dress, being of a deep maroon colour, usually with a more or less distinct yellow line down the middle of the back; while the sides of the neck and the inner border of the parachute yellowish, and the rest of the latter reddish or chestnut. On the other hand, in the presumed winter-coat, the upper-parts are chestnut, without any light line down the back. The larger forests of peninsular India south of the Ganges, as well as those of Ceylon, Burma, and Mergui, are tenanted by another very fine species known as the large brown flying squirrel (*P. oral*), in which the length of the head and body varies from 16 to 18 inches, and that of the tail from 24 to 25 inches. The general colour is grizzled-brown above, varying from deep chestnut to grey in one direction, and to black in the other; the under-parts being white, often more or less tinged with grey or brown. In the Western Himalaya, at elevations of from six thousand to ten thousand feet, and in Kashmir, this species is replaced by the closely allied large red flying squirrel (*P. inornatus*), distinguished by its

more rufous pelage. The spotted flying squirrel (*P. punctatus*), represented in our coloured Plate, is a considerably smaller species from Malacca and Burma, distinguished by the white spots on the back.

The habits of all the members of this genus are very similar and closely resemble those of the lesser flying squirrels. The large red species probably hibernates, but most of the others are active throughout the year. The common brown Indian form inhabits the forest, but in forest-clad districts they may be found near villages in clumps of mango and other trees. In addition to fruits and nuts, it is said to eat bark, and also insects and their larvæ; and it drinks by lapping with the tongue. Its cry is described as a low, soft monotone, quickly repeated. Mr. Blanford writes that this "flying squirrel sleeps during the day, sitting, like so many arboreal mammals, with its back bent into a circle and its head thrust inside; or, in hot weather, lying on its back with the parachute extended. It is not so active as other squirrels, either on trees or on the ground, the parachute impeding its movements. When passing from one tree to another at a distance, it leaps, with its parachute extended, from the higher branches, and descends, at first more directly, then, apparently, by availing itself of the resistance of the air, more and more obliquely, until its flight gradually growing slower, becomes horizontal and finally terminates in an ascent to the trunk or branch of the tree to which its flight is directed." It is stated that these squirrels have been known to traverse distances of sixty and nearly eighty yards in their flight from tree to tree. Although readily tamed, they are very difficult to keep alive in captivity.

Woolly Flying Squirrel. The woolly flying squirrel (*Eupetaurus cinereus*) differs from all the other members of the family in having markedly high-crowned teeth, with flat (instead of ridged) grinding surfaces, and is accordingly referred to a distinct genus, which must be regarded as the most specialised member of the group. This magnificent flying squirrel inhabits the district of Gilgit, to the north-west of Kashmir, and is one of the largest species, the length of the head and body being about 18 inches, and that of the unusually bushy tail about 24 inches. This species differs from the members of the preceding genus by its shorter and blunter claws; its general colour being dull greyish brown, with a slight greenish tinge above, and ashy brown below. From the nature of the districts in which it occurs, and also from the shortness and bluntness of its claws, it is inferred that this squirrel is in the habit of climbing about on rocks, instead of living on trees. A magnificent skin of this species was obtained in Kashmir by the present writer about 1878, but it was not till the arrival in England ten years later of a living although smaller example of the animal that it was recognised as a distinct species. It is not improbable that this fine flying squirrel also occurs in Tibet.

The Pigmy Squirrels.

Genus *Nannosciurus*.

A small group of tiny squirrels comprising only five species, of which three are from Borneo, and the fourth is an inhabitant of the Philippines, while the fifth (*Nannosciurus minutus*) is West African, are now regarded as constituting not only

a distinct genus, but likewise a separate subfamily, although they were till recently included among the true squirrels. Their skulls are remarkable for the elongated form of the region of the face, while the forehead is much broader than in any other type; and the process defining the hinder border of the socket of the eye is so elongated as to cause the eye to be almost surrounded by bone. In the upper jaw there may be either one or two pairs of small premolar teeth; and the molars are much more complex than in any other squirrels, closely approaching those of the dormice in structure; the upper molars having only three transverse plates, instead of the four characterising those of the other members of the family.

One of the prettiest representatives of the group is Whitehead's pigmy squirrel (*N. whiteheadi*), from North Borneo, in which the head and body measure only about 3¼ inches in length, and the ears are surmounted by extraordinarily long tufts of black and white hairs, apparently more elongated than in any other squirrel. This little animal, which is grizzled olive grey in general colour, may be commonly seen running up and down the trunks of the forest trees on Mount Kina Balu.

The Sewellels.

Family *Haplodontidæ*.

These North American Rodents differ so remarkably from the other living forms that they are regarded as constituting a family by themselves, of which the nearest affinities are supposed to be with the Squirrel family. They differ from all the members of that family by their extremely flattened and broad skulls, in which there is no postorbital process defining the hinder part of the upper border of the socket of the eye. The molar teeth have no roots, and the first pair of premolars in the upper jaw are exceedingly minute.

Common Sewellel. The common sewellel (*Haplodon rufus*) is an animal measuring about a foot in length, exclusive of the stump-like tail, which measures little more than an inch. The general colour of the fur is brown, more or less mingled with black, with the under-parts greyish; the front teeth being yellow. The general form of the animal is short and clumsy, with the body relatively large and cylindrical. Dr. Hart Merriam observes that "this singular animal, which has come down to us as a relic of the past, and has no near affinities with any existing group, inhabits a narrow strip of country on the north-west coast of the United States. All the specimens thus far obtained have come either from Oregon or Washington, or from the Chilukweyuk River near its junction with the Fraser, just across our border in British Columbia." The animal lives in companies, constructing burrows in moist ground.

Californian Sewellel. The Californian sewellel (*H. major*)—the mountain-beaver of the inhabitants—is a larger animal, measuring 16 inches in length, with greyish brown fur above. These Rodents inhabit the Sierra Nevada, and are largely aquatic in their habits. Mr. C. A. Allen, by whom the species was discovered, writes that they "live in small colonies, and inhabit wet ground where there is plenty of running water. They are very compact and strong, with a head

which resembles that of a pug-dog. They are very shy, timid animals. On first seeing a human being, they try to hide away, but on being aroused are savage enough. . . They come out of their burrows about sundown to get their food, and again at daylight in the morning." Mr. Allen proceeds to say that the food of this sewellel is mainly composed of aquatic plants, especially the stems of a water-lily; and he adds that the burrows of these animals are always on the lower part of a hillside, and frequently have running water passing through them. Their feet are eminently adapted for grasping, and it is stated that these creatures are in the constant habit of ascending broken and small trees furnished with branches. They are generally captured by means of traps set in the water.

The Beavers.

Family *Castoridæ*.

From the large relative size of the animals themselves, coupled with their extraordinary constructive and destructive powers, an amount of interest invariably attaches to beavers which is not vouchsafed to other members of the order to which they belong. As is so frequently the case in analogous instances, the constructive abilities and engineering capacities of these animals—marvellous as they undoubtedly are—have, however, been greatly exaggerated in popular estimation; and the creatures have been credited with performing tasks of which they are utterly incapable.

Beavers, of which there are two species or varieties,—one confined to Northern and Eastern Europe and parts of Western and Northern Asia, and the other to North America,—are the only existing representatives of the family to which they belong, and constitute the genus *Castor*. The family is characterised by the massive form of the skull, in which there are no postorbital processes defining the hinder border of the eye-sockets, and the angle of the lower jaw is rounded off. There is but one pair of premolars in each jaw; and the cheek-teeth have no roots, a perfectly flat grinding-surface, and re-entering folds of enamel. The two series of cheek-teeth converge towards the front of the jaws, and the premolar in each jaw is larger than either of the molars.

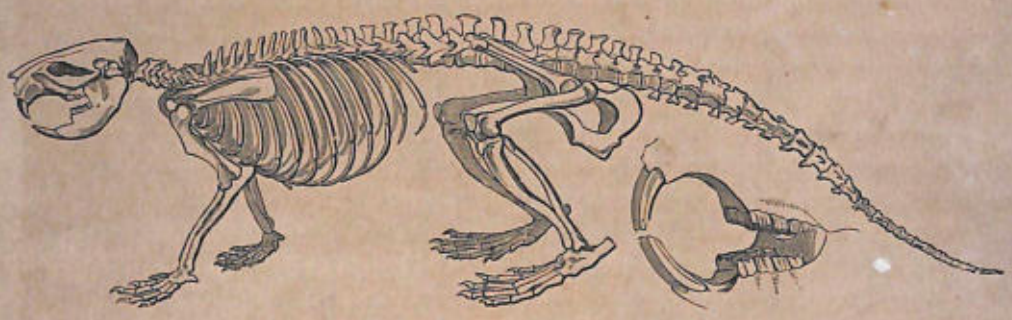
As a genus, beavers are characterised by their stout and heavy bodily conformation, this being most marked in the hinder quarters. The head is large and rounded, with short ears; and the tail is of moderate length, much flattened, and covered with a naked, scaly skin. The limbs are short, with five sharp-clawed toes on both the fore and hind-feet[1]; all the toes of the hind-feet being connected by a web extending to the roots of the claws. The portion of the muzzle surrounding the nostrils is naked, as are the soles of the feet, while the ears are scaly. Both the ears and the nostrils are capable of being closed. The fur is peculiarly thick and soft, its general colour being reddish brown above, and greyer beneath. There is, however, some amount of individual variation in this respect, individuals from northern regions inclining to be darker in coloration than those from the southern districts of the habitat of these animals. Occasionally pied or

[1] There is an additional claw on the second toe of the hind foot, probably employed in dressing the fur.

white beavers are met with. Each molar tooth has three folds of enamel on one side, and one on the other; the three folds occurring on the outer side in those of the upper jaw, and on the inner side in the lower teeth. In size, the beaver is the largest of all the Old World Rodents, its total length being about 40 inches, of which 10 are taken up by the tail. The weight of the adult animal usually varies from about 45 to 50 lbs., but may reach as much as 60.

European and American Beavers.

There has been much discussion as to whether the American beaver (*C. canadensis*) is entitled to rank as a distinct species, or merely as a well-marked variety of the European *Castor fiber*; and there is still a difference of opinion among zoologists on this point. That the two are very closely allied is admitted on all sides; and, although the matter is not of very much importance one way or the other, it is, on the whole, convenient to adopt the view of their specific duality. The main difference between the two forms is to be found in the characters of the skull; that of the European beaver being relatively narrower in front, with the nasal bones extending somewhat



SKELETON AND JAWS OF BEAVER.

farther back than is the case with its transatlantic cousin. A large series of specimens show, however, that these characteristics are liable to a certain amount of variation in the two forms.

Distribution of the European Beaver.

Owing to incessant persecution for the sake of their valuable fur, both the European and the American beaver are doomed to extinction as wild animals at no very distant date; this fate having already practically overtaken the European species, which only lingers on here and there in small numbers. Formerly, beavers were widely spread over Europe; and their abundance in the British Isles is attested not only by the numerous remains found in the fens and cavern-deposits of England, but likewise by the number of places, such as Beaverbourne, Beverage, Beaverege, Bevercater, Beverley, Beverstone, and Beversbrook, which derive their names from these animals. According to the researches of Mr. J. E. Harting, it does not appear that there is any historic evidence of the existence of beavers in England; but in Wales it is on record that they still lingered in Cardiganshire as late as the year 1188. That they occurred in the south of Scotland is proved by the occurrence of their remains, but there is no definite historic evidence of their existence; while in Ireland we have neither the testimony of their remains nor of documents.



BEAVERS AT WORK.

On the Continent beavers were exterminated from Holland in 1825. In France evidence of the former abundance of these animals is afforded by their buried remains, and by the names of places like Bièvre and Beuvray. Within the historic period the Rhine and its tributaries appear to have been their last strongholds, although they had become very rare during the last century. Beavers are, however, still met with in the Rhone and its affluents, where M. Mayet, writing in 1889, estimates that from twenty-five to thirty are annually killed. In the Pleistocene period the beaver ranged into Italy as far south as Rome, but there is no evidence of its existence there since that date. The lake-villages of Switzerland afford evidence of the abundance of beavers in that country during the prehistoric period; and in the early part of this century they still lingered on in the Rhine, one having been captured in the year 1829. In North-Western Germany the Moselle and the Maas were formerly noted for the number of their beavers. The Lippe—one of the tributaries of the Rhine—was likewise a well-known haunt; and at Kettlinghausen and Paderborn on that river, there were large colonies of these animals at the beginning of the present century. Again, in the Elbe basin, there was a considerable colony near Magdeburg in 1829, while at Wittenberg and Kühnert these animals were abundant in 1801, while no less than eight individuals were observed in the latter locality so late as 1878. In Bohemia, the valley of the Moldau, forming the upper part of the Elbe basin, abounded in beavers up to the year 1848, although this was largely owing to strict protection. On the upper Danube and its tributaries there were numerous colonies in the first half of this century, one of the most noted being on the small river Amper, to the north of Munich, which was in a flourishing condition between the years 1837 and 1846. Beavers also existed on the lower Danube in Austria, Hungary, and Turkey; and they have been recorded from the upper Euphrates Valley and the Caucasus. On the lower Danube a colony is preserved by the Emperor of Austria.

From the Caucasus the range of the beaver extended through Russia, Poland, and Livonia, to Lapland and Scandinavia. Beavers were abundant in the Tereck Valley to the north of the Caucasus in 1842; and in Livonia they were so common in 1724, that their dams were a serious inconvenience to the district. The last Livonian beaver was, however, killed in 1841; but a few were still living in the Dnieper and the Svislocz (Government of Minsk) in 1889. The Russian rivers Dwina and Petchora, respectively flowing into the White Sea and Arctic Ocean, were inhabited by beavers till 1842. Through Silesia it is believed that these animals extended as far east as Amurland; but in the valley of the Obi they are now extinct in the Irtish, although still lingering in the Pelyin; and they have quite disappeared from the Yenesei in Eastern Silesia. In Poland and Lithuania a few may still survive; but the last Lapland beaver was killed about 1830. In Scandinavia three considerable colonies still exist near Arendal in Norway, the number of individuals living in 1883 being about one hundred; these colonies are strictly preserved. In Denmark we only know of the existence of the beaver by the evidence of its remains buried in the peat-mosses. It may be added that in 1874 the Marquis of Bute introduced beavers into the island from which he takes his title, where they have since thriven.

Distribution of the American Beaver.

At the time of the discovery of America, the beaver of that continent had a wider distribution than any other mammal except the puma. Its range extended from Alaska and the Hudson's Bay district in the north, along the Atlantic seaboard as far south as Georgia and Northern Florida, and thence along the Gulf of Mexico as far as the Rio Grande in Texas, and also some distance into Mexico; while on the Pacific Coast it extended to California and Arizona. The desert and the prairie districts of the interior, as being unsuitable to its habits, were, however, of course, not tenanted by the beaver, which was necessarily confined to the valleys of the great rivers and lakes. Writing in 1877, Mr. C. A. Allen observes that "its present range, however, is much more restricted, very few being found east of the Mississippi River south of the great lakes, and it is everywhere less numerous than formerly. Some still remain in northern Maine and in the Adirondack region of New York, and probably some still survive thence southwards in the sparsely-settled districts to Alabama and Mississippi. A recent article states that they are still abundant in portions of Virginia. Their existence is in great abundance throughout the Atlantic States, and thence westward to the Pacific." Since the date when this passage was penned, the extermination of the beaver appears to have gone on apace; and Mr. H. T. Martin, writing in 1892, says that only a few colonies now linger in the United States, especially on the slopes of the Rocky Mountains, while in Canada the numbers of the animal are vastly diminished. "Along the watershed, between the Hudson's Bay rivers and the St. Lawrence, in the upper waters of the Frazer and Peace Rivers, and along the Rocky Mountain Range, may be considered the last homes of the beaver." Mr. Martin adds that "as to the ultimate destruction of the beaver no possible question can arise, and the evidences of approaching extermination can be seen only too plainly in the miles of territory exhibiting the decayed stump, the broken dam, and deserted lodge. The passing bear or wolverene tears open the lodge, partly in the vain hope of finding a meal; partly from habit; the rising waters float the logs away, while the drifting ice in fall and spring gradually destroys the dam, till within a decade, where once the busy colony spent their happy domestic lives, no sign remains of all their wondrous toil."

Habitat.

Beavers are mainly nocturnal, and almost exclusively aquatic animals; although it is stated that during the summer they will sometimes make journeys of considerable length on land, when they subsist upon fruit and corn, instead of their usual diet of bark and twigs. They are likewise essentially social creatures, usually associating in larger or smaller colonies; although the few still remaining in the rivers of the Old World are—owing to the lack of companions—for the most part either solitary or in pairs. Needless to say, these animals are expert divers and swimmers; their movements in the water being graceful in the extreme, and effected almost entirely by the aid of their powerful and webbed hind-limbs. In addition to bark and twigs, they consume large quantities of the roots and stems of water-lilies and other aquatic plants. The young, usually from three to four in a litter, are produced at the close of the winter or early in the spring, in the shelter of the burrow or lodge, but it is not yet ascertained whether they are born with their eyes open or closed. Beavers do not hibernate, in the strict sense of the term, although during the depth of the winter they sleep

longer, and move about much less than at other times. In the winter, in America at all events, they swim about beneath the ice, dragging up water-lily roots for food and feasting upon the store of branches they have accumulated in the deep pools during the winter; and it is for the purpose of securing a sufficient depth of water in which to swim beneath the ice that they construct their well-known dams. Most of the beavers still remaining in the rivers of the Old World live in burrows in the banks, without constructing either dams or lodges. The colony near Magdeburg, alluded to above, are known, however, to have undertaken both these engineering works; and it is hence probable that European beavers were originally similar as regards their habits to their American cousins, but that through their reduced numbers and the constant persecution which they have undergone, the building propensity has been lost.

In America beavers generally select as their haunts a well-timbered district traversed by a narrow stream; and by felling the trees on the banks, and forming with the aid of their trunks and boughs a dam and lodges across the stream, the water is headed back so as to form a large lake or pool. In some cases a series of such dams and pools may be seen one above another in the course of the stream. It is believed that the original object of tree-felling is to obtain a supply of food for winter; and that the employment of the peeled trunks and branches for the construction of the dam and lodges is a secondary development. The beaver fells the trees it requires by gnawing through their stems with its sharp front teeth at a short distance above the ground; the stem being generally gnawed nearly equally all round till the tree falls with its own weight. As trees on a river bank generally incline towards the water, they usually fall in the required direction. Sometimes, however, the animals miscalculate, and trees which they have felled may be seen caught in the forks of neighbouring stems. The trees selected for felling are usually from five to eight or nine inches in diameter, but occasionally trunks of as much as eighteen across are successfully attacked. The beaver goes to work in a thoroughly scientific manner, gnawing out very large chips, which are sometimes as much as nine inches in length. When the trees are felled, they are stripped of their boughs, and the trunks cut into lengths of five or six feet, which, after being barked, are rolled into the stream or pond, and employed in the construction of the dam and lodges.

The term "lodge," it may be explained, is applied in America to the abodes constructed by these animals in the water of their ponds. It is now generally accepted that the lodge is nothing more than an extreme development of the burrows or "wash" in the banks. On this subject Mr. Martin writes as follows: "Starting with the simple burrow, the next step is the accumulation of logs and branches about its entrance, forming what is called a 'bank-lodge.' In places where the water is shallow towards the shore, a great advantage would be derived from extending this artificial covering of brushwood, so that in time a natural evolution of the lodge disconnected entirely from the shore would take place, and form an independent and very convenient refuge from landward enemies." The lodge contains a large internal chamber, lined with grass, and is entered by several approaches beneath the surface of the water. The construction of the lodge is, however, of a much less elaborate nature than has often been stated to be the case.

On this point Mr. Martin writes that "the beaver-lodge is generally included in the list of marvels reserved for the investigation of those who visit beaver-districts, and yet no greater disappointment awaits the inquirer than the first inspection of one. Somehow the minds of all lovers of natural history become affected by the fabulous accounts concerning this structure, and it is a shock to stand for the first time before a pile of twigs, branches, and logs, heaped in disorder upon a small dome of mud, and to learn that this constitutes the famous lodge. Of course the superficial glance does not convey all that can be learnt in connection with this work, but it does most completely disillusionise the mind. On breaking through the upper walls, the interior is found to be similar to the general type of an animal's sleeping apartment, and has scarcely any distinguishing characteristic."

Both dams and lodges are made more or less impervious to water by the addition of a quantity of mud, which is plastered on by the beavers with the aid of the fore-feet, and not, as is often supposed, with the assistance of the tail; the latter organ acting only as a rudder in swimming. The length of a beaver-dam may occasionally be as much as one hundred and fifty or two hundred yards, and their ponds may cover many acres. Frequently a formation of peat commences round the edges of the ponds, and this may extend over the whole area, converting it into a swampy tract known as a beaver-meadow. A considerable part of the city of Montreal is built upon such beaver-meadows.

In summer beavers generally forsake the neighbourhood of their lodges to travel up or down the stream; occasionally, as already mentioned, taking considerable journeys on land. With the advent of early autumn they return to their winter-quarters, and at once set about the necessary repairs to the dam and lodges, and the collection of a supply of food for the winter.

Commercial Uses and Hunting. The beaver is hunted in North America not only for its valuable fur, but likewise for the substance known as castoreum, which is contained in two elongated glands at the hinder part of the body; while its flesh is also used as an article of food. Castoreum is a waxy substance with a peculiar smell, and is used in medicine, although chiefly on the Continent. It sells, according to Mr. Poland, from thirty-eight to forty-five shillings per lb., and no less than 1486 lbs. of this substance were sold in London alone in the year 1891. Formerly the great demand for beaver-fur was for the manufacture of hats, but since the supersession of silk for beaver-hair in this manufacture, the fur has been used for more ordinary purposes. Mr. Poland states that the number of beaver-skins sold by the Hudson's Bay Company in 1891 was 63,419, while in the year 1743 upwards of 127,080 were imported into Rochelle alone. The price, according to the same writer, varies from 5s. 3d. to 6s. 9d. per skin. The incisor teeth of the beaver were used by the North American Indians, and also by some of the ancient inhabitants of the Old World, as cutting instruments, the bases being fixed into a wooden handle with the aid of twine or thongs.

Before the advance of civilisation a large number of beavers were killed in America by the native Indians for the sake of their skins and flesh, but the slaughter was not such as to have any marked effect on their numbers. Some appear to have been taken in wooden traps, but the favourite method was to attack a lodge in the months of January and February. A party of Indians—male and

female—would on such occasions proceed to a beaver-colony, and, after cutting a series of holes in the ice around each lodge, in which nets were placed, the lodges themselves were dug open. Some of the animals would be killed in their sleeping-places, others were caught in the nets, while others were hunted by the dogs accompanying the party to their burrows, where they were dug out. Some individuals were, however, always allowed to escape, in order to re-populate the colony. With the increasing demand for skins as the country was opened up by Europeans, the Indians resorted to more effectual modes of capture, the rivers and ponds being staked across at the commencement of a raid, in a manner which prevented the escape of a single member of the colony. Subsequently steel traps were introduced, but, from the nature of the beaver's food, it was long before an attractive bait could be discovered. At length it was found that castoreum itself was a deadly lure, and from that date the traps have always been baited with some preparation of that drug. So attractive is castoreum to the animals by which it is produced, that a beaver which swam away with a trap attached to one leg has been known to be caught in another trap on the following day; and there is an instance recorded where one of these animals, after having gnawed off a leg in order to escape, again suffered itself to be ensnared.

The great natural enemy of the beaver is the glutton, or wolverene, whose common Canadian name of carcajou is a corruption of the Indian word quickwahuy, said to mean "beaver-eater." The glutton either digs the beavers out of their lodges, or catches them by lying in wait in the woods.

The Hudson's Bay Company have wisely assigned certain islands in their territory as beaver-preserves, where a certain number of the animals are killed every third year only. It has been proposed to establish "beaver-ranches" in America, but, as Mr. Martin points out, the attempts hitherto made to domesticate these animals do not hold out much encouragement as to the success of the project. It is true that beavers live and become fairly tame in menageries (where, from their nocturnal habits, they are but rarely seen), but they rapidly deteriorate, losing the brilliant gloss of their coats, and acquiring dull, listless habits.

Extinct Beavers. The European beaver makes its first appearance in the "forest-bed" of the Norfolk coast, belonging to the lower part of the Pleistocene period. Here it was accompanied by the giant extinct beaver (*Trogontherium*), distinguished not only by its superior size, but by differences in the structure of the skull and teeth. Its range extended to Siberia. Beavers belonging to the living genus occur in the Pliocene strata of Europe and the Miocene of North America. The earliest European beaver is the *Chalicomys*, which is found in the Miocene beds of the Continent, and was of considerably smaller size than the living forms, while it differed from all living Rodents in having a perforation at the lower end of the upper arm-bone or humerus.

CHAPTER XXXII.

Rodents,—*continued.*

The Mouse-Like Rodents.

Families *Myoxidæ*, *Muridæ*, *Spalacidæ*, etc.

The Rodents treated of in the present chapter comprise several families more or less closely related to the rats and mice, and hence collectively termed the mouse-like group. They differ from the squirrel-like Rodents described in the preceding chapter in the following points. In the first place, as shown in the accompanying figure of the skeleton of the dormouse, the two bones of the lower leg (tibia and fibula) are united at their extremities. Secondly, in the slender zygomatic or cheek-arch of the skull, the cheek-bone (jugal) seldom extends far forwards, and is usually supported from below by a long process from the upper jawbone (maxilla). None of them have any postorbital processes in the skull marking the hinder boundary of the upper part of the eye-sockets, and in no case is there more than a single pair of premolar teeth in each jaw, while frequently even these may be wanting in either one or both jaws.



SKELETON AND MOLARS OF COMMON DORMOUSE.

The Dormice.

Family *Myoxidæ*.

The elegant little creatures known as dormice, or sleepers, so closely resemble diminutive squirrels in form and habits, that they are commonly regarded as closely allied to that group. Apparently, however, these external resemblances are solely due to adaptation to a similar mode of life, the relationship of the dormice to the true mice being much closer than it is to the squirrels.

The dormice are confined to Europe, Asia (exclusive of the Indian and Malayan regions), and Africa, and are all of small size and arboreal habits. They are characterised by their large ears and eyes, and long, thickly-haired tails, the fore-limbs being short in proportion to the hinder ones. There is a pair of premolar teeth in both jaws, so that the total number of cheek-teeth on each side is four;

and these teeth are furnished with distinct roots, and have their crowns marked with transverse folds of enamel. The claws on the feet are short, and the first toe in the fore-foot is rudimentary.

The Common Dormouse.

Genus *Muscardinus.*

The common dormouse (*Muscardinus avellanarius*) is the sole representative of the group inhabiting the British Isles, and is the type of a distinct genus. This



THE COMMON DORMOUSE (⅔ nat. size).

tiny little animal, which is about equal in size to the common mouse, is so familiar to most persons from being commonly kept as a pet by children, that any description seems almost superfluous. It is, however, particularly characterised by the cylindrical form of the long and somewhat bushy tail; while internally it is distinguished from all its kindred by the complex structure of the anterior portion of its stomach. Its cheek-teeth have flattened grinding surfaces, with the folds of enamel arranged in a complex manner.

This dormouse has a rather large head, and a thick, compact body; the muzzle is somewhat pointed, and the ears are about a third the length of the head. The most striking feature of the animal is, however, the large size and prominence of

the full black eyes, which stand out in marked prominence to the tawny hue of the coat. In the adult the fur of the upper-parts is of a light reddish tawny colour, while below it is paler and yellower; the throat and upper part of the chest being marked by a white patch. In the young the colour is, however, at first of mouse-grey, the reddish tinge of the adult appearing first on the head and flanks, and thence spreading over the body. The length of the head and body is 3 inches, and that of the tail about half an inch less.

Distribution. The common dormouse appears to be confined to Europe, ranging from Sweden and Britain in the north to Northern Italy in the south, and extending eastwards as far as the north of Turkey, Galicia, Hungary, and Transylvania. Although generally more common in the southern than in the northern districts of its habitat, it is reported to be less abundant in the south of France than either of the other two species inhabiting Europe.

Habits. In its arboreal mode of life, and the manner in which it holds its food between its fore-paws when eating, as well as in the nature of its food, there is much to remind us in the common dormouse (and likewise its allies) of the squirrel. Whereas, however, squirrels are mainly diurnal, dormice are exclusively nocturnal, remaining curled up during the day in their nests, or in some hole, asleep, and only issuing forth in search of food with the falling shades of evening. The dormouse is usually to be found in dense thickets and coppices, or in hedgerows; making its nest generally among the underwood, although sometimes beneath a protecting tussock of grass in the open field. The winter-nest is a globular structure composed of twigs, leaves, moss, and grass: and is built in the autumn, and stored with a small supply of food for winter use. Occasionally small colonies of either the breeding or the winter-nests may be placed in the same thicket: Yarrell having observed as many as ten or twelve together. After feasting on the abundant nuts and mast of autumn, the dormouse accumulates a large amount of fat, and with the approach of winter retires to its nest for the period of hibernation. A warm day in winter serves, however, to arouse the little creature from its slumbers, when it will consume some of its store of food. The chief food of the dormouse consists of hazel-nuts, acorns, beech-mast, corn, and haws, and other wild berries. It is reported to extract the kernels from hazel-nuts without removing them from their stems; and in climbing from branch to branch in search of food it exhibits marvellous agility. Bell observes that "both fore and hind-feet are well padded internally with fleshy, broadish tubercles, thus converting them into hands, in the use of which the creature, when creeping about in a bush of whitethorn, as we have seen it, exhibits an adroitness which is quite unequalled by the little agile harvest-mouse, and scarcely surpassed by the squirrel."

The duration of the winter sleep is generally from five to six months, dormice generally retiring about the middle of October, and not resuming activity before the end of March or April, by which time they have completely lost all traces of the fat accumulated in autumn. The young do not generally commence their hibernation so early in the autumn as the adults. In England the young of this species are generally born in the spring, although there is evidence that in some cases they may be produced as late as September; thus indicating the prob-

ability of their being two litters in a year. Brehm, however, states that on the Continent the young are not born till August. The young are born blind and naked; the usual number in a litter being three or four. They are produced in a nest very similar to the one used for the winter sleep, which is always placed at a height of a yard or so above the ground. In Germany this species is known as the hazel-mouse (*haselmaus*).

The Squirrel-Tailed and Garden Dormice.

Genus *Myoxus*.

By many zoologists the two larger species of European dormice are each referred to distinct genera, while certain African representatives of the group constitute another pair of generic groups. Although clearly entitled to be separated



THE SQUIRREL-TAILED DORMOUSE AND GARDEN DORMOUSE (½ nat. size).

generically from the common dormouse, all these species are, however, so intimately allied, that it seems preferable to include the whole of them in the single genus *Myoxus*, distinguished from *Muscardinus* by the simple structure of the stomach.

Squirrel Tailed Dormouse.

Of the European species the largest is the squirrel-tailed dormouse (*M. glis*),—the *siebenschläfer* of the Germans and the *loir* of the French,—easily recognised by its thick, bushy tail (as shown in the left-hand figure of our illustration), in which the hairs are arranged in two rows. This species is further characterised by the large size of its cheek-teeth, in which the grinding surfaces of the crowns are flat, and the foldings of the enamel complex. The length of the head and body is a little over 6, and that of the tail rather less than 5, inches. The thick and soft fur is of an ashy-grey colour, more or less shaded with dark brown above, while on the under-parts and the inner sides of

the limbs it is silvery-white; near the junction of the dark upper-parts with the white of the under surface the colour becomes greyish brown. The eyes are surrounded by dark rings, and the tip of the snout, as well as part of the throat, are white. The ears are moderate size, and rounded.

This species is found in Southern and Eastern Europe, extending from Spain, Greece, and Italy, through South and Central Germany to Austria, Syria, and the south of Russia; it is unknown in Denmark and Scandinavia.

In general habits this species closely resembles the common dormouse, but it generally lies concealed during the day in the hollow of a tree, the cleft of a rock, or the burrow of another rodent; and its breeding-nest is invariably concealed in some such situation, and is never built among the boughs of bushes like that of the English dormouse. In autumn it becomes still fatter than the latter; and in this state it was much esteemed as a delicacy by the ancient Romans. The period of hibernation, according to Brehm, generally endures for upwards of seven months; these animals rarely coming forth before the latter part of April. The young, which are sometimes born in the deserted nest of a starling, are usually from three to six in number; and although blind, naked, and helpless at birth, are remarkable for the rapidity with which they come to maturity. In addition to various nuts and berries, this dormouse consumes fruit, and is also said to devour small birds and other animals. In its turn, it is preyed upon by martens, polecats, stoats, and wild cats. Like the common species, the squirrel-tailed dormouse is easily domesticated; and during its period of activity forms an attractive little pet.

The Tree-Dormouse. In Southern Russia, Hungary, lower Austria, and Siberia there is a second species of dormouse (*M. dryas*), nearly allied to the last, but of considerable smaller size, although larger than the garden dormouse. It is generally reddish brown above and white beneath (including the lower surface of the tail); and is easily recognised by the black line extending from near the nose through the eye to the root of the ear. The painted dormouse (*M. pictus*), of Eastern Persia, is a brighter coloured form closely allied to the above.

The Garden Dormouse. The garden dormouse (*M. nitela*), which is represented on the right hand of the illustration on p. 107, is the European representative of a group of several species; distinguished from the preceding by the thinner and tufted tail, the larger and more pointed ears, and the characters of the cheek-teeth. These teeth are relatively small, and have their grinding surfaces concave, with the foldings of enamel very faintly marked. The group is represented in Africa as well as in Southern Europe.

The garden dormouse was known to the ancient Romans as the nitela, and on the Continent at the present day is termed in France the *lerot*, and in Germany the *gartenschläfer*. It is smaller than the squirrel-tailed dormouse, although larger than the common species, the length of the head and body being at the most $5\frac{1}{2}$ inches, while the tail measures about $3\frac{3}{4}$ inches. The head and upper-parts are greyish brown, with a more less marked rufous tinge, and the under-parts pure white. A black ring encircles the eye, and thence extends backwards as a streak beneath the ear to the neck; while there are dark and light spots behind and in front of the ears. The tail is greyish brown at the base, but at the end black above and white below.

The garden dormouse takes its name from being commonly found in the gardens and orchards of the warmer parts of the Continent, where it does much damage to the choicer kinds of fruit. It is found in Central and Western Europe, including France, Belgium, Switzerland, Italy, Germany, Hungary, Galicia, and the Baltic provinces of Russia; and is stated to be specially common in the Hartz Mountains. There is nothing calling for particular remark in the habits of this species, except that it is stated to be more carnivorous in its tastes than any of its European kindred. The young may be produced in a deserted thrush's nest, or in some hole in a tree, or in a freely suspended nest; and it is characteristic of this species that whenever it builds a nest this is always placed between small boughs and never concealed.



SKELETON OF GARDEN DORMOUSE.

Other Species. Omitting mention of the other species allied to the garden dormouse, it may be observed that there is a third group of the genus confined to Africa, the members of which are characterised by the hair being arranged uniformly on the tail, instead of in two longitudinal rows; the whole tail being relatively shorter than in the other groups, with a well-marked tuft at the tip. These African dormice are further characterised by the very small size of their cheek-teeth, in which the foldings of enamel are nearly obsolete.

Extinct Dormice. Remains of dormice are found not uncommonly in the Tertiary strata of Europe, as far down as the upper portion of the Eocene period; most of the species agreeing approximately in size with some of the living forms. The extinct giant dormouse from the rock fissures and cavern deposits of Malta was, however, far larger than any existing species, and more nearly resembled a guinea-pig; this association of giant dormice with pigmy elephants in Malta being not a little remarkable.

Jumping Mice, Jerboas, etc.

Family *Dipodidæ*.

The Rodents included in this family are all purely terrestrial, and for the most part characterised by the great length of their hind-limbs as compared with the front pair, and their long and generally hairy tails; their general appearance and mode of progression thus being markedly kangaroo-like. They have very frequently four upper cheek-teeth; and in all cases the incisor teeth are narrow, and the molars marked by transverse enamel-folds. The skull, as shown in the accompanying figure of the skeleton of the jerboa, is characterised by the shortness of the brain-case, and the very large size of the apertures in front of the eye-sockets for the passage of the nerves supplying the face. There are also other

distinctive features in the skull, more especially in the large size of the hinder part of the auditory bulla, into which it would be out of place to enter here.



SKELETON OF JERBOA.

The jerboas and their allies are mainly Asiatic and African forms, although there is one outlying species in North America, and a few range into Southern Europe. Most of the jumping kinds are inhabitants of open and dry districts, such as grassy steppes or sandy deserts; and approximate in coloration very closely to that of the ground on which they dwell. They form burrows in clayey or sandy soil, which are generally situated in the open plains, but sometimes among thicker or thinner bush-jungle. In habits they are mostly nocturnal, lying concealed in their burrows by day, and issuing forth to feed at night. Their nutriment consists of roots, berries, seeds, fruits, leaves, grass, and other herbage; but a few will also eat insects, small birds, and carrion. In feeding they sit in a half-erect posture upon their hind-quarters and tail, and convey the food to their mouth with the aid of their paws. Their movements are peculiar; the body being supported on the hind-limbs alone, perhaps aided, however, at times by the tail. In walking, the legs are moved alternately in the ordinary manner; in which respect these animals differ from kangaroos, which always hop. Progression at a more rapid rate is, however, always effected by a series of leaps from the hind-legs; the length of such leaps being generally very great in proportion to the size of the animal. Like all desert-haunting animals, the jerboas are extremely quick of hearing and long-sighted. Although generally silent, many of these animals have a kind of whining cry, which has been compared to that of a kitten. In the colder districts of their habitat, the species hibernate more or less completely; but they never lay up a store of provisions for winter use.

The family may be divided into four main groups or subfamilies.

The Jumping Mouse.

Genus *Zapus*.

The so-called jumping mouse of North America (*Zapus hudsonianus*) is the typical representative of the first group of the family. It is characterised by the presence of four pairs of rooted cheek-teeth in each jaw, by the vertebræ of the neck being entirely separate from each other, and by the long hind-limbs being furnished with five complete toes, of which the metatarsal bones are

separate. In the fore-limbs the first toe is rudimental, and furnished with a flat nail. Well-developed cheek-pouches are present.

In general appearance this animal resembles a mouse with elongated hind-limbs and a very long tail; the degree of elongation of the hind-legs not being so great as in some other members of the family. The length of the head and body is a little more than 3 inches, and that of the tail about 5 inches, although there is a considerable amount of individual variation in the relative proportions of the latter. In the summer-coat the fur is brown above, yellowish on the flanks, and white below; but in the winter it is uniformly brown. The moderate-sized ears are black with light-coloured edges, and the long and nearly naked tail is tipped with a pencil of hairs.

Distribution and Habits. The geographical range of the jumping mouse is very large, extending from the cold regions of the Great Slave Lake and Hudson's Bay to Arizona and Mexico; although in the latter districts it appears to be restricted to the mountains. In British North America and the northern United States it ranges from the Atlantic to the Pacific coasts.

This species differs from most of its allies in not being strictly nocturnal, generally venturing forth early in the evening, and not unfrequently being abroad during the day. It likewise frequents more wooded and damper situations. The following excellent accounts of its habits was communicated to Dr. Hart Merriam by Mr. E. Slade, who observes that, "the long-tailed jumping mouse inhabits high land or low land, forest or pasture, cultivated field or swamp, and appears to be equally at home in either, and not numerous in any situation. It possesses a momentary agility second to no other rodent, and a muscular strength of enormous power for so small a creature. When suddenly disturbed, it often moves away in a direct line, the first three or four leaps being 8 or 10 feet in length, but these distances rapidly decline to about 4 feet. This is not always the case, however, for it frequently takes an irregular course and jumps at divers angles for several successive leaps, keeping the same general direction, or changing at will. It can double, and quickly too, if pursued, and by its manœuvres and instantaneous squattings can elude a hawk or an owl, and its spontaneous irregularities enable it to escape being brained by a weasel, or swallowed whole by the common black snake. It feeds upon the buds, leaves, and twigs of many kinds of plants; upon seeds, grain, wild berries, chestnuts, acorns, grass, and to some extent upon the bark of shrubs. As a rule, three litters are produced in a season, each consisting of from two to four young." In leaping, the successive springs are made with such rapidity that the feet of the animal seem scarcely to touch the ground. The nest is placed in a variety of situations, sometimes in the hollow stump of a tree, more frequently under logs of timber, often in clefts of rocks, and occasionally a short distance from below the surface of the ground in an open field.

The jumping mouse hibernates during the winter in a hole deep down in the ground; but the length of the sleep appears to depend upon the latitude of the locality and the temperature of the season. In mild winters the hibernation is often interrupted for longer or shorter periods. The underground nest is carefully made of grass, in which the little animal lies tightly curled up, with

the nose closely pressed to the belly, and the long tail curled round the body, which assumes an almost ball-like form. So deep are the slumbers of these animals, that they may be handled for a long time without evincing the slightest signs of life. The young of the various litters are to be met with from May till August. Fossil remains of the jumping mouse occur in the Pleistocene deposits of the United States.

The Five-Toed Jerboas.

Genus *Alactaga*, etc.

The jerboas, of which there are several genera, may be divided into two groups, according to the presence of five or three toes on the hind-feet, and constitute the second subfamily. The whole subfamily is characterised by the cheek-teeth, of which there may be either three or four pairs, having distinct roots; by the vertebræ of the neck being more or less completely united together; and by the long metatarsal bones of the hind-limbs being joined together so as to form a cannon-bone, as shown in the figure on p. 110. In all cases only the three middle toes of the hind-feet are of any functional importance; the lateral digits, when present, being small and not reaching the ground.

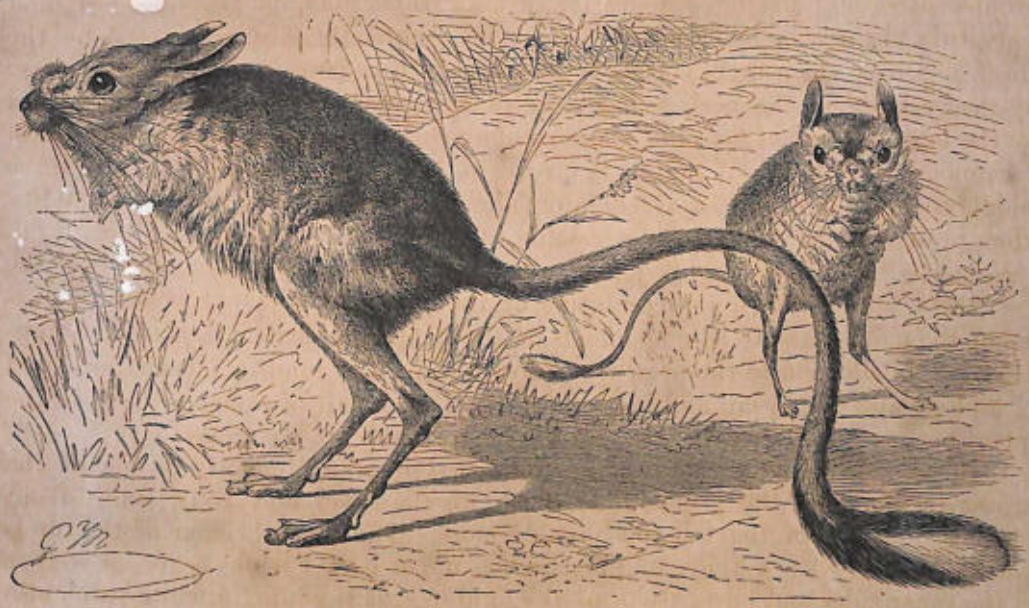
The Kirghiz Jerboa. The kirghiz jerboa, or alagdaga (*Alactaga decumana*), is the best known representative of the genus to which it belongs, and is one of the most characteristic mammals of the steppes of Central Asia. The genus *Alactaga*, in addition to the presence of five toes on the hind-feet, is characterised by its long and tufted tail and large ears; there are a pair of premolar teeth in the upper, but none in the lower jaw, and the incisor teeth are not grooved.

The alagdaga (as the animal is designated by the Mongols) is one of the largest members of the group, the length of the head and body being about 7 inches, and that of the tail considerably more. The general colour of the fur is reddish yellow, with a tinge of grey on the upper-parts; while below, as well as on the inner sides and lower parts of the hind-legs, it is white; a white patch also occurring on the outer sides of the thighs. The tail is brown, with a black-and-white tip.

Range. The range of this jerboa includes the whole of the steppe districts of Central Asia, and also extends into Persia as far as Bushire, and into South-Eastern Europe as far as the Crimea and the region of the Don. During the Pleistocene period this jerboa inhabited parts of Germany.

Habits. The alagdaga is a social animal, dwelling in small companies, and also selecting such portions of the steppes as possess a clayey soil for the construction of its large burrows. It is strictly nocturnal in its habits, issuing from its burrow at the commencement of darkness, but, according to Radde, not remaining abroad the whole night. Its speed is said to be considerably greater than that of the true jerboa, and the length of its leaps are enormous; indeed, it is stated that even when mounted on a swift horse it is impossible to overtake these creatures. The burrows constructed by the Kirghiz jerboa are very complicated, having several branches radiating from a central chamber; one of these branches, it is said, always stops a short distance below the surface of the ground, and is only

used as an exit in time of danger, when the animal removes the barrier and escapes in an unsuspected direction. Usually two or three pairs occupy the same burrow. In addition to the usual vegetable diet, the alagdaga also eats insects, and the eggs and young of the steppe-lark, if not the old birds themselves. The young are born in summer in a nest placed deep down in the burrow, and are usually from five to six in number, although occasionally there may be as many as eight in a litter. How long the young remain with their parents is unknown, but it is quite probable that they do not depart till the spring following their birth. In cold weather these animals do not leave their nests; and the winter sleep is a long one, enduring, according to Radde, from the beginning of September till the latter part of April. The flesh of the alagdaga is eaten by the Kirghiz and other dwellers on the steppes; the capture being



THE KIRGHIZ JERBOA (½ nat. size).

effected by surrounding the burrows with a fence and pouring water down the open holes, when the animals seek to escape by breaking through the closed entrance.

Afghan Jerboa. The Afghan jerboa (*A. indica*) is a smaller species of the same genus, with proportionately longer ears and tail; the length of the head and body being about 3½ inches, and that of the tail, inclusive of the tuft at end, upwards of 7½ inches. This species inhabits Afghanistan, the south-east of Persia, and Northern Baluchistan; and is found commonly on the plains of Quetta at an elevation of about six thousand feet. In habits, this jerboa seems to be very similar to the larger species; its period of hibernation lasting from October till April. Central Asia is also the home of other species of the same genus.

Yarkand Jerboa. The recently discovered Yarkand jerboa (*Euchoretes naso*) is the sole representative of a distinct genus characterised by certain features in the skull, the great length of the nose, and the enormous size of the ears, which are longer than the head. The fur is sandy-coloured above and white below; the

tufted tail being black near the end, but white at the extreme tip. The length of the head and body is 3¼ inches, and that of the tail 6½ inches.

Broad-Tailed Jerboas. Certain species of jerboas inhabiting the desert regions of Central and Northern Asia and Nubia are distinguished from those of the two preceding genera by their flattened and lancet-shaped tails, in consequence of which they have received the name of *Platycercomys*. They are further distinguished by the absence of premolar teeth in both jaws. There is nothing worthy of special notice in the habits of these species.

The Three-Toed, or True Jerboas.

Genus *Dipus*.

The true jerboas, as typically represented by the common Egyptian species (*Dipus jaculus*), are the most specialised representatives of the subfamily, having completely lost the two small lateral toes on the hind-limbs. They are further



EGYPTIAN JERBOA.

distinguished by the presence of vertical grooves on the front of the incisor teeth; while they have a pair of premolar teeth in each jaw. They resemble the alagdaga in the great length of the hind-limbs and tail, and the comparatively large size of the ears; the tuft of hair at the tip of the tail is, however, smaller. Usually the premolar teeth are wanting.

In size, the Egyptian jerboa is rather inferior to the alagdaga, the length of the head and body being about 6¾ inches, while the tail, exclusive of the hairs at the end, measures a little over 8 inches. The general colour of the upper-parts is a sandy grey; the under surface of the body being white, and a broad white stripe extending down the hind-limbs. The tail is yellowish brown above and whitish beneath, with the usual black-and-white tip.

The range of the Egyptian jerboa extends from the north of Arabia westwards

through Lower Egypt to Oran in Algeria. There are, however, numerous other species of the genus, some of which inhabit Eastern Persia and Central Asia.

Habits.

The name of two-legged mouse was applied to the Egyptian jerboa on account of the fore-legs being applied so closely to the chest when the animal is jumping that it has an almost bird-like appearance. The home of this species is arid and desert districts, where the ground consists solely of sand and pebbles, and the vegetation is so scant that it is a marvel that even such a tiny creature can find the wherewithal to live. Here it lives in companies, frequently of considerable size, in association with sand-grouse, the small desert-lark, the cream-coloured courser, and various lizards. So exactly does the colour of the jerboa harmonise with its surroundings, that when at a short distance it is scarcely possible to recognise the presence of a living creature. Although very abundant, it is, from its extreme shyness, but seldom seen. Like its kindred, this jerboa



THE AFRICAN JUMPING HARE (⅓ nat. size).

is essentially a nocturnal animal; but it generally comes out to feed before sundown, while it not unfrequently sits at the mouth of its hole, or a short distance off, even in the full sunshine. It digs a burrow in the hard gravelly soil with its fore-feet, aided sometimes by its incisor teeth; these burrows generally having four entrances. According to Arab reports, the whole colony take part in the construction of the burrows; and at the slightest sound the animals immediately take refuge in their retreats. In walking gently the jerboa moves one foot after the other, but directly the pace is quickened, it progresses by means of leaps; and so rapid are then its movements, that travellers liken them to the flight of a bird. When leaping, the tail is carried stuck out nearly straight behind. The jerboa is very impatient of rain and damp; and when such conditions are prevalent it relapses into a kind of torpid condition, analogous to the hibernation of species inhabiting more northern regions.

According to Brehm, very little is definitely known regarding the breeding of this species. The Arabs state that it forms a nest from its own fur within the labyrinths of its burrow, where from two to four young are produced at a birth.

The Arabs capture these tiny creatures by stopping up all the entrances to a burrow except one, where they place a net, and then digging down into the central chamber, when the jerboas are either caught in the nets or by the hands of their pursuers. Many are thus taken alive, while the flesh of those killed is eaten. The chief foes of the jerboa, next to men, are fennecs, caracals, and owls, by all of which large numbers are destroyed.

This jerboa, like its allies of Central Asia, is easily tamed; and from its beautiful form and delicate build, as well as its engaging manners, is always highly esteemed as a pet by its owners. In its wild state the jerboa eats not only leaves, fruits, and seeds, but likewise insects and carrion.

The African Jumping Hare.

Genus *Pedetes*.

By far the largest representative of the long-limbed members of the family is the South African species, designated by the Cape colonists, inappropriately, the jumping hare—the springhaas of the Boers. This animal (*Pedetes caffer*) constitutes not only a distinct genus, but also a separate subfamily; being distinguished from the jerboas by the following characters. In the neck the whole of the seven vertebræ are separate; the hind-feet have four toes, and their comparatively short metatarsal bones are not united together; while the cheek-teeth, of which there are four on each side of the jaws, do not develop roots.



SKELETON OF AFRICAN JUMPING HARE.

In size the jumping hare may be compared with the common hare, to which it also approximates in general coloration; the length of the head and body being about 24 inches, and that of the tail rather more. The head is relatively large, with long pointed ears; the fore-limbs are proportionately longer than in the jerboas; and the long tail is thickly haired throughout its extent. There are five toes, provided with long, sharp claws on the fore-feet, while in the hind-feet the claws are wider and blunter, and approximate somewhat to nails; the middle hind-toe being much larger than either of the others. The long and soft hair of the upper-parts is reddish brown, more or less mingled with white; while beneath the colour is pure white.

Distribution and Habits. The range of the jumping hare extends from the Cape to Angola on the west, and Mozambique on the east coast. Its habits approximate very closely to those of the jerboas. Thus it inhabits more or less desert districts, where it constructs complex burrows, in which several families

dwell together; and is thoroughly nocturnal. At the Cape it is found in considerable numbers, and frequents both the mountains and the open plains. When feeding, the jumping hare goes on all fours; but when at speed progresses with the leaps characteristic of the family. Ordinarily the length of each spring is from six to nine feet; but it is said that the leap may occasionally cover a space of as much as twenty or even thirty feet. The young are born during the African summer, and are usually from three to four in number; and during the rainy season young and old alike seldom stir from their burrows. The food appears to be entirely of a vegetable nature. The flesh is largely eaten by the Hottentots, who catch almost as many of the creatures as they please by the simple expedient of pouring water down their holes, upon which the owners immediately bolt.

The Sminthus.

Genus *Sminthus*.

Three rat-like Rodents—the one (*Sminthus subtilis*) from Eastern and Northern Europe and Central Asia, the other (*S. concolor*) from North-Western China, and the third (*S. leathami*) from Kashmir—are interesting in showing that the long hind-limbs are not an essential attribute of the members of the present family. Indeed the former of these Rodents—for which there is unfortunately no English name—is so rat-like in appearance that it was long referred to the next family. It differs, however, from all the members of the latter by the presence of a pair of premolar teeth in the upper jaw (although there are none in the lower), while its skull agrees in essential features with that of the jerboas. The common sminthus has rather long and pointed ears, and a tail of nearly the same length as the body, and clothed with short hairs. The premolar and last upper molar teeth are very small; and the whole of the cheek-teeth have a complex pattern on their crowns.

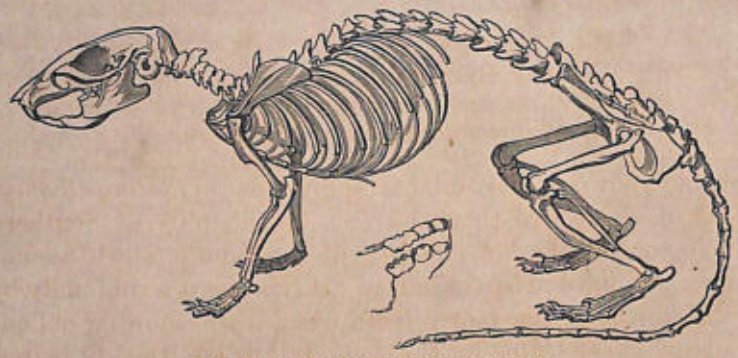
The Mouse Tribe.

Family *Muridæ*.

The Mouse family, which includes mice, rats, hamsters, voles, lemmings, etc., is by far the most extensive group in the whole Rodent order, having a cosmopolitan distribution, and being the only family represented in Australia. The majority of the mice—as we may conveniently term all the members of the group—are of terrestrial habits, and have naked and scaly tails of varying length; while in most cases there is no great disproportion between the length of the fore and hind-limbs. The incisor teeth are narrow; and, owing to the invariable absence of premolars, there are never more than three pairs of cheek-teeth in each jaw.

In structure these teeth exhibit great variation in the different groups, being either furnished with roots, or rootless, while in some cases their crowns are surmounted with simple cusps, and in others with folds of enamel arranged in a series of angles. In all cases the first toe of the fore-foot is rudimental. The skull is the most characteristic part of their entire organisation, although it is difficult

in a popular work like the present to point out its distinctive peculiarities without the aid of a series of figures. It may be mentioned, however, that the frontal region between the eye-sockets is much narrowed; and that in the zygomatic, or cheek-arch, the cheek (jugal) bone is usually reduced to a mere splint occupying the middle of the arch. Again, the lower surface of the process arising from the upper jawbone to form the front half of the cheek-arch is more or less flattened out into a nearly perpendicular plate; while the vacuity in the front of the eye for the passage of the nerves of the face is generally of considerable height, and wider above than below.



SKELETON AND MOLARS OF BROWN RAT.

The number of genera and species belonging to this family is so great that it is impossible to notice more than a small moiety in this work. Accordingly, only representatives of the various subfamilies into which these Rodents are divided, and such forms as are of general interest, are selected for description.

The Australian Rats.

Genus *Hydromys*.

The Australian rats, of which there is one aquatic species, together with an allied terrestrial form from the same region, constitute a subfamily distinguished from all the other mice by having only two pairs of molar teeth in each jaw; these teeth being rooted, and having their crowns divided into distinct lobes.

The Australian water-rat (*Hydromys chrysogaster*) is a rat-like aquatic Rodent, with broad and partially-webbed feet, the webs and claws being larger in the hinder than in the front-limbs. The fur of the back is black with an admixture of golden-coloured hairs; the under-parts being of a dark golden hue, save for a narrow stripe of flaxen running from the lower part of the neck to the middle of the belly. Except for its terminal fifth, which is flaxen-coloured, the tail is black. The tip of the muzzle is thickly covered with hairs, by means of which the nostrils can be closed. The length of the head and body is about 2 feet, and that of the tail half as much. The skull differs in the form of the front portion of the cheek-arch from the ordinary murine type. This species is confined to Australia and Tasmania, where it is known to the colonists as the beaver-rat. It is thoroughly aquatic in its habits, and is not uncommon on the banks of the rivers; while it is at times seen on the seashore. It is an inhabitant of Australia, Tasmania, and New Guinea.

The Queensland rat (*Xeromys myoides*) is a terrestrial species of about double

the size of an ordinary mouse, which, while possessing teeth like those of the Australian water-rat, has unwebbed toes and the external form and skull of a mouse. It is, therefore, of interest as serving to connect its aquatic cousin with the more typical members of the family.

The Malabar Spiny-Mouse.

Genus *Platacanthomys.*

The pretty little murine known as the Malabar spiny-mouse (*Platacanthomys lasiurus*), from elevations of about two thousand feet in the hills of Southern India, is interesting as being one of the few members of the family which assume a dormouse-like appearance and have arboreal habits. It represents a subfamily by itself, characterised by the crowns of the molar teeth when worn showing oblique and nearly parallel bands of enamel, and by the long tail being thickly haired. This little mouse has long pointed ears; and a number of broad flat spines mingled with the hair of the upper-parts. In colour it is reddish brown above, and white beneath; the length of the head and body being 4½ inches, and that of the tail, with the hair at the end, half an inch more. This mouse lives in large trees, in which it hollows out small cavities that it fills with leaves and moss. It is stated to feed on jack-fruit and the pods of the pepper-tree.

The Gerbils.

Genus *Gerbillus.*

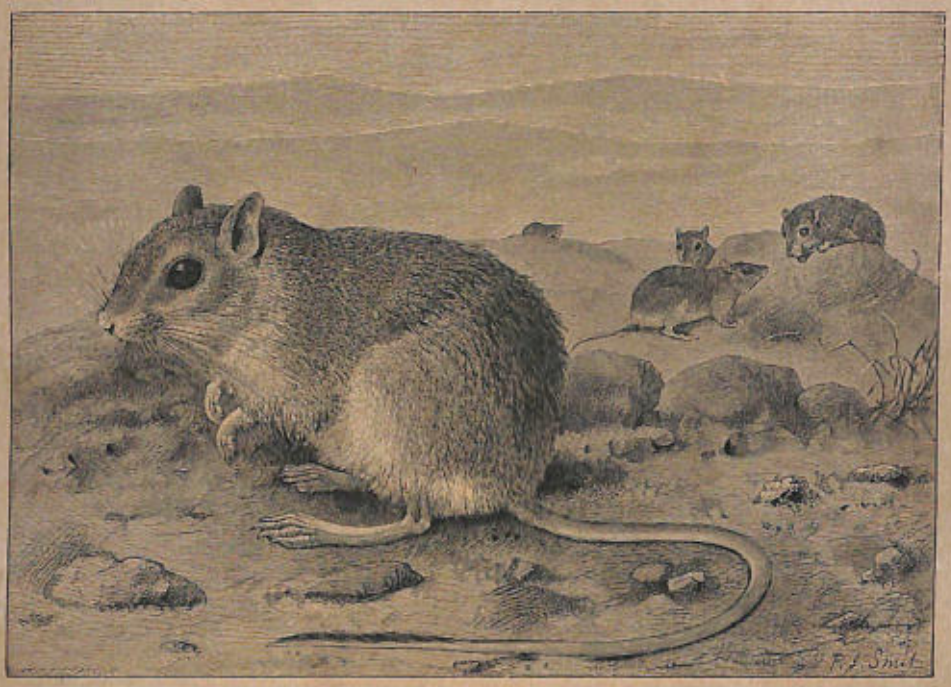
The elegant little Rodents commonly known as gerbils constitute the typical representatives of a third subfamily, and are easily recognised by their elongated hind-limbs, long and hairy tails, and their general jerboa-like appearance and habits. Indeed, they might be mistaken at first sight for members of the latter group; but a close examination will show that they differ externally by their longer muzzles, smaller eyes, and the presence of five functional toes to the hind-feet. They are further distinguished by their molar teeth being divided into transverse laminæ, of which there are three in the first, two in the second, and one in the third tooth of each side. The upper incisor teeth are narrow and grooved; and the bullæ of the auditory region of the skull are generally very large. The true gerbils, of which there are more than half a hundred species, inhabit Asia and Africa; but there are some allied genera confined to the latter continent.



LOWER JAW AND TEETH OF GERBIL.

One of the best known species is the Indian gerbil (*Gerbillus indicus*), which is about the size of a rat, with moderate-sized rounded ears, and the fur light brownish rufous above, and white beneath. With its large, bright eyes, and long tufted tail, this gerbil (like its cousins) is one of the most graceful of the smaller Rodents. In common with the other species, it inhabits open sandy plains, where it lives in companies, constructing extensive burrows approached by numerous

chambers, and containing large central chambers containing dried grass. The Indian gerbil is a thoroughly nocturnal animal, seldom leaving its burrow during the daytime. It is frequently found near cultivated grounds, where it does much damage to the corn crops, sometimes appearing in such numbers as to constitute a veritable plague. Away from cultivated districts, its food consists mainly of grass and roots. It has been stated that gerbils lay up stores of food in their burrows, but it does not appear that this is really the case. Gerbils resemble jerboas in progressing by a series of leaps from their long hind-legs; the length of the leaps



EGYPTIAN GERBIL.

in the Indian species being from twelve to fifteen feet. So active are these animals, that they are generally able to elude such dogs as may pursue them, sometimes even jumping upon their backs. The Indian gerbil is one of the most prolific of Rodents, frequently producing from twelve to fifteen young at a birth, and occasionally, it is said, even more.

The Philippine Rat.

Genus *Phlœomys*.

The Philippine Islands are the habitat of a peculiar species of rat (*Phlœomys cumingi*), which differs so markedly from all others that it must be regarded as constituting a subfamily by itself. While having the ordinary murine form, these rats resemble the gerbils in having their molar teeth divided into transverse laminæ,



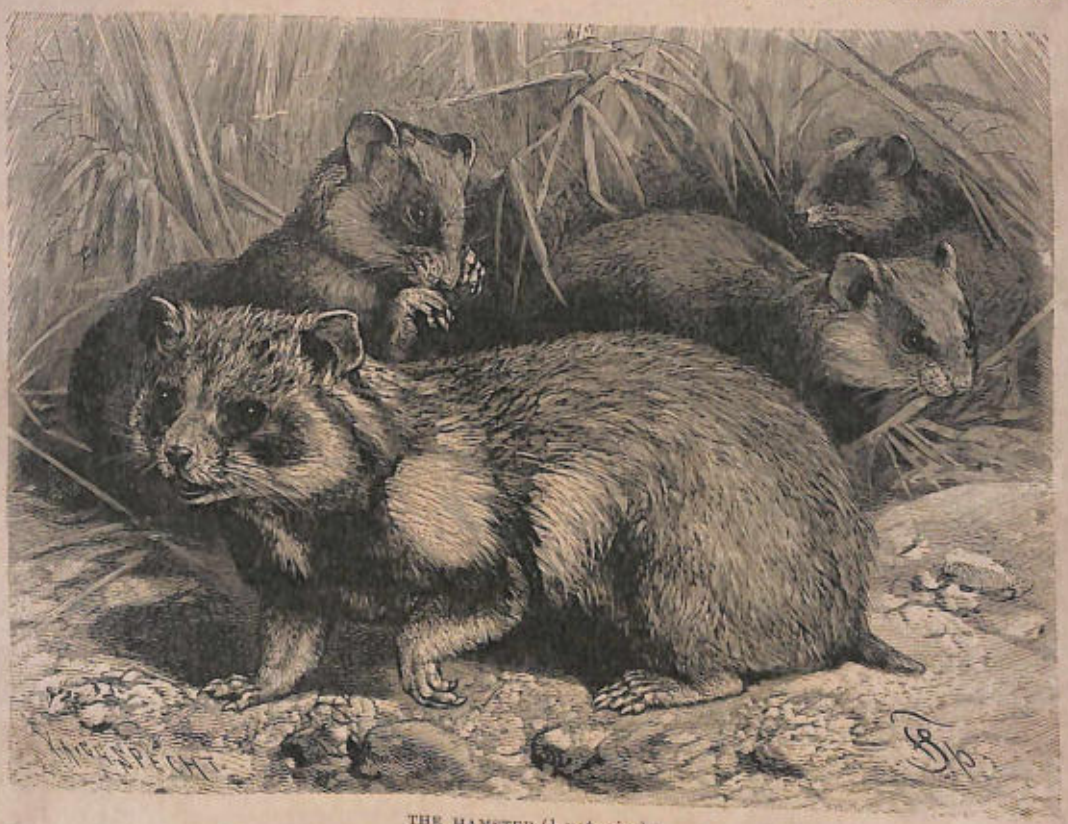
PHILIPPINE RATS.

of which there are three in the first tooth of the series, and two in each of the others. The incisor teeth are very broad, with smooth front surfaces. The muzzle is unusually short, the profile convex, and the ears rather small; while the feet are characterised by their great breadth, and the large size of their claws. The tail is shorter than the head and body, and sparsely-haired. The hair is rather long and coarse, and darker on the muzzle, the sides of the face, the back of the head, the shoulders, and the fore-part of the back than elsewhere.

The Hamsters and White-Footed Mice.

Genus *Cricetus.*

The well-known hamsters of the Old World, together with the American white-footed mice, constitute an extensive genus of murine Rodents, which, with others, represents a distinct subfamily. These Cricetines, as all the members of



THE HAMSTER (⅓ nat. size).

the subfamily may be called, are characterised by the crowns of their molar teeth carrying a number of distinct tubercles or cusps, which in the upper jaw are arranged in two longitudinal rows separated by a median groove; these teeth being always implanted in the jaw by distinct roots. The whole of the Old World Cricetines are characterised by the shortness of their tails; but in some of the

American forms these appendages are considerably longer. The Cricetines are distributed nearly all over the world, with the exception of Australia, and include the only representatives of the Rodent order found in Madagascar. In structure they appear to be the most generalised group of the entire murine family, and it is accordingly believed that they represent the ancestral stock from which came the more specialised rats and mice constituting the murine subfamily. This hypothesis is supported by the circumstance that the hamsters are some of the oldest types of the family with which we are acquainted, their remains being comparatively common in the Miocene strata both of Europe and North America.

Common Hamster. The common hamster (*Cricetus frumentarius*), of Europe and Northern Asia, is the typical representative of the genus under consideration; the leading characters of the genus being that the incisor teeth are not marked by grooves, while the first upper molar tooth generally has six tubercles on its crown. Cheek-pouches, which may be of large size, are frequently present; and the tail is often very short.

The hamster itself is a decidedly handsomely-coloured Rodent, and is by far the largest member of the group, measuring about a foot in length, of which some 2 inches are taken up by the tapering hairy tail. It is stoutly built, with a thick neck, a rather pointed muzzle, medium-sized membranous ears, large and brilliant eyes, short legs, and small claws. The thick glossy coat is composed of hair and a woolly under-fur. The general colour of the upper-parts is usually light brownish-yellow, but the upper surface of the snout and the region of the eyes, as well as a band round the throat, are reddish brown. There is a yellow patch on the back, the mouth is whitish; and the under-parts, the greater portion of the legs, and a stripe on the forehead are deep black, but the feet are white. There is, however, great individual variation with regard to colour, many examples being entirely black, while others are pied, and others, again, wholly white.

The hamster inhabits suitable localities from the Rhine in Germany to the Obi in Siberia; but its distribution is somewhat partial. In Germany it is wanting in the south and south-western districts, and also in East and West Prussia, but it is abundant in Thuringia and Saxony. Its favourite haunts are in soft dry soils, but it avoids those of a sandy nature as being unsuitable for its burrows, although it will sometimes select gravelly ground.

The hamster has always attracted a considerable amount of interest, from the elaborate structure of its burrows, and the provident nature of its habits. The burrow always comprises a large dwelling-chamber, situated at a depth of from one to two yards below the surface of the ground, with a nearly perpendicular entrance-passage and an oblique exit. There is also a store-chamber or granary communicating with the dwelling-chamber by means of a gallery; and it appears that the young, the females, and the males generally occupy distinct burrows, which may be distinguished by the size of their entrance-passages, those of the males being the largest. When a burrow is tenanted, the passages are kept scrupulously clean, and the presence of any litter in them would at once proclaim that the habitation was deserted; chaff and straw may, however, be generally seen near the entrance of a burrow. Although the entrance-passage goes nearly straight down into the earth, it also has a turn before opening into the dwelling-chamber; and in old burrows

the entrance and exit passages are polished smooth by the constant friction of the coats of their occupants. Of the chambers, the dwelling-place is the smaller, and has smooth walls and the floor strewn with fine straw; it has three apertures—two communicating with the exterior, and the third with the granary. Young hamsters have but a single granary in their burrows, but the old males, which spend the whole summer collecting, frequently have from three to five such chambers. These are completely filled with corn, the passage communicating with the dwelling-chamber being frequently stopped up with earth. All kinds of corn are equally acceptable to these industrious little animals; and it will often be found that, while one part of the store-chamber is filled with grain of a particular kind, the other portion may contain a different sort. In addition to corn, which forms their main winter nutriment, hamsters in summer eat peas, beans, roots, fruits, grass, and other green herbage; and in captivity these animals will eat almost any kind of food that is put before them.

Burrows of the nature described above are constructed solely for winter use; and when the weather becomes cold in October the hamsters retire to their innermost recesses for their hibernation; the entrance and exit of each burrow being then closed with earth. In February or March the animals awake from their slumbers, although they do not for some time open their burrows, where they remain feeding upon the stores of corn. About the middle of March the adult males make their first appearance abroad; and these are followed early in April by the females. At this time they devour ravenously almost anything that comes before them, not refusing an occasional young bird, a mouse, or a beetle. Soon afterwards they set about constructing their summer-burrows; on the completion of which the sexes pair. These summer-burrows are of simpler construction than the winter habitations, being seldom more than one or two feet in depth. Usually these burrows contain but a single chamber of about a foot in diameter. In the case of the females the nest-chamber has one exit passage, but from two to eight entrances; although until the young go afield but one of the latter is used; the advantage of these numerous entrances when there is a large number of young being sufficiently obvious. The nest-chamber is furnished with a bed of soft hay. Towards the end of April the males visit the burrows of the females; and if two individuals of them should happen to meet in the same domicile, a fierce encounter ensues, the hamster, for its size, being an extremely ferocious and quarrelsome animal. In from four to five weeks after the pairing-time the first litter of young is produced, the number in each litter varying from six to eighteen; and as a second equally numerous brood comes into the world in July, the rate of increase of these animals is exceedingly rapid. When born, the young, although furnished with teeth, are naked and blind. The hair, however, quickly grows, and by the eighth or ninth day the eyes are opened; while within a fortnight the young are able to burrow, and are soon after driven away by their parents to shift for themselves. Although hamsters do not attain their full growth for a twelvemonth, it appears certain that a female born in May is capable of producing offspring in the ensuing autumn.

With these marvellously rapid powers of reproduction it is no wonder that hamsters frequently appear in countless swarms, when they inflict incalculable

harm upon the harvest. Fortunately, however, they have a host of enemies, and buzzards, owls, ravens, and other predacious birds thin their ranks by hundreds; while among four-legged foes, polecats and stoats follow the track of the advancing legions, and kill them where and when they can. The polecat and stoat are, moreover, able to follow the hamsters into the recesses of their burrows, where they probably destroy them by hundreds. Man, too, joins the ranks of the destroyers of these mischievous rodents; and in some cases organises regular hunts for their destruction. Government rewards are sometimes offered to aid in ridding the country of these pests; and Brehm relates that in the year 1888 no less than 97,519 hamsters were destroyed in the single district of Aschersleben, for which a reward of 1950 marks was paid. In digging out the hamsters, the stores of corn which they laid up for winter use form not the least important part of the enterprise; the grain being carefully dried and used for human consumption. In many districts the flesh of the hamster is eaten, and is said to be not unlike that of the squirrel. The fur too, although not of high value, is extensively used for linings, some thousands of skins being annually imported into England.

Other Species. In Eastern Europe there are smaller species of hamster in which the black of the under-parts only occupies a small area on the chest; and from these a transition is easy to the small uniform grey hamsters of Central Asia, one of which ranges as far south as Gilgit, while another occurs in Persia.

White-Footed Mice. The New World possesses not a single indigenous representative of the true rats and mice of the Old World, all the American members of the family belonging either to the Cricetine or to the closely allied Microtine subfamily. The great majority of the species belong to a group which may be conveniently designated white-footed mice, from the general prevalence of white on their feet and under-parts. These American mice, which have representatives from one end of the continent to the other, are frequently regarded as constituting a number of distinct genera; but as they all possess molar teeth of essentially the same structure, it is simpler to include the whole of them in the genus *Cricetus*. They exhibit, however, great variation in regard to bodily form and the relative length of the tail. Thus there are some species with long tails and a general dormouse-like appearance, other long-tailed forms are mouse-like, others again have short hamster-like tails and vole-like bodies, while one species has spines mingled with the fur.

The best known representative of the group is the common white-footed mouse (*C. leucopus*) of North America, which may be regarded as taking the place filled in Europe by the house-mouse. It is, however, far more attractive in appearance than the latter, although of approximately the same size and general configuration. In addition to its long tail, large ears, and bead-like eyes, this mouse is characterised by having the fur of the upper-parts of the body of a rich fawn colour, which forms a striking contrast with the snowy-white of the under-parts and feet. Indeed, when we add to this the natural grace and agility of its movements, we have in this animal, as Dr. Hart Merriam observes, one of the most beautiful and interesting inhabitants of the forests of North America.

The white-footed mouse is an inhabitant either of forests or open fields; and in the wild state feeds chiefly upon beech-nuts, of which it accumulates large

stores for winter use. These stores are generally accumulated in hollow trees or logs, and sometimes may contain two or three quarts of beech-nuts or clover-seed. This mouse, unlike the hamster, remains, however, active throughout the winter; and may be seen running about on the snow, where its long tail leaves a characteristic track. It is an agile climber, running up tree-stems with the activity of a squirrel, and frequently disappearing in some hole at a great distance above the ground. In addition to nuts and seeds, the white-footed mouse will readily eat the flesh of such animals as come in its way, and it is possible that it may occasionally kill small birds for itself. From three to six young are produced at a birth, and there appear to be several litters during the year. The first coat of the young is of a uniform dull grey colour. In the northern portions of the range of this mouse, the nest is generally built either in the hollow of a tree or a log, or in a burrow; but more to the south these animals construct an "outside nest" of moss, grass, leaves, or bark, which is generally more or less cocoanut-shaped, and may be as much as a foot in diameter. It is usually suspended from a horizontal branch at some distance from the ground, and has its entrance on the under surface. The group to which this particular species of white-footed mice belongs is distinguished by having only five tubercles on the first molar tooth in the upper jaw. The rice-field mouse (*C. palustris*), which attains the size of a small rat, does much damage to the rice crops in the Southern States.

The Fish-Eating Rat.

Genus *Ichthyomys*.

A remarkable species (*I. stolzmanni*) inhabiting the mountain-streams of central Peru is allied to the preceding group, but distinguished by its aquatic and probably fish-eating habits, as well as by its webbed and fringed hind-feet. In size it comes near the brown rat, but has the head much flattened, larger whiskers, and very small ears and eyes; while in colour it is dark above and whitish beneath, with a black-and-white tail.

The Grooved-Toothed Mice.

Genera *Rhithrodontomys* and *Rhithrodon*.

Two groups of American Cricetines are distinguished by their upper incisor teeth being marked by parallel grooves. Of these, the American harvest-mouse (*Rhithrodontomys humilis*) resembles the rice-field mouse in external appearance, and is found in the southern United States as far north as Iowa; the two other species of the genus being also North American.

The Rhithrodonts, on the other hand, are exclusively South American, and are characterised by their rabbit-like appearance, the head being very short, with a highly convex profile, very large eyes, and rather large rounded ears. The rabbit-like rhithrodon (*Rhithrodon cuniculoides*), from Patagonia, is one of the best known species. The length of the head and body is 6½ inches, and that of

the tail about half as much again. Its general colour is yellowish grey mixed with black, with the under-parts pale yellow, and the rump, feet, and lower surface of the tail white.

The Wood-Rats.

Genus *Neotoma*.

The Florida rat (*Neotoma floridana*) is the best known representative of a small genus of North American Cricetines, distinguished by their large size and the circumstance that the cusps on their molars show some approximation to the type of structure obtaining in the voles. The Florida rat, which inhabits the southern United States and the north of Mexico, is about the size of an ordinary rat, to which it also approximates in general coloration, although the under-parts and feet are entirely white. This species has a thin scaly tail, but in the bushy-tailed wood-rat (*N. cinerea*) from the north-western and western districts of North America, this appendage resembles that of a dormouse. The wood-rats are active, climbing animals, sometimes found in forests, but in other cases inhabiting rocky districts. In woods or near streams they frequently make heaps of twigs, straw, etc., in which to form their nests. The young, of which there are from three to six in a litter, cling to the sides and back of the female parent when she is walking about, somewhat after the manner of certain opossums, and two litters are generally produced in the year. In addition to vegetable food, the Florida rat will also eat crayfish and frogs.

Other Cricetines. There are several other genera belonging to the Cricetine sub-family which cannot be mentioned here. It may be observed, however, that *Hypogeomys*, together with four other genera, are confined to Madagascar, where they are the sole representatives of the Rodents.

The African Crested Rat.

Genus *Lophiomys*.

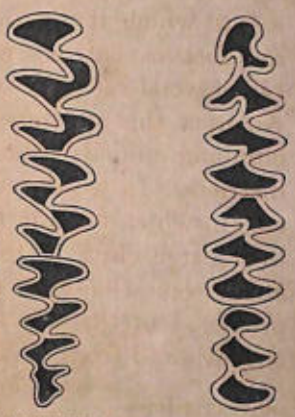
A rare and remarkable Rodent from North-East Africa differs from the preceding Cricetines in certain features, which have been regarded as entitling it to rank as the representative of a distinct family, but there can be little doubt that it is merely a highly-specialised member of the present group. The African crested rat (*Lophiomys imhausi*) derives its name from the great crest of long erectile hairs running down the back and tail, some of which are as much as 3½ inches in length, and at their bases have a peculiar spongy structure. The tail is long and bushy, the limbs short, and the ears small. In the hind-foot the small front toe can be opposed to the others. The general colour is blackish brown, but there is a large triangular white spot on the front of the head, and a white streak beneath each eye, while the tip of the tail is also of the same hue. Moreover, the long hairs of the body have only the middle portion dark-coloured, their two extremities being white. Internally the crested rat differs from all other members of the family by its rudimentary collar-bones, and also by the circumstance that

the sides of the hinder part of the skull are completely roofed over with bone, as in a turtle. This Rodent inhabits the district of Shoa, and is doubtless arboreal, although nothing definite is known of its habits in a wild state.

The Voles.

Genus *Microtus*.[1]

The voles, together with their near allies the lemmings and the musquash, constitute a group closely allied to the Cricetines, but distinguished by the peculiar character of their molar teeth. Indeed, the voles and their allies are evidently nothing more than a specialised modification of the Cricetine type, and it is more as a matter of convenience than from any well-founded distinctive characters that they are placed by themselves in a distinct subfamily. The whole group is characterised by the molar teeth being usually rootless or with imperfect roots, and composed of two longitudinal rows of alternately-arranged triangular prisms. These prisms, as shown in the accompanying figure, decrease in number from the first to the third tooth in each jaw, but are variable in number in the different species, and thus form a valuable aid in their discrimination. The tail of the voles is either short or of moderate length; and these Rodents are distinguished from the true rats and mice not only by this character, but likewise by their more corpulent form, their smaller eyes and ears, their more obtuse muzzles, and proportionately shorter limbs. The subfamily has a wide distribution in the Northern Hemisphere, but is quite unknown in Asia south of the Himalaya, in the Malayan region, and in Africa and South America. It is connected with the Cricetine subfamily by a North American genus known as *Phenacomys*, in which the molar teeth are furnished with roots.



CROWN-SURFACE OF THE UPPER AND LOWER MOLAR TEETH OF THE CHINESE VOLE. (From Thomas.)

Water-Vole. The water-vole, or, as it is commonly termed, the water-rat (*Microtus amphibius*), may be taken as a typical example of the widely-distributed group of voles, of which there are about half a hundred species, ranging from Britain through Europe to China, and thence eastwards to North America. The genus is sufficiently characterised by the molars being rootless and the soles of the feet naked.

From its diurnal habits and wide distribution the water-vole is one of the best known of the indigenous British mammals. In size it agrees approximately with the brown rat, the length of the head and body being about 8¼ inches, and that of the tail slightly more than half as much again. The fur is dense and shining, and of a full reddish brown colour mingled with grey above and yellowish grey below. The feet are not webbed, and the tail is hairy. The number of the prisms

[1] The name *Arvicola* has been commonly applied to the voles, but by the rules of zoological nomenclature it has had to give place to *Microtus*.

in the molar teeth are different from those in the smaller British voles, but since the species is sufficiently distinguished by its superior size, it will be unnecessary to enter into the consideration of this point. A black variety of the water-vole is sometimes met with.

The water-vole has a wide distribution, extending from England in the west to China in the east, and occurring throughout continental Europe. Curiously enough, however, it is unknown in Ireland, where the other two species of British vole are likewise wanting.

Every English brook and river is tenanted by the water-vole, whose long burrows in the banks are sometimes a source of considerable inconvenience to the agriculturist. The burrows are, however, by no means confined to the banks of rivers, being not unfrequent in water-meadows, and occasionally in ploughed fields



THE WATER-VOLE (⅔ nat. size).

at a considerable distance from the water. Although the water-vole has been accused of carnivorous propensities, it is very doubtful if the charge can be substantiated. Its favourite food in summer appears to be the sweet inner pith of certain kinds of water-flags, but it will also eat many other aquatic plants, such as duckweed and horse-tails. In winter, when hard pressed for food, the water-vole turns its attention to the bark of trees and shrubs, and at this season frequently inflicts very serious damage on osier plantations. In cultivated districts it will also then readily eat mangold, turnips, potatoes, etc. When feeding upon duckweed, Bell says that "the creature sits, like a squirrel, on its haunches, near the water's edge, and, taking up a lump of the soft and slimy-looking mass in its fore-paws, eats a small part only, and, letting the remainder fall, takes up some more, which is similarly treated and rejected."

In May or June, and occasionally as early as April, the female gives birth to five or six young in the depths of its burrow; and it is probable that when the

litter is produced early in the spring, a second one follows during the summer. When their holes are rendered inaccessible by frost, water-voles are found to take shelter on shore, sometimes frequenting the cover afforded by an osier-bed, and on other occasions taking refuge in pollard willows. In spite of its feet not being webbed, the water-vole is an expert swimmer and diver; and its coat is of such a nature as to throw off the water as readily as does the plumage of a duck. Fossil remains of the water-vole are found in the cavern-deposits of England, and also in the "forest-bed" of the Norfolk coast; while those of extinct species of the genus to which it belongs, occur in the Pliocene crag-deposits of Suffolk and Essex.

Short-Tailed Field-Voles. In addition to the water-vole, the British Islands (exclusive of Ireland) possess two other species of the same genus, the commonest of which is the short-tailed field-vole, or field-mouse (*M. agrestis*). This species is



THE CONTINENTAL FIELD-VOLE (⅔ nat. size).

about the size of an ordinary mouse, and is greyish brown in colour above, and greyish white beneath, with dusky feet; the tail being about one-third the length of the body, while the under surfaces of the hind-feet have six naked pads. It is specially characterised by the circumstance that the second molar tooth in the upper jaw has five prisms. This character, unimportant as it may seem, serves to distinguish this species from the continental field-vole (*M. arvalis*)—represented in the accompanying illustration—in which, in common with the other continental short-tailed members of the genus, the corresponding tooth has but four such prisms.

The common short-tailed field-vole is found all over England and Scotland, as well as the greater part of the Continent; its range extending from the north of Italy to Finland, and from Spain and France to Russia; but in the southern portion of its habitat it is less numerous than the continental field-vole. The English species is commonly found in meadows—especially those where the ground is moist, and makes extensive runs beneath the grass, in which it roams both by

night and day, although it is more active during the dark hours. In addition to these runs, the field-vole also constructs burrows of considerable size. The food of this species consists of seeds, roots, and herbage of all kinds. In gardens it displays an especial taste for the bulbs of crocuses and newly-sown peas and beans, among which it frequently does great damage. In winter, when other food is scarce, the field-vole will not unfrequently ascend trees to feed upon their bark. It is also by no means averse to a diet of insects and flesh.

The field-vole is an unusually prolific animal, producing from three to four litters in a year, and each litter containing from four to six young. The nest in which these are born is composed of moss and leaves, and is usually placed beneath a tussock of grass in some slight hollow in the ground.

The most remarkable peculiarity in connection with this field-vole is the swarms in which it occasionally makes its appearance in various parts of the country. According to Mr. J. E. Harting, one such "mice-plague" appeared in 1580 in Essex, a second visited Hampshire and Gloucestershire during 1813–14, while a third was recorded in Wensleydale which lasted from 1874 to 1876. In the second of these visitations, upwards of thirty thousand voles were destroyed in the Forest of Dean, and eleven thousand five hundred in the New Forest. Quite recently (1892), another such plague has made its appearance in the south of Scotland, especially in parts of Dumfriesshire and Roxburgh; the area over which the voles extended being estimated at from eighty thousand to ninety thousand acres. The mildness of the winter of 1890–91, coupled with the scarcity of owls, kestrels, and weasels (due to the over-zeal of gamekeepers), are supposed to have been the inducing cause of this last visitation. It is reported, however, that, as on similar occasions, numbers of owls arrived in the affected districts for the purpose of preying on the voles, which by the end of 1893 had well-nigh disappeared.

The habits of the continental field-vole are similar to those of the English species. It is stated, however, to be even a more prolific animal, the number of young varying from four to eight, while as many as six different litters may be produced in a single season. Moreover, it is probable that the young produced in the spring will themselves be parents in the following autumn. On the Continent the plagues of voles are even more serious than in England. Thus, according to Brehm, during a visitation of these animals which took place in Germany in the year 1822, upwards of 1,570,000 were taken in one district, 590,327 in another, and 271,941 in a third. Again, in the summer of 1861, a total of 409,523 voles were taken in a single district of Rhine-Hessen.

Bank-Vole. The third species of the genus in Britain is the bank-vole (*M. glareolus*), which may be distinguished externally from the field-vole by the colour of the back inclining more or less markedly to rufous, and also by its larger ears, and proportionately longer tail, which is equal to half the length of the head and body. The molar teeth differ from those of the field-vole not only by the circumstance that in the second one of the upper jaw there are but four prisms, but also in that in the adult state these teeth form imperfect roots. The whole proportions of the bank-vole are more elegant than those of the field-vole, while its fur is more smooth and glossy, its coloration more brilliant, and the eye larger. It is found locally over England and parts of Scotland, as far north as

Morayshire, while abroad it ranges from France across Asia to China. Its general habits are the same as those of the field-vole, but it is said to be more generally found in sheltered situations, and is especially fond of visiting gardens.

There is, however, a great probability that both the bank-vole and the red-backed vole (*M. gapperi*) of North America, are merely local varieties of the Arctic vole (*M. rutilus*), which inhabits the circumpolar regions of both hemispheres; their differences in coloration being merely such as might well be due to the varying climatic conditions of the countries they severally inhabit.

Alpine Vole.

The Alpine vole (*M. nivalis*), which is the last species to which we refer at any length, is interesting on account of the elevated regions forming its habitat. It is a small species with a relatively long tail: the



THE ALPINE VOLE (⅔ nat. size).

total length being about 7 inches, of which slightly more than half is taken up by the tail. The ears are large; and the number of prisms in the first upper molar tooth is the same as in the water-vole. The colour varies from brownish grey above and greyish white beneath to pure white. This species has an exceedingly limited distribution, being confined to the Alps and Pyrenees, where it ranges from an elevation of about four thousand feet to the limits of perpetual snow. It is, indeed, most abundant near the snow line, above which it also sometimes wanders in search of the scanty vegetation which exists at such altitudes. Not only is the Alpine vole found in these dreary regions during the short season when the ground is more or less free from snow, but it likewise remains there from year's end to year's end. Accordingly, for upwards of nine or ten months of the year, it lives beneath a deep pall of snow. Here it makes regular runs, along which it travels in search of food when the supply hoarded for winter use becomes exhausted. No other known mammal leads a similar existence.

Other Species. The list of species of voles being almost endless, space only permits of passing references to a few of the more interesting. In North America the commonest species is the meadow-vole (*M. riparius*), which in the northern regions during the winter abandons its frozen burrows and forms nests on the surface of the ground, which soon become buried in the snow. The heat of the little animal inside melts and cakes the surrounding snow, which thus forms a continually increasing dome-shaped mass around the nest. The root-vole (*M. œconomus*) of Siberia and Kamschatka, is interesting on account of the large stores of food it accumulates in its burrows, and likewise on account of its migratory habits, which resemble those of the lemming. Numerous voles occur in the Himalaya, Tibet, and Central Asia; the earliest described Himalayan species being Royle's vole (*M. roylei*).

The Lemmings.

Genus *Myodes*.

Closely related to the voles are the lemmings, of which one species, commonly known as the Norwegian lemming (*Myodes lemmus*), inhabits the mountains of the Scandinavian peninsula and thence northwards to the North Cape, while the second is confined to North America. Lemmings are distinguished from voles by their heavier build, more convex and obtusely snouted head, extremely short tail, and by the soles of the small feet being covered with hair. They have also longer claws, thicker fur, and very small ears; while there are likewise important differences in the structure of the skull and teeth. There is considerable individual variation in regard to size and coloration in the Norwegian lemming. Usually, however, its length is about 5 inches; while the general colour of the fur is yellowish brown, darker above than below, more or less spotted and streaked with blackish brown.

Habits. Lemmings are the most abundant rodents found in Norway, and they have always attracted great interest from the circumstance, that at certain intervals countless swarms descend from the mountains to the cultivated plains, and thence make their way, apparently under the influence of some blind impetus, to the sea, into the waters of which they boldly plunge to meet a death by drowning. In the course of such migrations, the lemmings take a straight line across country, swimming rivers or lakes, climbing mountains, and eating their way through fields of corn or grass, and thus leaving a track of desolation in their rear. The line of march is marked by flights of predaceous birds hovering above the hosts; the flanks and rear of the army being harassed by four-footed foes, who, however, at first make but little apparent diminution in its numbers. Disease also claims its victims; and from these combined attacks, the numbers which eventually reach the sea, sometimes after an interval of from one to three years from the time of starting, form but a small minority of the original swarm.

In general appearance, lemmings look not unlike small marmots or hamsters; and they resemble the latter to a considerable extent in their mode of life. Although in Finmark they occur at the sea-level, in the more southern parts of Scandinavia they are found only high up in the mountains above the level of firs, in the belt

clothed with birch and juniper. Here they select dry spots in the swampy ground, making their shallow burrows either beneath stones or in the peaty soil. Generally they do not form well-marked tracks from one hole to another, except when the ground is covered with snow. They are on the move by day as well as by night. Except when migrating, lemmings show a great aversion to water, always selecting the driest portions of the swamps, and if forced to enter a river, manifesting their dislike by squeaks and grunts. Generally they sit quietly during the day, in or near the entrances of the burrows, but should a human being appear on the scene, they at once become violently excited, raising themselves up on their hind-quarters,



NORWEGIAN LEMMINGS MIGRATING (½ nat. size).

and squeaking, as if to warn him off from their territories, while their gestures are such as to give the impression that they are about to attack the intruder. Indeed, they will sometimes bite vigorously at the trousers of any person who approaches too close to their holes. The squeaks and grunts uttered on such occasions by the lemmings are said to closely resemble those of guinea-pigs. In the winter, they form large nests in their tunnels through the snow, which are exposed to view when it melts; several tunnels radiating from each nest, which are formed partly in the peat and partly in the snow. The chief food of the lemming in its native haunts consists of grass, reindeer-moss, the catkins of the birch, and probably various descriptions of roots. It appears that the young are born in the nests, which are usually made of dry grass with a lining of hair, and that there are

usually from five to six young in a litter. It is considered by Brehm that there is probably more than one litter in a season; but precise information as to the breeding-habits of these creatures is still a desideratum.

It is probable that the periodical migrations of the lemmings are induced by a scarcity of food. Brehm remarks that if an early spring following a wild winter is succeeded by a hot and dry summer, everything will be favourable for an unwonted increase in the number of these animals. The dry summer will, however, equally tend to diminish the quantity of vegetation available for their support, and, accordingly, a migration to more fertile regions will be rendered necessary. Why, however, the migration should be continued in this extraordinary manner is a question which has not yet received a satisfactory answer. The number of lemmings taking part in a migration has been estimated at many millions; and on such occasions every bush and every rock or large stone has a lemming hiding under it, while sometimes even the towns swarm with these creatures. Not only do the lemmings attempt to swim rivers and lakes which are too wide for them to cross, but, writes Mr. T. T. Somerville, "they tumble into holes, wells, and brooks, the sides of which are too steep for them to scramble out of again, so that frequently people are at a loss to obtain water that is not polluted by their bodies. Doubtless this accounts for an epidemic popularly termed 'lemming fever,' that is said to prevail after the migration, and which is described as resembling ordinary typhoid."

The Banded Lemming.

Genus *Cuniculus*.

The banded lemming (*Cuniculus torquatus*), from the circumpolar regions of both hemispheres, differs in several important points from the true lemmings, and is accordingly referred to a distinct genus. Externally it is distinguished by the absence of conchs to the ear, the shorter and more thickly-formed feet, the practical loss of the first toe of the fore-foot, which has only a rudimental nail, and also by the great length of the claws of the third and fourth toes in the same limb. The molar teeth are more like those of the voles than in the case of the true lemmings, but the first of these teeth in the upper jaw is peculiar in having seven distinct prisms. The banded lemming is so variable in coloration as almost to defy description. It may be said, however, in general that the fur of the upper-parts presents a kind of "watered" appearance, owing to the intimate mingling of chestnut, rufous, black, grey, and tawny; the under-parts being leaden-grey. Usually a more or less distinct black line runs along the back from the muzzle to the tail; while there may be a greyish collar on the nape of the neck.

Habits. The habits of the banded lemming are probably very similar to those of the other species, although it does not undertake similar periodical migrations to the same extent. Baron Nordenskiöld states that there are no lemmings in Spitzbergen, but that they must be exceedingly numerous at certain seasons in Novaia Zemlia, where, in early summer, the grass is seen to be traversed in all directions by the tracks made by these animals beneath the snow.

Fossil Lemmings. It is interesting to note that remains of both the Norwegian and the banded lemming have been found in the Pleistocene deposits of Britain, apparently indicating the prevalence of different climatic conditions to those of the present age.

The Musquash.

Genus *Fiber*.

The musquash, or musk-rat (*Fiber zibethicus*), is a North American species, considerably exceeding in size all other members of the vole subfamily. Although resembling a vole in its general external appearance, as well as in the structure of its molar teeth and skull, the musquash differs by its compressed and



THE MUSQUASH (⅛ nat. size).

proportionately longer tail, of which the length is nearly equal to that of the body, exclusive of the head. In addition to its compressed form, the tail is also characterised by being nearly naked, and covered with scales. The feet, which are partially webbed, differ from those of the voles in having their soles entirely naked.

The musquash is a massively-built animal, with the head and body attaining a length of about a foot, and the tail about 10 inches. The head is unusually wide and not separated from the body by any distinctly constricted neck; while the eyes are relatively small, and the ears scarcely project above the fur. With the exception of the small area immediately surrounding the nostrils, the muzzle is completely covered with hair. The limbs are short, with the first toe rudimentary in the front pair, although well developed in the hinder. The compressed form of the tail is increased by the presence of a line of hairs on both its upper and lower surfaces. The fur, of which the general colour is blackish brown, passing into grey on the muzzle and under-parts, has the soft and velvety texture of that of the beaver. It

is, however, mostly shorter than in the latter, although on the back and flanks there are interspersed a number of longer bristle-like hairs.

Distribution and Habits. The geographical range of the musquash is large, extending from the so-called barren grounds of Arctic America to the genial climate of the Rio Grande, while it also reaches from the Atlantic to the Pacific.

Musk-rats are thoroughly adapted for an aquatic life, and generally frequent ponds, swamps, and sluggish streams. Although their food consists mainly of the roots of grasses and water-plants, they consume considerable quantities of river mussels; they will likewise catch and eat fish, while they are said at times to devour the flesh of such individuals of their own species as they may find dead, or wounded and helpless. Occasionally they wander considerable distances from the water; and Dr. Merriam relates an instance where two of these creatures were discovered comfortably ensconced beneath the hearthstone of a room.

The musquash is an excellent diver, being able to remain below the surface of the water for a considerable time. It is much less strictly nocturnal in habits than the beaver, and may be frequently observed swimming about in broad daylight, more especially if the sky be overcast. In leaping into the water to dive, it makes a loud noise by striking the flat tail against the surface. The long burrow always has its entrance beneath the surface of the water, from which it inclines upwards in the bank for a distance of from 10 to 15 feet, when it expands into a large chamber, in which may be a nest. Usually one or more galleries lead from this chamber further into the bank. In certain districts where the water is deep these animals in the autumn sometimes collect large heaps of vegetable matter in the form of haycocks. Such heaps are known as "musk-rat huts" or "houses." After mentioning that some of those built in the water attain enormous dimensions, Dr. Merriam observes that "the summit of the structure is commonly high enough out of water to admit of an air-chamber within, which communicates with the outside world by means of a hole through the centre of the mass, the entrance or entrances being under water. Many of the houses contain no mud or sticks, but consist wholly of balls and knots of roots and swamp-grasses. It seems clear that the animals make no attempt to construct a dwelling of any particular shape, but merely heap the materials together without plan or order, the resulting mound naturally assuming, in a general way, the form of a flattened cone. . . . The materials of which the hut are composed, it will be observed, are such as serve as food for the animals during the long winters; hence the musk-rat's house is in reality a storehouse, which he devours piecemeal as the winter advances."

The nest is usually placed in a burrow in the bank, although occasionally in the aforesaid hut. Here from five to nine blind and naked young are produced at a birth, and it is reported that there may be as many as three litters in the course of a season.

Fur. Although not of much value, the fur of the musquash is much used, both in America and Europe. According to Mr. Poland, from three to four million skins come into the market annually; the Hudson's Bay Company alone having sold over half a million in 1891. Dr. Merriam states that although the flesh of the musquash is red and rather flabby, yet that, failing other meat, it is eatable.

The Mole-Like Voles.

Genera *Ellobius* and *Siphneus*.

Certain representatives of the vole group are specially adapted for a subterranean mole-like life, and, therefore, differ considerably from the other forms, although they retain the ordinary type of molar teeth. In form they are characterised by the blunt and rounded head passing imperceptibly into the cylindrical mole-like body, the absence of external ears, the short tail and limbs, and the broad feet, each provided with five claws. The incisor teeth project considerably, and their enamel is usually white, instead of having the yellow or orange tinge so prevalent among the ordinary voles.

These mole-like voles, of which there are but few species, are mainly confined to Central and Northern Asia, although one species ranges as far south as Afghanistan and Quetta, and another extends into Eastern Europe. They are divided into two genera, according as to whether the claws of the fore-feet are short or long; *Ellobius* including the short-clawed and *Siphneus* the long-clawed species. The so-called Quetta vole (*E. fuscicapillus*) is about 5 inches in total length, of which half an inch is occupied by the tail. It is brownish white above, with the exception of the greyish brown head, while the under-parts, feet, and tail are white; the fur being long and soft. It is reported to construct horizontal galleries in the ground, with heaps of earth thrown up at intervals, after the fashion of the mole.

The Rats and Mice.

Genus *Mus*.

The true rats and mice, together with certain allied forms referred to distinct genera, are the representatives of the last subfamily of the *Muridæ*, which is exclusively confined to the Old World. They are primarily characterised by the crowns of the unworn upper molar teeth carrying a number of tubercles arranged in three longitudinal rows; these teeth always having distinct roots. When worn by use, the crowns of the molars exhibit transverse bands of enamel. The tail is always long and scaly, and in most cases almost destitute of hairs. Moreover, the ears are large, and the eyes bright and prominent, while the muzzle is sharply pointed, and the build light and elegant. Their movements are quick, active, and graceful, and their coloration is in most cases uniform and sombre, as would naturally be expected from the nocturnal and burrowing habits of the majority of the species.

The Murine subfamily includes a considerable number of species, by far the greater majority of which are comprised in the genus *Mus*. That genus is characterised by the incisor teeth being smooth, and the molars distinctly tuberculated. The ears and eyes are proportionately large, and the tip of the muzzle is naked, while the tail is long and scaly. The first toe of the fore-foot has a short nail in lieu of a claw; and the fur is soft, although in some cases intermingled with

spines. The genus is the largest in the whole mammalian class, comprising not far short of a hundred and fifty species, which are distributed over the whole of the Old World with the exception of Madagascar; some of these, by human aid, having now acquired a cosmopolitan range. With such a multitude of species, it is of course only possible to allude to a few of the more interesting.

Brown Rat.

The brown or, as it is often inappropriately called, the Norway rat (*M. decumanus*), offers one of the most remarkable instances of a successful usurpation to be found in the animal kingdom; this creature having ousted the black rat from most parts of England and a large area on the Continent. So far as can be ascertained, its original home appears to have been Western China, from whence it gradually travelled westward to continental Europe, finally reach-



THE BROWN RAT (½ nat. size).

ing the shores of the British Islands by the involuntary aid of ships. Its westerly migration was, however, by no means limited to Europe, as it has been carried by vessels across the Atlantic, and is now as abundant in many parts of North America as it is in the Old World. The migration of the rat into Russia is known to have taken place about 1727, in which year large troops of these animals crossed the Volga from Central Asia, and made their way westwards. In Paris it appeared about the middle of the eighteenth century, and it is generally supposed to have first reached England in 1730.

In appearance the brown rat is unfortunately too well known to need much description, although it is advisable to point out the features by which it is distinguished from its cousin the black rat. In form this species is characterised by its heavy build, massive blunt muzzle, comparatively small ears, and relatively short tail; the length of the tail being always less than that of the head and

body (8 to 9 inches), and usually not exceeding that of the body alone. The colour of the upper-parts is usually greyish brown, while the under surface is white; but black varieties are often met with, which in Ireland have been regarded as indicating a distinct species.

Habits. The brown rat is a far more powerful animal than the black species, which has not a chance against its stronger rival, although curiously enough it is stated that on some ships the two kinds may be found living together. The following anecdote, related by the late Mr. Frank Buckland, illustrates in a striking manner the superior power and at the same time the extreme ferocity of the brown rat. "A London rat-catcher," writes the narrator, "shut up together in a cage the result of his day's work, consisting of several dozen rats, of both species, and put them away carefully for the night, their intended fate being to afford sport for his employer's dogs the next morning. What was his astonishment when he came to fetch them, to find none but brown rats remaining! these cannibals having cruelly devoured all their sable brethren."

Rats are practically omnivorous in their diet, devouring every kind of human food with avidity, and inflicting untold damage on the hen-roost, the dove-cot, and the rabbit-warren. Their devastations to corn-ricks, or to grain stored in insufficiently protected granaries, are too well known to need more than passing mention. Not only will they, as in the instance recorded above, prey on their cousin the black rat, but they will likewise slay and devour members of their own kind which have been caught in traps or otherwise disabled. In robbing poultry-houses, it is a well-ascertained fact that rats will convey the eggs in an unbroken condition for considerable distances, although it is not yet ascertained how this difficult feat is accomplished. The partiality of these animals for fish is well known, but that they will occasionally catch young eels for themselves has been only recently discovered. Mr. Harting adds that snails—both land and fresh-water—also form a portion of their diet; while on the sea-coast they will eat prawns and other crustaceans.

The prolific nature of the brown rat is little short of marvellous, and thoroughly accounts for its enormous numbers when in favourable situations. Several litters are produced annually, each of which generally contains from eight to ten, and sometimes as many as twelve or fourteen young; and a female rat will breed when only half-grown, although the number of its progeny is then but three or four at a birth. When these animals obtain access to small islands inhabited by sea-birds or rabbits, the abundant food soon leads to a prodigious increase in their numbers; but sooner or later they practically exterminate the indigenous inhabitants, and then have to seek a more precarious livelihood by preying upon the crustaceans and molluscs on the shores. Some years ago the number of rats in the slaughter-houses around Paris was so great, that as many as 2650 were killed in a single night, and over 16,000 within a month.

Rats, impelled by scarcity of provisions, at times make migrations in large bodies—generally, or always during the night; and on such journeys they will not hesitate to plunge boldly into and swim over such rivers as may come in their way; and it is related that instances have occurred of their being suddenly hemmed in during such voyages by a rapid formation of ice. Some years ago the

rats that frequented the London Zoological Gardens were in the habit of regularly swimming to and fro across the Regent's Canal. When brought to bay, the ferocity with which a rat will defend itself against a human or canine foe, is known to most persons. When pressed by hunger, rats will, however, occasionally attack human beings without provocation; and it is on record that an unfortunate man on entering a coal-pit which had been closed for some time, was actually killed and devoured by a starving host of rats.

Black Rat. The black rat (*M. rattus*) is smaller and more elegantly built than the brown, with a longer and thinner tail; the length of the head and body being about 7 inches, while that of the tail varies from 8 to 9 inches. Its snout, moreover, is longer and more slender, projecting to a greater distance



THE BLACK RAT (⅓ nat. size).

beyond the lower jaw, while its ears are considerably larger. In Europe the black rat, as its name implies, generally has fur of a deep bluish black colour; but in India and other parts of the East there are varieties, in one of which the tint is usually brown above and white below, while in a second the hue is rufous or yellowish brown, and spines are mingled with the fur. When domesticated, white and pied varieties are readily produced; and most of the rats thus coloured which are exhibited by showmen, belong to this species. In one of the Indian varieties the length of the head and body is not more than 5 inches, while in another it reaches 8 inches.

Distribution and Habits. The black rat is very commonly spoken of as the indigenous British species; this, however, is incorrect, as this rat was also introduced from the East, although at a much earlier date than its brown cousin. The exact date of its arrival in Europe cannot, however, now be determined, although it is known to have existed on the Continent in the thirteenth century. At the

present day the European variety of this species is almost cosmopolitan; but the brown and rufous varieties extend from Northern Africa through India to Burma, and are doubtless indigenous to both these regions.

The black rat, in addition to its inferior size, is a far less ferocious animal than the brown species, which accounts for the ease with which it has been conquered by the latter. In England it is now comparatively rare—the Isle of Dogs being one of its last strongholds; but it is more common in certain parts of the Continent. In Europe its habits are generally very similar to those of the brown rat; but in India it frequently ascends trees, where it makes its nests among the branches; while in some of the islands of the tropics it lives exclusively in the crowns of the cocoanut palm, upon the fruit of which it feeds.



THE HOUSE MOUSE (⅔ nat. size).

House Mouse. In Britain, from the absence of any species of intermediate size, it is easy to distinguish between the rats, or larger species of the genus, and the smaller mice; but in other countries it is impossible to draw any line of distinction, and the two terms must consequently be employed in a somewhat arbitrary manner. The typical representative of the mice is the common house mouse (*M. musculus*), which is now of almost world-wide distribution, although probably originally a native of Asia. The characteristic features of this species are its relatively large ears, long tail, and nearly uniform brownish coloration, which is only slightly paler below than above.

The distinctive peculiarity of this species is its partiality for human habitations and their neighbourhood; its tastes being practically omnivorous, although its

chief food consists of grain and other vegetable articles of human consumption. It is noteworthy that in corn-stacks rats and mice live in perfect harmony together, without any trace of that mutual antipathy existing between the brown and the black rat. This mouse is nearly as prolific as the brown rat, producing from three to five litters in a year, each of which includes from four to eight blind young. In habits, the house mouse is more active than most of its kindred, being able to ascend vertical walls with ease, and also having the power of springing to considerable distances. In domestication, white and pied breeds of this species are common.

This mouse exhibits a peculiar susceptibility to musical sounds, to which it listens with marked attention. Occasionally, in common with other members of the family, individuals of this species are endowed with considerable vocal powers. A lady writes that although the song of one of these "singing-mice" was not very effective, yet it was a distinct vocal effort. Sometimes the mouse in her possession "would run up an octave, and end with a decided attempt at a trill. Sometimes it would try to trill up all the notes. An octave seemed to be about its range. I could distinctly see the expansion and vibration of its throat and chest as one can in a song-bird. Its favourite position when singing was an erect one, standing on its hind-feet."

Long-Tailed Field Mouse. Since the term "field mice" is popularly applied to the voles as well as to the true mice, it is necessary to prefix the epithet "long-tailed" to the common British species (*M. sylvaticus*) of the present genus. This field mouse is rather larger than the field vole, from which it can be distinguished at a glance by its lighter build, longer and more pointed muzzle, much larger ears, and greatly elongated tail, which is nearly equal in length to the head and body. The general colour of the fur is reddish grey above, and whitish beneath, with a spot of light brown on the chest. This species is common in many parts of England, and is also widely distributed over the temperate regions of Europe, while eastwards it is replaced by the closely allied Persian field mouse, ranging from Persia over a large portion of Central Asia.

This field mouse is generally found in England in gardens, hedgerows, and cornfields, but in winter it sometimes takes shelter in houses, while it also frequents corn-stacks, although in less numbers than the house mouse. It commonly burrows in the ground, and lays up large stores of food for winter use; whole handfuls of corn, nuts, or seeds being sometimes discovered in these subterranean retreats. Since these mice are exceedingly prolific, the amount of damage they sometimes do to cornfields and gardens is almost incalculable; and additional harm is frequently effected by pigs in their search after the concealed hordes of these little Rodents.

Harvest Mouse. The elegant little creature of which a group is represented in the coloured Plate is the most beautiful, and also almost the smallest of the British mamma...; the one inferior to it in point of size being the pigmy shrew. The harvest mouse (*M. minutus*), as the creature is called, was first discovered in England by Gilbert White of Selborne, and is so small that its weight is only about one-sixth of an ounce; the total length being about 4½ inches, of which nearly one-half is taken up by the tail. The ears and tail are proportionately



HARVEST MOUSE

rather small; and the colour of the fur is yellowish red above and white beneath.

The harvest-mouse, although local, is widely distributed in the British Islands, and extends over the great part of Europe, ranging eastwards through Russia into Siberia, and occurring as far south as the north of Italy. This species usually keeps far away from human habitations, frequenting cornfields and pastures; but is often carried home with corn-sheaves, and then spends the winter in the rick where they are deposited. In the latter situations, the harvest-mouse remains active throughout the year; but when living in the open fields it constructs a burrow in which to pass the winter months in a state of torpor. The summer nest is a globular structure of grass and leaves suspended among the corn-stalks at some distance from the ground;



THE BARBARY MOUSE (nat. size).

and when ascending or descending the stems to reach this nest, or in search of food, the little creatures are much aided by their prehensile tails. No better description of this nest exists than the one given by White, which although often quoted will bear one more repetition. He writes that the structure was "most artificially platted, and composed of the blades of wheat; perfectly round and about the size of a cricket ball, with the aperture so ingeniously closed, that there was no discovering to what part it belonged. It was so compact and well filled that it would roll across the table without being discomposed, though it contained eight little mice that were naked and blind." The number in a litter varies from five to eight or nine, and it is probable that there are several broods in the course of a summer. The numbers of the species are, however, kept down by the hosts of predaceous birds and small carnivorous mammals that make it their prey. Like the long-tailed field-mouse, the present species is partly insectivorous in its diet. Mr. Harting states that he has several times kept harvest-mice in captivity, and succeeded in rearing

their young to maturity. He describes them as charming little pets, allowing themselves to be handled without making any attempts to bite, and readily taking food from the hand.

Other Species. The only other species of the genus *Mus* that can be noticed here are two, one of which is remarkable for its coloration, and the other on account of its habits. The Barbary striped mouse (*M. barbarus*) is the most strikingly coloured member of the group, the ground-colour of the fur of the upper-parts being a yellowish brown, upon which are a number of longitudinal blackish brown stripes; the under-parts being pure white. This mouse inhabits Northern and Central Africa, being especially common in the Atlas Mountains, and also occurs in the desert regions of the interior as far as Kordofan. There appears to be nothing worthy of special note in its habits.

The Australian brown-footed rat (*M. fuscipes*) is remarkable as being nearly or quite as aquatic in its habits as the water-vole.

The Bandicoot-Rats

Genus *Nesocia*.

The bandicoot-rats of Southern Asia differ from ordinary rats in the much greater width of their incisor and molar teeth, and also by the tubercles on the crowns of the latter being so completely connected as to form transverse ridges. Members of the genus extend from Palestine to Formosa, and from Ceylon to Central Asia; but they are most abundant in India and the adjacent regions. The great Indian bandicoot-rat (*Nesocia bandicota*) is the largest member of the subfamily, measuring from 12 to 15 inches from the tip of the snout to the root of the tail, and weighing between 2½ and 3 lbs. It is common in cultivated districts and near human dwellings in most parts of India, although unknown in Lower Bengal. It is a burrower, like other species of the same genus, some of which turn up mounds of earth like mole-hills. When disturbed, this rat utters grunts like a pig; but it has far less pluck than the brown rat, and makes but a poor fight against a dog.

Other Genera.

There are about eleven other genera belonging to this family, of which a few of the more interesting may be briefly noticed.

Bush-Rats. The bush-rats (*Golunda*) are represented by one Indian and one African species, and are distinguished by the presence of a groove on the front of the upper incisor teeth. The length of the head and body in the Indian species (*G. ellioti*) is about 4½ inches, and that of the tail half an inch less.

Spiny Mice. The spiny mice (*Acomys*), of which there are several species of the approximate size of the house-mouse, are peculiar in having the hinder portion of the back covered with thick, rigid, grooved spines in lieu of hair, and thus look almost like minute hedgehogs. They are desert-loving creatures, ranging from Syria to Eastern Africa as far south as Mozambique, while a single example of one of the species has been found in Sind.

Jerboa-Rats. The sandy deserts of Australia are inhabited by certain elegant representatives of the present group distinguished by their elongated hind-limbs, long ears and tail, and general jerboa-like appearance. Indeed, these jerboa-rats (*Hapalotis*) seem to take the place of the true jerboas in the regions they inhabit.

Lichtenstein's Rat. A peculiar species from Tasmania, known as Lichtenstein's rat (*Mastacomys*), differs from ordinary rats in the great width of the molar teeth, and also by the circumstance that the female has but four teats. It somewhat resembles the water-vole in size and form, although the body is clothed with longer and softer fur.

The Mole-Rats.

Family *Spalacidæ*.

The strange-looking creature shown in the illustration on p. 148 is the typical representative of a small family of Old World Rodents, all of which are adapted for a purely subterranean mole-like life. Except for their large and projecting incisor teeth, which at once proclaim them members of the Rodent order, the mole-rats have a general mole-like appearance, their eyes and external ears being small or rudimentary, the limbs short and provided with large and powerful claws, and the tail usually short or practically wanting, while the body is cylindrical and not marked off from the head by any distinct neck. Their molar teeth are furnished with roots, and have re-entering folds of enamel on their crowns, and premolars may or may not be present. It may be remarked here that the assumption of mole-like habits and a more or less mole-like bodily form is common to several groups of smaller mammals. Thus, among the Insectivores, we have the true moles and the Cape golden mole; while in the Rodents we find mole-like forms in the mole-voles in the present family, and also in the South American tucutuco, belonging to the family *Octodontidæ*, described in the next chapter. The marsupial mole of Australia presents us with an example of the Pouched Mammals, having a similar form and mode of life.

Great Mole-Rat. The great mole-rat (*Spalax typhlus*), which is the only representative of its genus, is characterised by the absence of premolar teeth, by the minute eyes being completely covered with skin, and the rudimental wart-like ears. The fur is soft, and so arranged as to be reversible, by which means the movements of the animal in its burrow are much facilitated. The general colour is yellowish brown tinged with ashy grey above, and ashy grey, mingled with spots and flecks of white, beneath. This species inhabits South-Eastern Europe, whence it extends eastwards to Syria, Mesopotamia, and Persia, and also occurs in Lower Egypt.

Habits. The great mole-rat constructs tunnels very much resembling those of the mole, their course being marked by heaps of earth thrown out at intervals. But while the mole constructs its lengthy burrows for the sake of feeding upon earth-worms, the present species and its allies make their subterranean journeys in search of bulbs and roots. In Egypt, according to Dr. J.

Anderson, the burrows of the mole-rat are made in sandy soil containing quantities of bulbs of asphodels and hyacinths, upon which the creature feeds. The tunnels are of great extent and complexity, some of the passages being as much as thirty or forty yards in length, and are generally about eighteen inches below the surface. In certain spots the borings descend, however, to a depth of some four feet, and here some of them terminate in chambers packed full of bulbs, while others open out into sleeping apartments, from which secondary passages again radiate. Dr. Anderson states that "the tunnels are perfectly smooth and cylindrical, and in digging through the soil above them numerous bulbs of the same kind as those found in the storehouse were observed." When taken from its burrow, the first instinct of the animal is to dig headlong into the soil; and when underground it is able to move with equal facility either backwards or forwards.

Bamboo-Rats.

In Northern India, Tibet, China, Burma, and the Malayan region, as well as in Abyssinia, the family is represented by a group of species, commonly known as bamboo-rats (*Rhizomys*), which differ from the preceding by



THE GREAT MOLE-RAT (⅓ nat. size).

the minute eyes not being covered with skin, as well as by the presence of small external naked ears, and of a short tail partially covered with hair. The bay bamboo-rat (*R. badius*), ranging from the Eastern Himalaya to Siam, is one of the best known representatives of this genus, and attains a length of from 7 to 9 inches, exclusive of the tail, which is about 2½ more. This species generally makes its burrows among tall rank grass, but sometimes at the roots of trees, and in their construction uses its teeth as well as its claws. There is some doubt whether these animals drive tunnels in search of roots, as they are known to issue forth at night in order to feed on the young shoots of grass, and probably bamboo, but it is generally believed that they also eat roots. When above ground, they move slowly, and they are said to be so fearless, or stupid, as to allow themselves

to be caught without resistance, although when taken they bite savagely and severely. From three to four young are produced at a birth. The hill-tribes of Burma are in the habit of eating the flesh of these animals. The Sumatran bamboo-rat (*R. sumatrensis*), ranging from Tenasserim to Siam, is a much larger species, measuring from 15 to 19 inches in length, exclusive of the tail. Remains of an extinct bamboo-rat occur in the Pliocene rocks of the Siwalik Hills at the foot of the Himalaya.

Cape Mole-Rats. Africa, south of the Sahara, is the habitat of several types of mole-rats differing from these above mentioned in the formation of the lower jaw, and also by the general presence of premolar teeth. At the Cape there are two species, one of which (*Bathyergus maritimus*) is nearly a foot in length, with the upper incisor teeth grooved, no external ears, and extremely powerful claws; the silky hair being of a light greyish brown colour. This second species (*Georychus capensis*) is about half the size of the former, with smooth upper incisors, and weaker claws. The late Prof. Moseley states that the strand-mole (*Bathyergus*), which is always found on the flats near the shore, constructs numbers of tunnels and hillocks, the former of which are large enough to easily admit the hand and arm. On the other hand, the runs of the smaller species are generally constructed on higher ground, although sometimes with those of the so-called strand-mole. The hillocks constructed by the latter are generally about a foot in height; those freshly made being of a dark colour. Prof. Moseley writes that "one has not long to watch, standing a few yards off, before the fresh heap is seen to heave up, three or four times in succession, as the strand-mole forces freshly scooped-out earth up into it from below. I tried at first shooting into the heap as it was thus heaving, in the hope of getting the mole, but never with any success. In order to shoot the worker, the earth should be quickly thrown back from the fresh heap, and the hole laid open to the air. One then only has to retire about ten paces and wait patiently. The strand-mole does not like the fresh air, and in the course of five minutes or so comes back to fill up the hole, but usually puts its head out for a moment first to find what's up, though it certainly cannot see far with its minute eyes, which are not bigger than the heads of carpet-pins, the whole eyeball when extracted being not bigger than a tenth of an inch in diameter." When trapped, the animal bites the air fiercely with its enormous front teeth, at the same time uttering a half-snarling, half-growling noise.

Although there is but a single species of *Bathyergus*, there are several of *Georychus* in different parts of Africa. In addition to these there is an allied form, known as *Myoscalops*, characterised by having usually three pairs of premolar teeth in each jaw, in addition to the three molars.

Naked Sand-Rats. The sandy deserts of Somaliland and Shoa are inhabited by two members of the present family, which are some of the most extraordinary-looking little creatures in existence. In size the naked sand-rats (*Heterocephalus*) may be compared to a common mouse, but in appearance they are likened by Mr. O. Thomas, on account of their nearly naked skin, small eyes, and peculiar physiognomy, to tiny hairless puppies. They have small heads, with projecting incisor teeth, and no external ears, while the limbs and tail are of moderate length. The eyes are almost functionless; and, although the feet are fringed with hairs,

the yellowish skin is almost naked, save for a few sparsely scattered hairs. One of the two species has three pairs of molar teeth in each jaw, while in the other there are but two.

These sand-rats are entirely subterranean in their habits. Mr. Lort Phillips states they throw up "groups of miniature craters, which exactly represent volcanoes in active eruption. When the little beasts were at work I used frequently to watch them, and found that the loose earth from their excavations was brought to the bottom of the crater, and sent with great force into the air in a succession of rapid jerks, but they themselves never venture forth from the shelter of their burrows."

The American Pouched Rats.

Family *Geomyidæ*.

The possession of large cheek-pouches lined with hair, which open externally to the mouth at the lower edges of the cheeks, forms the distinctive peculiarity of a family of rat-like Rodents confined to the New World. The forms included in the family vary considerably in external appearance and habits; its larger and burrowing representatives being known as pocket-gophers, while the smaller terrestrial types are respectively termed kangaroo-rats and pocket-mice. In addition to three pairs of molar teeth with transverse plates of enamel on their crowns, and which may or may not be rooted, all these Rodents have a single pair of premolar teeth in each jaw. Their skulls are characterised by the great twisting of each branch of the lower jaw, and likewise by the forward extension of the cheek-bone.

Pocket-Gophers.

Genera *Geomys* and *Thomomys*.

The pocket-gophers include large rat-like species, with burrowing habits, and are characterised by their small eyes, rudimental external ears, and the equality in length of their comparatively short limbs. The whole of them are confined to North and Central America.

Common Pocket-Gopher. The common pocket-gopher (*Geomys bursarius*) is selected for illustration as the best known representative of the group, and as being the type of the genus *Geomys*, characterised by the presence of a deep groove on each of the broad upper incisor teeth. This species attains a length of from 7 to 8 inches from the muzzle to the root of the tail; while the hairy tail itself varies from 2 to 3 inches. The fur is of a soft and mole-like texture; and of a beautiful reddish brown colour above, becoming greyish beneath, while on the feet, and generally also on the tail, it is white.

This pocket-gopher is an inhabitant of the extensive plains of the valley of the Mississippi and its tributaries, extending somewhat beyond these limits to the northwards. Here it lives a mole-like life, constructing subterranean tunnels and throwing up at intervals conical heaps of earth, after the fashion of the "little gentleman in black velvet." The tunnels generally run at a distance of about a

foot below the surface; but sometimes, as when passing beneath a garden path, they descend deeper. They are driven for the purpose of obtaining access to the roots of plants on which these animals chiefly subsist. The tunnels generally communicate with one another by cross-passages; and in a certain spot—generally beneath the roots of some large tree—the animal sinks a deep shaft, at the termination of which is constructed a dwelling-chamber. This chamber is generally as much as from four to five feet below the surface, and is entered by a tortuous passage. It is of large size, and generally lined with soft grass, upon which the owner reposes. The nest of the female is constructed in a similar chamber, which



THE COMMON POCKET-GOPHER ($\frac{1}{2}$ nat. size).

is, however, encircled by a horizontal gallery, after the manner of the residential chamber of the mole. Here in the latter part of March or beginning of April are produced from five to seven young; their nest consisting partly of soft fur from the body of the mother. Generally a passage proceeds from one side of the nest-chamber to a store-chamber, which is filled with roots, nuts, and seeds—in cultivated districts potatoes often forming a large proportion of its contents. The food is said to be carried to this storehouse in the capacious cheek-pouches of the animal. Usually the pocket-gopher works at its tunnels or domicile from about four to ten o'clock in the morning, during which time it excavates from twelve to twenty feet of tunnelling, and will throw up from two to five hillocks. Other species of pocket-gophers belonging to this genus are found in the Southern United States, Mexico, and Central America.

Northern Pocket-Gopher. The northern pocket-gopher (*Thomomys talpoides*) is the best known representative of a second genus, containing at least two species, and distinguished by the absence of grooves in the upper incisor teeth. This species measures from 6 to 8 inches in length, and the tail some 3 inches more; while its general colour is very similar to that of the brown rat. The animals of this genus are distributed over the whole of Canada and North America west of the Rocky Mountains. In habits they precisely resemble the preceding genus.

The Kangaroo-Rats.

Genus *Dipodomys*.

The kangaroo-rats and their smaller allies the pocket-mice are utterly unlike the pocket-gophers in external appearance, having elongated hind-limbs and tails,



THE COMMON KANGAROO-RAT (½ nat. size).

large eyes, and well-developed ears, while their habits resemble those of the jerboas. They agree, however, with the former in the possession of large external cheek-pouches, and their general internal structure, although their upper incisor teeth are proportionately much narrower, and there are certain peculiarities in the conformation of the skull.

Common Kangaroo-Rats. The kangaroo-rats are characterised by the molar teeth being rootless, and their best known representative is the common species (*Dipodomys phillipsi*) depicted in our illustration, which inhabits the desert regions to the eastward of the Rocky Mountains, and is characterised by the possession of four toes on the hind-feet. The head and body of this animal measure a little over 4 inches in length; while the tail is very long and tufted at the end, and the general build of the creature light and elegant. The colour of

the upper-parts is mouse-brown, becoming tawny on the flanks, while the under-parts, the tip of the tail, and a spot above each eye are white or yellowish. In the Rocky Mountains the place of this species is taken by Ord's kangaroo-rat (*D. ordi*), which is a rather larger and more stoutly built animal, with a relatively shorter tail, and having five toes on each hind foot.

Habits. The habits of the kangaroo-rats are very similar to those of the jerboas, these Rodents frequenting the most arid districts they can find, and living in burrows made beneath rocks or stones. In such districts there is no water, and but little vegetation save gigantic cactuses; and it appears that the food of the kangaroo-rats is formed by the roots, blades, and seeds of the scanty grass that manages to struggle into existence. Probably the only water that these creatures drink is that derived from dew collected on the cactuses. Little or nothing seems to be known of their breeding-habits.

The Pocket-Mice.

Genera *Perognathus* and *Heteromys*.

The tiny little Rodents known in the United States as pocket-mice are distinguished from the kangaroo-rats by the presence of roots to their molar teeth, and also by their inferior size—the whole length of the head and body seldom exceeding 2 inches. The genus *Perognathus*, as represented by the banded pocket-mouse (*P. fasciatus*), of North America, is characterised by the hair being coarse and bristly; whereas in the genus *Heteromys*, of which representatives extend as far southwards as Trinidad, the fur is mingled with a number of flattened spines. Most of these animals are brownish above and white beneath, with a tawny stripe on the flanks dividing the dark from the light area.

CHAPTER XXXIII.

RODENTS,—*continued.*

THE PORCUPINE-LIKE RODENTS.

Families *OCTODONTIDÆ*, *HYSTRICIDÆ*, etc.

The Rodents described in the present chapter, which include the whole of the remaining members of the order, with the exception of the hares, rabbits, and picas, are distinguished from all those described above by the conformation of the lower jaw. In both the squirrel-like and mouse-like groups, the angular, or lower posterior process of the lower jaw, it will be remembered, takes its origin from the inferior edge of the socket of the lower incisor teeth. In the present group, on



SKELETON OF THE CANE-RAT.

the other hand, this process originates from a prominent ridge on the outer side of the jaw; the position of this ridge being shown in the figure of the skeleton of the cane-rat. All the members of the group are further characterised by the stoutness of the zygomatic or cheek-arch of the skull; and also by the bones of the lower leg (tibia and fibula) being perfectly distinct from one another.

The porcupine-like Rodents are very characteristic of America, and more especially of the southern half of that continent. Thus the whole six families into which the group is divided occur in America, while only two of them have any Old World representatives. Of the latter, the porcupine family is almost cosmopolitan; while the *Octodontidæ* are represented in the Old World only in Africa, south of the Sahara. With the exception of one species, these Rodents have one pair of premolar teeth in each jaw.

The Octodont Tribe.

Family *Octodontidæ*.

As there is no collective English name for the various members of this extensive family, we are compelled to adopt a modification of its Latin title. These Rodents are more or less rat-like animals, characterised by having complete collar-bones, and their molars marked by enamel-folds on both sides. In the skull the jugal portion of the cheek-arch nearly always has an angle on its lower edge. The feet, which are armed with long curved claws, generally have five toes. The teats are placed high up on the sides of the body; the ears are short and but thinly haired; while the tail, which varies greatly in length, may be either clothed with short hair, or scaly. With the exception of a few African forms, and others from the West Indies, this family is characteristic of South America.

The Gundi.

Genus *Ctenodactylus*.

One of the most remarkable of the African representatives of the family is the gundi (*Ctenodactylus gundi*) from the regions bordering the Sahara, characterised by the two inner toes of the hind-feet being furnished with a horny comb and bristles, which are employed in cleaning the fur. In size this animal may be compared to a water-vole, with relatively long hind-legs. It has no premolar teeth, the feet have only four toes each, the ears are small, and the tail is reduced to a mere stump. The gundi inhabits rocky districts, and is diurnal; its mode of life being very similar to that of the jerboas.

Pectinator. In Somaliland the gundi is replaced by a closely allied species, known as *Pectinator spekei*, distinguished by its moderately long and bushy tail, and the presence of a small premolar tooth in each jaw.

The Degu.

Genus *Octodon*.

The degu (*O. degus*), which is the typical representative of the family, is a species inhabiting Chili and Peru, and distinguished from the last group by the feet having five toes, without any comb-like appendages, in the hind-limb. The molar teeth are alike in both jaws, and are simply indented on both sides by the folds of enamel. In general form the degu is like a rat, and it is slightly inferior in size to the water-vole; the length of the head and body varying from 7½ to 8 inches, while the tail, exclusive of the tuft at the end, measures about 4 inches. The fur is remarkable for its softness, the ears are of moderate size, and the nearly naked tail terminates in a distinct tuft. The general colour of the fur on the upper-parts is brownish yellow, mottled with black, while the under-parts are yellowish, and the feet white; the tail is dusky above and whitish below, with the hair at the tip blackish.

Habits. The degus are some of the commonest Rodents in Chili, and associate in large companies. They are generally found in hedges or bushes, and in the neighbourhood of towns may frequently be observed running across the high-roads, while they often resort to gardens and orchards, where they commit considerable damage. Their burrows are constructed in hedge-banks or under bushes, and those of the whole colony communicate more or less freely with one another. When disturbed, they scamper off at once to seek refuge in their burrows, with their tails raised over their backs. In many respects they resemble squirrels in their habits, climbing trees with facility, and laying up stores of food for winter use, although, owing to the mildness of the climate of the regions they inhabit, they do not hibernate. Their food usually consists of the various



THE DEGU (⅔ nat. size).

plants growing round their burrows, supplemented in winter by bark. It is believed that two litters are produced annually, each containing five or six young.

Habrocoma. There are other species of *Octodon* inhabiting Chili and Bolivia; and in addition to these the latter country possesses two representatives of the allied genus *Habrocoma*, so named from the extreme softness of the fur, which approaches that of the chinchilla. The habrocomas are about the size of an ordinary rat, and distinguished by their larger ears, the absence of a tuft to the tail, and by the lower molar teeth being more complex than the upper ones. Another allied Rodent from the Southern Andes, known as *Aconæmys*, is distinguished by the enamel-folds of the molars meeting in the middle line. The regions where these animals are found are buried in snow for several months of the year.

The Tucotucos.

Genus *Ctenomys.*

The tucotucos, of which there are several South American species, are characterised by their adaptation for a subterranean life. They have small and almost rudimental ears, small eyes, and short tails. Their incisor teeth are extremely broad; and their molars are rootless, with kidney-shaped crowns. On the fore-feet the curved claws are longer than the toes; while the hind-toes are furnished with a number of bristles. The species of tucotuco vary in length from 8 to 12 inches, exclusive of the tail, which is about one-fourth as long again; and the general colour of the soft fur is greyish, while the incisor teeth are red.



THE MAGELLANIC TUCOTUCO (½ nat. size).

Distribution and Habits. There are four species of these animals, ranging from Brazil and Bolivia to the Straits of Magellan; our figured example being the Magellanic species (*Ctenomys magellanica*). The name tucotuco is derived from the peculiar cry of these animals, which, from their subterranean habits, are also termed oculto. In many districts, especially where the soil is sandy, these Rodents are found in large numbers; whole tracts being frequently undermined by their long and shallow burrows, of which the course is indicated by lines of hillocks. They are nocturnal in their habits, feeding mainly upon the roots of plants, of which they are saved to lay up a store. Mr. W. H. Hudson writes that on the Argentine pampas wherever there is a stretch of sandy soil, or a range of sandhills, the tucotuco is to be found; "not seen, but heard; for all day long and all night sounds its voice, resonant and loud, like a succession of blows from a hammer; as

if a company of gnomes were toiling far down underfoot, beating on their anvils, first with strong measured strokes, then with lighter and faster, and with a swing and rhythm as if the little men were beating in time to some rude chant unheard above the surface." The tucotucos seem to be somewhat gregarious in their habits, as several may be often taken from a single burrow.

Cururo. Chili is the home of two species of Rodents known as cururo (*Spalacopus*), nearly allied to the last, but distinguished by their rudimental ears. Somewhat curiously, another nearly related form (*Petromys typicus*) is found in South Africa, which differs from its American cousins by the harshness of its fur, the shortness of the thumb, the rather bushy tail, and the partially rooted molar teeth.

The Coypu.

Genus *Myopotamus*.

Widely different in its habits from the tucotuco is the coypu (*Myopotamus coypu*) of South America, which is one of the largest members of the order,



THE COYPU (¼ nat. size).

attaining a length of from 20 inches to 2 feet, exclusive of the tail. It belongs to a group of several genera distinguished from the preceding American examples by the very harsh nature of the fur, and depth of the folds of enamel in the half-rooted or rootless molars. The coypu itself is characterised by the very large size of its incisor teeth; and by the upper molars having two folds of enamel on each side, while in those of the lower jaw there are one external and three internal folds. The molars are partially rooted, and the last one is larger than either of the others. The ears are of moderate size; and the tail, which is scaly, with a thin coating of short hairs, is about two-thirds the length of the head and body. Each of the feet

has five toes, which in the hind-limb are connected by webs. The fur of the coypu is long, but beneath there is a dense and soft under-fur. The colour of the upper-parts is a mixture of dusky and brownish yellow, the sides and under-parts being pure brownish yellow, the tip of the muzzle and chin white, the feet dusky brown, and a patch below each ear yellow.

Distribution. The coypu is found in the rivers and lakes of South America, on both sides of the Andes, from Chili and Peru to about the 48th parallel of south latitude. In the Chonos Archipelago, according to Darwin, coypu are found exclusively in the channels and bays separating the various small islands.

Habits. In general appearance and habits the coypu is not unlike a beaver, being thoroughly aquatic, and making its burrow in the banks of the rivers and lakes it frequents. When, however, the banks are not sufficiently high to allow of this, a platform-like nest is constructed among the reeds. The burrow is generally three or four feet in depth, and expands at the end into a chamber of some two feet in diameter. They are generally found in pairs, but in Argentina the writer has seen them coming out in large parties in the evenings to swim and sport in the water. Here they utter peculiarly mournful cries; the females, at the proper season, being each accompanied by some eight or nine offspring, which endeavour to obtain a seat on their parent's back, those that are unable to attain this position of security swimming behind. Although a first-rate swimmer, the coypu is said not to be an adept at diving; and its movements on land are always awkward and ungainly. These animals usually select for their haunts the stillest parts of the rivers, lakes, or ponds; and their food consists of the foliage, seeds, and roots of the water-plants growing hard by. In the Chonos Archipelago, where they make their burrows in the forest at some distance from the shore, they are said, however, to subsist partly on molluscs.

In Argentina Mr. Hudson states that at one time the coypu became very scarce owing to the numbers killed for their fur. An enactment was then passed forbidding the killing of these animals; the result being that they "increased and multiplied exceedingly, and, abandoning their aquatic habits, they became terrestrial and migratory, and swarmed everywhere in search of food. Suddenly a mysterious malady fell on them, from which they quickly perished and became almost extinct." The under-fur of the coypu is an important article of commerce, the average number of skins annually collected varying from three hundred thousand to five hundred thousand. In Argentina the coypu is universally known as the nutria, which is properly the Spanish name for the otter; the same term being applied in commerce to the fur.

The Hutias.

Genus *Capromys*.

The large Rodent known as the hutia-couga (*C. pilorides*), is one of a group of four or five species confined to the West Indian Islands, where they appear to be the only indigenous members of the order. They are all allied to the coypu, from which they are distinguished by their arboreal habits and more rat-like appearance,

as well as by certain structural peculiarities. Thus the incisor teeth are narrower than in the latter, while the upper molars are characterised by one fold of enamel on the inner side, and two on the outer side. The ear is relatively small, and the tail generally of considerable length, thick, and sparsely haired. The hutia-couga, which is the species represented in our figure, is confined to Cuba, and is somewhat smaller than the coypu, the length of the head and body being about 22 inches. The fur is very long and coarse, its general colour being a mixture of yellowish grey and brown, becoming reddish brown on the back and loins, while beneath it is dusky brownish grey, with a more or less marked yellow tinge. The paws are black, the



THE HUTIA-COUGA (⅓ nat. size).

ears dark, and the chest and a streak down the middle of the belly grey. Internally this species is remarkable in that the liver is split up into a number of small lobules. Another Cuban species is the hutia-carabali (*C. prehensilis*), distinguished, among other characters, by the tip of the tail being prehensile. In Jamaica there is the short-tailed hutia (*C. brachyurus*), while in the Bahamas the genus is represented by Ingraham's hutia (*C. ingrahami*).

Habits. The hutia-couga inhabits dense forests, and is an expert climber, ascending trees both to avoid pursuit and in search of food. It subsists mainly on fruits, leaves, and bark; but it also eats the flesh of small animals, particularly that of a kind of lizard. This species can be easily tamed; and its flesh is considered a delicacy by the natives of Cuba, who either hunt the creature with dogs, or capture it by means of snares. The smaller hutia-carabali is said to confine itself to the most remote districts of the forests, and to frequent the top-

most branches of the trees. It is more shy and less easily tamed than the first species; and, like the latter, fights fiercely in self-defence when attacked. In one of the species, at least, there are but four teats in the female, from which it may be inferred that the number of young in a litter is small. The nipples, as in the coypu, are situated high up on the sides of the body; and this seems to disprove the suggestion that in the latter animal they are thus situated in order that the young may be able to suckle while the parent is in the water. In Hayti and Jamaica the hutias are also represented by a nearly allied rodent known as *Plagiodon œdium*, distinguished by the extreme complexity of the enamel-folds of the molar teeth, which in the upper jaw form a kind of zigzag pattern.

Cane-Rat.

Africa possesses a single representative of this group of the family, known as the cane-rat (*Aulacodus swinderianus*), which is a large species of burrowing habits, easily recognised by three deep grooves on each of



THE CANE-RAT (¼ nat. size).

its broad red upper incisor teeth; these grooves giving the name to the genus of which this animal is the only representative. The molar teeth resemble those of the hutias. The cane-rat attains a length of about 21 inches to the root of the tail; the tail measuring from 5½ to 8½ inches. Its general appearance is rat-like, with the fur very coarse, and the tail but sparsely haired. In the fore-feet the thumb is rudimentary and the fifth toe small; while in the hind-foot the first toe is entirely wanting. The general colour of the fur is brown, richer in tint on the back than on the flanks; the chin and upper lip being whitish, while the throat is a dirty yellow, and the under-parts pale brownish yellow. The feet are pencilled with black and yellow. A full-grown male will weigh as much as 9 or 10 lbs.

The cane-rat has an extensive distribution in Africa, ranging from the Upper Nile (where it is represented by a variety with partially-webbed hind-feet) through Eastern and Central Africa to the Cape; while on the western side it ranges as far north as Guinea. In Guinea it is known to the natives as the yumba, while in South-Eastern Africa it is termed the ivondue. In Sierra Leone it is said to feed chiefly upon ground-nuts and roots, in search of which it digs in the soil, while it also forms burrows for its residence. In South-Eastern Africa the habits of these rodents appear to be somewhat different. For instance, Mr. W. H. Drummond states that cane-rats "do not form burrows of their own; but when forced out of the thick tangle of overgrown grass or reeds in which they lie, a task by no means easy of accomplishment, they take refuge in any hole or crevice among rocks or stones, or in the deserted burrows of the ant-eater or porcupine. They are not only destructive to a degree among sugar-cane, gnawing down stem after stem, but most difficult to extirpate. In spots such as these, they live in what fields happen to be lying fallow, which, being covered with an impenetrable thicket of grass and weeds, offer them a secure retreat from which they can nightly issue forth into the canes." The cane-rat is largely hunted by the natives, and in some cases by Europeans, for the sake of its flesh. Schweinfurth remarks that its flesh "is excellent when roasted; it is rich, and without being sweet and insipid like that of the hyrax, it is free from any unpleasant flavour. In quality it is about equal to poultry, whilst in taste it may be described as being intermediate between pork and veal."

Other Genera. There are numerous other South American representatives of the Octodonts. These are mostly smaller rat-like forms than the preceding, with long cylindrical tails; many of them being remarkable for the intermixture of flattened lance-like spines with the fur. Some of the best known genera are *Loncheres* and *Echinomys*, and these are mostly characterised by the possession of the above-mentioned spines. The majority of the species of these two genera inhabit Guiana and Brazil, but one species of *Echinomys* ranges into Central America. Most of them are brown above and white beneath, but in some cases the white extends on to the flanks, shoulders, and head, thus giving them somewhat the appearance of long-tailed guinea-pigs. A third genus, *Carterodon*, of which there is but one Brazilian species, is distinguished by a longitudinal groove on each upper incisor.

The Porcupines.

Family *Hystricidæ*.

The well-known porcupines, which have the widest geographical distribution of any family of this section of the order, are distinguished from their allies by the presence of a number of large quill-like spines in the skin. Their build is stout and massive; and the fore and hind-limbs are of subequal length. In the skull, the region of the face is comparatively short and broad; while the cheek or jugal bone in the zygomatic arch is devoid of the angle on its lower edge, distinctive of most of the members of the preceding family. The molar teeth are partly or completely rooted with folds of enamel on each side. Porcupines derive their

name from the French *porc-épin* (spiny-pig), probably in allusion to their grunting pig-like cries. They are common to both the Old and New Worlds; although the representatives of the group found in the two hemispheres constitute two distinct subfamilies.

Canadian Porcupine.

The common Canadian porcupine (*Erethizon dorsatus*) belongs to a group confined to America, all the members of which are arboreal in their habits, while most of them have prehensile tails. They are all characterised by the absence of a cleft in the upper lip, by the naked soles of the feet being covered by a number of tubercles, by the want of the first toe in the fore-foot, and the presence of only three teats in the female. Their molar teeth have complete roots; and the collar-bones are fully developed. *E. dorsatus* differs from its allies in having a short and nonprehensile tail; and also in the presence of five toes in the hind-feet. It is a heavy and clumsily-built animal, with long brown hair, almost or completely concealing the short spines, which are white with brownish tips. The length of the creature is about 2 feet, and its weight from 15 to 20 lbs. The limbs, neck, ears, and muzzle are short; the ears being almost concealed by the long bristly hair at the sides of the head. The claws are very long and powerful; and the tail massive and almost four-sided in shape. The stout spines vary in length from less than one inch to more than four inches in different parts of the body; they cling loosely to the skin, and are thus easily detached, and as they are slightly barbed at the points they make their way completely through the flesh of any animal in which they may become fixed. As in other members of the family, the quills, when the animal is in repose, lie smoothly and are directed backwards; but under the influence of excitement they can be erected by the aid of a sheet of muscle underlying the skin. The Canadian porcupine extends in the country from which it takes its name as far northwards as the limit of trees, while in the United States it extends on the eastern side as far south as Virginia, and on the western coast from Alaska to Arizona and New Mexico. Despite its heavy form and nonprehensile tail, it is an adept at climbing, and spends the greater part of its time among the branches of trees. Dr. Hart Merriam states that although largely nocturnal, these animals may at times be seen abroad during daylight. Their lair is usually made among the clefts of rocks, but sometimes in a hollow tree or heap of bushes. Even in the cold climate of the Adirondacks, this porcupine, although less active in winter, never hibernates. Dr. Merriam writes that when one of these animals "has selected and settled himself in a tree to his liking, he may not leave it, day or night, until he has denuded it of the whole of its foliage. I have seen many hemlocks thus completely stripped, not a green twig remaining, even on the smallest bough. It seems incredible that so large and clumsy an animal



SKELETON OF PORCUPINE.

should be able to climb out far enough on the branches of trees to reach the terminal leaves; but he distributes his weight by bringing several branches together, and then, with his powerful paws, bends back their ends and passes them through his mouth. When high in the tree-tops he is often passed unnoticed, mistaken, if seen at all, for the nest of a crow or a hawk."

The food of this animal consists not only of the leaves of various trees—especially the hemlock-spruce—but likewise of their twigs and bark; while beech-mast is also a favourite article of its diet. The pods of water-lilies are also eaten; while a partiality for salt is very marked. The nest is constructed in the same situations as the sleeping lair. The young in the Adirondack region are born early in May, and are usually one or two in number. At birth, according to Dr.



THE CANADIAN PORCUPINE ($\frac{1}{6}$ nat. size).

Merriam, they are very large for the size of the animal, being actually larger, and proportionately more than thirty times the size of the cubs of the black bear. This porcupine uses its tail as a weapon of offence, inflicting severe blows by its lateral action. Few animals care to attack the porcupine, although, as previously mentioned, both the puma and fisher-marten make these animals their prey, and are frequently found with their flesh bristling with quills.

Tree-Porcupines. The tree-porcupines are distinguished from the Canadian porcupine by their long prehensile tails, and the presence of only four toes on the hind-feet. They are also of lighter build; and their spines are short, closely set, and parti-coloured, sometimes almost concealed by long hairs. In the absence of the first toe, the inner side of each hind-foot is furnished with a large fleshy lobe which can be bent inwards to a certain degree, and forms an efficient aid in climbing; more especially as the whole foot is set so obliquely on the leg that the rough sole is directed somewhat outwardly. The tail is thick at the

base, but slender at the end, where its upper surface is devoid of hair. It is this upper surface which is applied to the branch, and the tail is, therefore, coiled in the reverse direction to that of the spider-monkeys, as shown in our illustration. The muzzle is thick, and obliquely truncated, so that the upper lip somewhat overhangs the lower portion, with large nostrils; the whole being clothed with fine velvety hair. Both the ears and eyes are small. The quills have numerous exceedingly minute spines at their extremities, with their points directed backwards, so as to act as barbs.

Brazilian Tree-Porcupine. The Brazilian tree-porcupine (*S. prehensilis*), which is the species commonly seen in menageries, is found in Brazil, Guiana, and part of Bolivia, and has the spines projecting freely above the fur. In length the head and body measure from 16 to 18 inches; the tail being about an inch shorter.



BRAZILIAN TREE-PORCUPINE (⅓ nat. size).

These animals, like the other species of the genus, are usually solitary, passing the greater part of the day in slumber, and feeding in the morning and evening. Their food consists of the leaves, young shoots, and bark of the trees on which they dwell. In climbing it is said that they ascend the trunks of trees by the feet alone, the tail being employed only when among the smaller branches, which these animals but seldom leave. When sleeping, they generally rest in the fork of a branch. Comparatively little is known of their habits in a wild state; but in captivity they are harmless, stupid creatures. Their flesh is eaten by the natives of Brazil, by whom they are known by the name of cuandu.

Mexican Tree-Porcupine. The Mexican tree-porcupine (*Synetheres novæhispaniæ*), belongs to a group which has the hair so long as almost to conceal the spines. It is distinguished by the nearly uniform black colour of the fur, and also by the presence of numerous spiny bristles mingled with the hair of the lower parts of the body. These bristles arise in small clusters from tubercles, and being white for

the greater part of their length form star-like spots among the dark fur. These bristles and the spines on the back are black at the tips.

This species inhabits the forests on the eastern coasts of Mexico. Nothing special is recorded of its habits; but it may be mentioned that from observations made on captive individuals of other species, it is probable that none of the tree-porcupines ever drink. It is stated that in those long-haired species in which the fur is of a greyish tint, the general appearance of the animal when reposing on the arm of a tree closely simulates a gnarled and lichen-clad knot.



MEXICAN TREE-PORCUPINE (⅛ nat. size).

Thin-Spined Porcupine. A peculiar porcupine (*Chætomys subspinosus*), from Central and Northern Brazil, differs from all the members of the preceding genus by the shape of its skull and the more complicated structure of its molar teeth, as well as by the slenderness of its spines, which may be described as half-way between those of the other groups and mere bristles. It is a large species, of a dull brown colour, with the under-parts inclining to rufous, and the feet and tail brownish black. The tail, although long, is not prehensile; and the habits of the animal are less completely arboreal than those of the preceding group. Remains of a species of *Erethizon* occur in the superficial deposits of Pennsylvania, and those of *Synetheres* in the caverns of Brazil.

True Porcupines. With the true porcupines, as typically represented by the common South European species (*Hystrix cristata*), we come to the second subfamily, all the members of which are confined to the Old World, and differ from their Transatlantic cousins by the following characteristics. Externally the soles of the feet are perfectly smooth, the fore-feet have a small thumb, and the female is provided with six teats. In the skeleton, the collar-bones are incomplete; and the molar teeth have imperfect roots. In habits all

these porcupines are purely nocturnal and terrestrial; consequently, the tail is never prehensile.

Common Porcupine. The common porcupine, of which a group is represented in our coloured Plate, and a single individual in the accompanying woodcut, is the best known member of the first of these genera. As is the case with the other species of the genus, it is characterised by its massive form, its large size, the great length of the quills on the body, and by the short spiny tail terminating in a cluster of short slender-stalked quills, which are hollow and open at their extremities; these tail-quills making the peculiar rattling noise noticeable when a porcupine is in motion. The genus is further characterised by the great elevation and convexity of the skull, in which the chamber of the nose is frequently more capacious than the brain-case.



COMMON PORCUPINE.

Next to the beaver, the porcupines are the largest of the Old World Rodents, the common species measuring from 26 to 28 inches in length, exclusive of the tail. The prevailing colour of this species is brownish black, with a white band crossing the front of the neck, and about half-way up the sides, when it becomes gradually narrow. The neck is furnished with a crest of long bristles, which are mostly brown at the base and white above. The quills on the body are of two kinds—the one distinguished by their great length, slenderness, and flexibility, while the others are shorter and stouter, and are mostly concealed by the longer ones. These quills are mostly marked with broad rings of black and white; both extremities being of the latter hue. Those on the rump are, however, chiefly black; while the open quills at the end of the tail, as well as most of those clothing the rest of that appendage, are entirely white. This porcupine inhabits Southern Europe and Northern and Western Africa.

Other Species. In India the common species is replaced by the closely allied hairy-nosed porcupine (*H. leucura*), distinguished by the muzzle being densely clad with hairs, as well as by the quills at the base of the tail, and sometimes a row in the middle of the hinder part of the back, being mostly white. The skull, moreover, is less convex, with smaller nasal bones. This species is found from Ceylon to Kashmir, and appears to extend westwards as far as the Black Sea. Two other species inhabit India; of which the Bengal porcupine (*H. bengalensis*) has a much shorter crest on the neck, while in Hodgson's porcupine this crest is totally wanting. The latter occurs in the Eastern Himalaya, and is represented by allied forms in Borneo and the Malayan region. The South African porcupine (*H. africæ-australis*) is a third representative of the crested group. Fossil porcupines occur in the Pliocene rocks of Northern India, and also in the upper and middle Tertiaries of Europe.

Habits.

As the habits of all the true porcupines appear to be very similar, they may be treated collectively. In the first place, it should be mentioned that the old idea of porcupines being able to eject their quills at an enemy is a pure fable. Although a belated individual may occasionally be seen making its way homeward in the early morning, porcupines remain concealed during the daylight hours, either in caves or clefts of rocks, or in burrows excavated by themselves. They generally prefer rocky hills, and although in Europe they are usually found either solitary or in pairs, in India they are frequently gregarious. Their food is entirely vegetable, and consists mainly of roots, although in cultivated districts they do much damage to crops, garden vegetables, and such fruit as they can reach. In Europe the pairing-season takes place early in the year; and in the spring or commencement of the summer the female produces from two to four young, in a nest



AFRICAN BRUSH-TAILED PORCUPINE (⅛ nat. size).

formed of leaves, grass, and root-fibres. The young are born in an advanced state, having their eyes open, and their bodies covered with soft flexible spines, which soon harden by exposure to the air. When frightened or irritated, porcupines erect their quills, with a peculiar rattling of the hollow ones at the tip of the tail, at the same time stamping with their hind-feet. If attacked by dogs or other four-footed foes, they rush backwards and inflict severe wounds with the long quills on their hind-quarters, which are sometimes driven deeply into the flesh of their antagonists. Dogs, according to Dr. Jerdon, readily follow the scent of porcupines, and thus track them to their lairs. Leopards are said to despatch them easily by a single well-directed blow on the head. From the large size of their teeth and jaws, porcupines have great gnawing powers; and the writer has seen in India tusks of elephants which have been half-eaten by these animals as they lay in the jungles. The flesh of porcupines is excellent eating, and is said to resemble something between pork and veal in flavour.

Brush-Tailed Porcupines. The brush-tailed porcupines, of which one species (*Atherura africana*) inhabits Western and Central Africa, and the other (*A. macrura*) Burma and the Malayan region, are much smaller and more rat-like animals than the true porcupines, from which they are distinguished at a glance by their long and scaly tails terminating in a tuft of bristles. The body is covered with flattened and grooved spines, which are not much longer on the hind-quarters than on the back and shoulders. In the Indian species the length of the head and body may reach as much as 22 inches; that of the tail being about 10 inches. In colour this species is dark brown, with the tips of the spines sometimes paler. The longer spines on the hind-quarters are mostly white; the under-parts, and the bristles at the end of the tail, are whitish.

Gunther's Porcupine. A rare porcupine from Borneo (*Trichys guentheri*) differs so markedly from the preceding in the characters of its skull, that it is regarded as indicating a third genus of the subfamily. It is distinguished externally from the brush-tailed porcupines by its shorter spines, and the narrow parallel-sided bristles of the tail.

Chinchillas and Viscachas.

Family *Chinchillidæ*.

The remaining porcupine-like Rodents are confined to South and Central America and the West Indies. Those included in the present family are few in number, and are characterised by their terrestrial habits, elongated hind-limbs, long bushy tails, and extremely soft fur. Internally they have complete clavicles; their molar teeth are divided into a series of parallel transverse plates by the extension of the folds of enamel completely across their crowns; and the incisors are remarkable for their shortness. In the skull the palate is very narrow in front, while behind it remains unossified for a considerable distance in advance of the last molar teeth.

Chinchillas. The chinchillas are characterised by having four toes on the hind-feet, and five on the fore-feet, by the length of the bushy tail, and also by the enormous size of the bullæ of the internal ear on the base of the skull, which are so much enlarged as to appear on the sides of its upper surface.

Common Chinchilla. The common chinchilla (*Chinchilla lanigera*) is a squirrel-like Rodent, with very large ears, and a tail about half the length of the head and body; the latter measuring 10 inches. The fur, which is about an inch in length, is of extreme softness, and of a delicate pearly grey, mottled with black above, and yellowish white beneath; while the tail is mostly black, with lighter bands on the sides. The front surfaces of the incisor teeth are of a bright orange.

This species inhabits the higher Andes, from the south of Chili to the north of Bolivia; and in certain districts is very abundant. Chinchillas live in burrows, where they associate in large companies, and may frequently be seen abroad during the daytime, keeping, however, to the shade thrown by the rocks. On the ground they run much after the fashion of mice, but when feeding they sit up on their hind-quarters in a squirrel-like manner, and grasp their food between the fore-paws.

The regions which these animals inhabit are lonely and barren, with but very small amount of vegetation. In such places there are numerous perpendicular faces of rock, up and down which these tiny creatures dart with such lightning-like rapidity as to render it almost impossible for the eye to follow them. Although by no means shy, the report of a gun is sufficient to send them at once to their holes; and a spot which at one moment may be seen covered with hundreds of these creatures, will be left deserted in an instant. The natives hunt them with the aid of a species of weasel, which enters their burrows. From its peculiar softness and delicacy, the fur has long been highly appreciated in Europe, where large quantities are annually imported.



THE CHINCHILLA (¼ nat. size).

Short-Tailed Chinchilla. The short-tailed chinchilla (*C. brevicaudata*), from Peru, is an animal very little known to naturalists, some of whom have even doubted its right to rank as a distinct species. It is, however, decidedly larger than the common chinchilla, with relatively shorter ears and tail. The general colour of the fur of the upper-parts is a very pale bluish grey, mottled with slaty black; the under-surface of the body, as well as the feet, being white. The tail gradually becomes bushy towards the tip; its fur being a mixture of greyish white and greyish black, becoming darker towards the tip on the upper-surface.

Cuvier's Chinchilla. This (*Lagidium cuvieri*) is considerably larger than either of the preceding, the length of the head and body varying from about 16 to 20 inches, and that of the tail, exclusive of the hair at the tip,

from 11 to 12 inches; and since it differs by having only four toes on each foot, it is considered to represent a distinct genus. The ears, moreover, are longer and more pointed; while in the skull the bullæ of the internal ear are relatively smaller. The general hue of the long and soft fur is ashy grey, tinged with yellow and pencilled with black; while on the under-parts it is pale yellow, gradually becoming deeper in hue on the flanks. The feet are grey; while the tail is black below, with very long hairs above, some of which are also of the same jetty tint. One of the most remarkable features about the animal is the length of the black whiskers, in which some of the hairs may measure seven inches. This species is also an inhabitant of the higher Andes of Chili,



THE SHORT-TAILED CHINCHILLA (⅛ nat. size).

Peru, and Bolivia, ranging to elevations of some sixteen thousand feet above the sea-level. In habits these animals seem to be almost identical with the true chinchillas, dwelling in barren rocky districts, and exhibiting the same marvellous activity. Their food is composed of grass, roots, and moss, to procure which they have frequently to travel long distances from their homes. Their principal enemies are the condor, and the dogs of the shepherds. They are captured by the Indians in snares for the sake of their fur, which is, however, far less valuable than that of the chinchilla.

Viscacha.

The third generic modification of the present family, which is represented only by the viscacha (*Lagostomus trichodactylus*), differs from its cousins in being an inhabitant of the open pampas, ranging from the Rio Negro to the Uruguay River, instead of the heights of the Andes. These animals

are primarily distinguished from the last by the toes of the hind-feet being reduced to three in number; while the claws on these feet, and to a less degree those of the fore-feet also, are relatively longer. The cheek-teeth, with the exception of the last in the upper jaw, are also distinguished by having only two transverse plates of enamel, and their squarer form.

In its stoutly-built body and sturdy limbs the viscacha, as remarked by the late Mr. G. R. Waterhouse, presents a contrast to the delicately-formed chinchillas exactly similar to that existing between the squirrels and the marmots; this



CUVIER'S CHINCHILLA (¼ nat. size).

difference in form being accompanied by a precisely similar difference in habits, the viscachas being purely burrowing rodents.

In the viscacha the length of the head and body varies from some 19 to 23 inches; that of the tail being about a third as much again. The ears are rather small, and distinctly notched behind, the tail is bushy throughout the greater part of its length, and the fur is rather short. The colouring of the fur is somewhat striking. Above, the general hue is grey, with some dusky mottlings and black markings; while the whole of the under-parts are white or yellowish white. From the muzzle a blackish band extends across each cheek; above which is a broad white stripe terminating in front of the eyes, while a third narrower dusky band crosses the lower part of the forehead. The tail is blackish brown.

Habits. The viscacha is by far the most common rodent on the Argentine pampas; and an excellent account of its habits is given by Mr. W. H. Hudson, from which the following summary is compiled. These animals live in societies usually numbering from twenty to thirty individuals; they form warrens known as *viscachera*, each of which may contain from twelve to fifteen burrows, some of them being double or triple. Such a viscachera will cover from one to two hundred square feet of ground. The burrows vary much in extent; some opening out into wide chambers, from which other tunnels radiate; while others communicate with their neighbours. The whole viscachera forms a raised mound of earth which has been brought up from the burrows. It is always formed on the open plains; and the entrances to some of the compound burrows



THE VISCACHA (¼ nat. size).

are sometimes as much as a yard in diameter. Usually the burrow takes the form of the letter Y. A passerine bird (*Geositta*) belonging to the wood-hewer family, makes its breeding-holes in the sides of the viscacha-burrows; while when deserted by their rightful owners they are occupied by a kind of swallow (*Atticora*). Moreover, on the mound of the viscachera may frequently be observed a pair of burrowing owls (*Speotito*), which generally excavate a domicile for themselves, but sometimes occupy one of the burrows on the flanks of the mound. The whole of the ground in the neighbourhood of the burrows is carefully cleaned from all vegetation, the refuse of which is heaped up near the entrance; and it is this habit which renders these animals so obnoxious to the farmer. Their usual food is grass and seeds, but they sometimes also eat roots; while in the dry season they are reduced to withered grass and thistles. When the herbage is green the viscachas require no water; but the first shower in the dry season brings them at once out of their holes to imbibe the much-needed fluid.

Viscachas are essentially nocturnal. Mr. Hudson states that in winter they "seldom leave their burrows till dark, but in summer come out before sunset; and the viscachera is then a truly interesting spectacle. Usually one of the old males first appears, and sits on some prominent place on the mound, apparently in no haste to begin his evening meal. When approached from the front he stirs not, but eyes the intruder with a bold indifferent stare. If the person passes to one side, he deigns not to turn his head. Other viscachas soon begin to appear, each one quietly taking up his station at his burrow's mouth, the females, known by their greatly inferior size and lighter grey colour, sitting upright on their haunches, as if to command a better view, and indicating by divers sounds and gestures that fear and curiosity struggle in them for the mastery. With eyes



A VISCACHERA.

fixed on the intruder, at intervals they dodge the head, emitting at the same time an internal note with great vehemence; and suddenly, as the danger comes nearer, they plunge simultaneously, with a startled cry, into their burrows." When driven to the recesses of their burrows they utter a peculiar kind of growling sound.

The viscacha is a far from prolific animal, the female producing in September a single litter, which usually contains two, but occasionally three young. As the animal takes about two years in reaching maturity, the vast numbers in which it existed on the pampas, previous to a war of extermination waged against it by the agriculturists, is not a little remarkable.

The habit of accumulating the remains of its food around the entrance of its

burrow has been already mentioned; but, in addition, the viscacha collects every hard object with which it meets. Darwin writes that "around each group of holes many bones of cattle, stones, thistle-stalks, hard clumps of earth, etc., are collected into a heap, which frequently amounts to as much as a wheelbarrow would contain. I was credibly informed that a gentleman, when riding one dark night, dropped his watch; he returned in the morning, and by searching in the neighbourhood of every viscacha-hole on the line of road, as he expected, soon found it.

Fossil Forms. Remains belonging to the same genus as the viscacha are met with in the superficial deposits of South America; while in the older formations there occur those of allied extinct genera. One of these extinct rodents (*Megamys*) was the largest member of the order; its size approaching that of an ox.

The Agutis and Pacas.

Family *Dasyproctidæ*.

The South American Rodents, respectively known by the names of aguti and paca, constitute a small family with the following characteristics. The limbs are of nearly equal lengths, and furnished with hoof-like claws; the tail is short or wanting; the molar teeth have imperfect roots, and enamel-folds on both sides of the crowns; and the incisor teeth are long. In the skeleton the collar-bones are rudimentary, the palate is broad, and the lower jaw lacks the distinct ridge on the outer side characteristic of the preceding families.

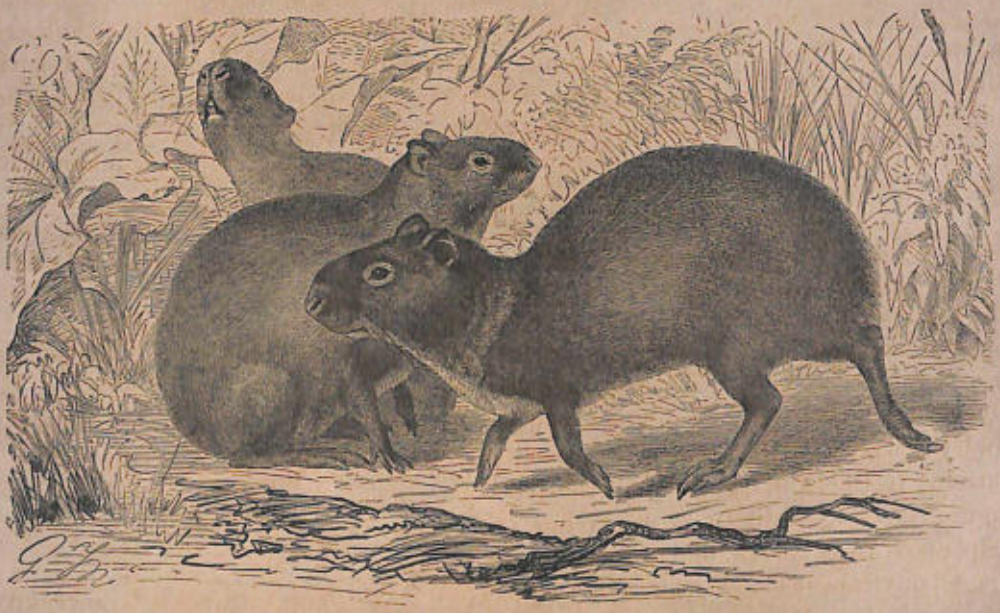


SKELETON AND SKULL OF AGUTI.

Agutis. The agutis are elegantly-formed Rodents, with a superficial resemblance to the chevrotains among the Ungulates; and are characterised by their long and slender limbs, and the presence of only three toes on the hind-feet; the fore-feet, however, having the full number of digits. The hair is coarse, more especially on the hind-quarters, where it becomes longer than elsewhere. The crowns of the molar teeth are rounded; and when worn exhibit a single lateral fold of enamel, with several islands of the same on their summits. There are several species of aguti inhabiting the greater part of Central and South America as far as Paraguay; and there is one species in the West Indies. The common aguti (*Dasyprocta aguti*) may be taken as the chief example of the genus, all the members of which are very similar to one another in form and habits. This species, which occurs abundantly in the dense forests of Guiana, Brazil, and Northern Peru, attains a length of from 18 to 20 inches, and is of general olive-brown colour. The middle line of the under surface of the body is, however, yellow or whitish; while the long hairs of the hind-quarters are mostly of a bright orange tint. The feet are pencilled with black and

yellow, and the toes dusky. The large ears are pinkish, except on their margins; and the small fleshy tail is naked, and of a dusky hue.

Although essentially forest-dwelling animals, agutis are sometimes seen in the early morning or evening on the open spaces. They are mainly nocturnal, remaining concealed during the day in hollow trees or in cavities or burrows among their roots; such burrows, according to Bates, being in some cases two or three feet in depth. Their movements are extremely active and graceful. When going slowly they advance at a kind of trot; but when running their pace takes the form of a series of rapid springs, which succeed each other so quickly as to give the appearance of a gallop. Cutias, as these animals are called on the Amazons, can swim well, but are unable to dive. Their food consists of the



THE COMMON AGUTI (¼ nat. size).

foliage and roots of ferns and other plants, as well as fallen fruits; their sharp incisor teeth enabling them to perforate the shells of the hardest nuts. In cultivated districts they do much harm to plantations of sugar-cane and plantains. Of their reproduction in a wild state but comparatively little is known. They breed, however, at least twice in the year,—generally once in May, before the commencement of the period of drought, and again in October, at the setting in of the rainy season. In captivity, where these animals not unfrequently breed, there are usually only one or two at a birth; but in a wild state it is quite probable that the number may be greater. For a considerable portion of the year the two sexes remain apart; but at the pairing-season each male selects a female, which he follows with squeaks and grunts, and with whom he remains until after the birth of their offspring. The female brings forth her young in a lair or nest carefully formed of leaves, roots, and hair; and attends them sedulously for some weeks, preventing the male from having any access to them

until some days after birth. When first born the young closely resemble their parents. If captured at a sufficiently early age, agutis can be readily tamed; and it is not uncommon in South American houses to find one or more of these animals roaming at large. The nocturnal foes of the aguti are the ocelot and other species of cats, and also the Brazilian wolf. They are much hunted by the natives for the sake of their flesh. Bates writes that on the Amazons they are hunted with dogs; the method being for one hunter to proceed in the early morning to beat the forest in the neighbourhood of a river, while his companion takes his station in a boat. On being hard pressed by the dogs, the agutis at once make for the water, where they are shot by the man in waiting.

Aguchi. The only other member of the genus to which we shall allude is the aguchi (*D. cristata*), which inhabits Northern Brazil and Guiana as well as parts of the West Indies. This species is distinguished from the others by its smaller size, and its longer and more slender tail, which is clothed with silver-white hairs. Its general colour is rich chestnut-brown, with a characteristic bright golden yellow, or rust-coloured patch behind each ear.

It may be added that fossilised remains of agutis are met with abundantly in the caverns of Lagoa Santa, in Brazil.

Pacas. The Rodent known in South America by the title of paca (*Cœlogenys paca*) is readily distinguished externally from all its allies by the longitudinal rows of light spots ornamenting its fur; while internally it is remarkable for the extraordinary structure of its skull. Its hind-feet are distinguished from those of the agutis by having five distinct toes; and the limbs are much shorter and the whole build far more massive than in the latter. In the skull, as shown in the accompanying figure, the zygomatic or cheek-arches are greatly expanded from above downwards, so as to form huge bony capsules on the sides of the face, each of which encloses a large cavity communicating by a narrow aperture with the mouth. Externally the paca is stout-bodied, measuring about 2 feet in length, with rather short limbs, and a broad head, terminating in a blunted muzzle covered with fine hair. The ears are rather small, and but scantily clothed with hair; the feet are naked below; and the tail is reduced to a fleshy tubercle. The fur is coarse, and closely applied to the body. Its general colour varies from fawn to blackish; and the number of longitudinal rows of spots is likewise variable, being in some instances only three, while in others there may be five such rows. The female has two pairs of teats, placed at a considerable distance apart.



SKULL OF PACA.

The common paca has a very extensive range, being found throughout the greater part of South America as far as Paraguay. In Brazil it is fairly common, but it is much scarcer in Paraguay, while in Peru it is rare. It occurs in Tobago and Trinidad, but is unknown to the westward of the Andes. In the highlands of Ecuador, at elevations of from six thousand to ten thousand feet, it is represented by Taczanowski's paca (*C. taczanowskii*), distinguished by its inferior size, and the difference in the form of the skull, as well as in coloration.

Habits.

The habits of the common paca appear to be very similar to those of agutis; these animals going about either singly or in pairs, and being strictly nocturnal. Their resting-place during the day is either some cavity among the roots of a forest-tree, or a burrow excavated by their own exertions, and reaching to a depth of from four to five feet. Their food is precisely similar to that eaten by the agutis. In disposition they are shy and timid; and when pursued they invariably make for the water, in which they swim well and with considerable rapidity. During the summer the female produces a single



THE PACA (¼ nat. size).

(occasionally two) offspring, which is believed by the natives to remain in the burrow during the period of suckling—several months in duration. The Ecuador paca is said to be not uncommon in the forests on both sides of the Andes. It makes a burrow with two entrances, in which a male and female take up their residence. The natives, who hunt these animals for the sake of their flesh, pursue them in the forests with dogs, and then drive them out from their burrows by lighting a fire at one of the entrances.

A tame individual of the common species noticed by Rengger was at first very shy and suspicious, biting fiercely at the hands of any person approaching it. During the day it endeavoured to conceal itself as much as possible, but at night it

would wander about the house, uttering a grunting noise, and consuming such food as was placed for it. In the course of a few months its shyness and ferocity gradually disappeared, and it learned to distinguish between its master and strangers, although it never exhibited friendliness to anyone. It would eat almost any kind of human food, except flesh; and was remarkably cleanly in its habits, frequently dressing its fur with its claws. Bright sunlight seemed to blind the creature; while in the dark its large eyes gleamed like those of a cat.

The skin of the paca is so thin, and its hair so coarse and harsh, that its pelage is of no commercial value. Its flesh is, however, white and well-flavoured; and on this account the animal is much sought after by the natives of the countries it inhabits. During the months of February and March pacas become most extraordinarily fat, and it is at this season that their flesh is most esteemed. In the woods of Brazil pacas and agutis, together with certain edentates, are the only mammals whose flesh is eatable; and they are accordingly most acceptable to the traveller, who is often compelled for long periods to subsist on a vegetable diet.

Branick's Paca. This animal is interesting as apparently forming a connecting link between the true pacas and the other families of the present group, and on these grounds it has been made the type of a family by itself. In size and general form of the head and body, as well as in coloration, this animal closely resembles the paca; from which it is distinguished externally by its rather long and thickly-haired tail, by each foot having four toes, and by the vertical cleft on the upper-lip. Internally it differs by the complete clavicles, and by the molar teeth being divided into transverse plates of enamel, as in the chinchillas and cavies. The only known example (*Dinomys branicki*) was discovered one morning at daybreak, rather more that twenty years ago, wandering about the courtyard of a building in Peru; and from that day to this nothing more has ever been heard of the species.

The Cavies.

Family *Caviidæ.*

The cavies, familiar to us all from childhood in the form of the domestic guinea-pig, form a well-marked family distinguished by the following characters. The limbs are generally similar to those of the agutis, and are furnished with four toes in front and three behind. The collar-bones are imperfect; and the molar teeth are divided by continuous folds of enamel into transverse plates. As indicated by the well-known proverb concerning the guinea-pig, the tail is small or rudimentary. The incisor teeth are short; and the lower jaw differs from that of the agutis in having a strongly-marked ridge on each external surface. The majority of the members of the family are terrestrial, but one genus is aquatic.

The true cavies, as represented by the guinea-pig, are comparatively small Rodents, characterised by their stout build, short and subequal limbs, small ears, and the total absence of a tail. All the wild species are uniformly coloured, and their range comprises the whole of South America.

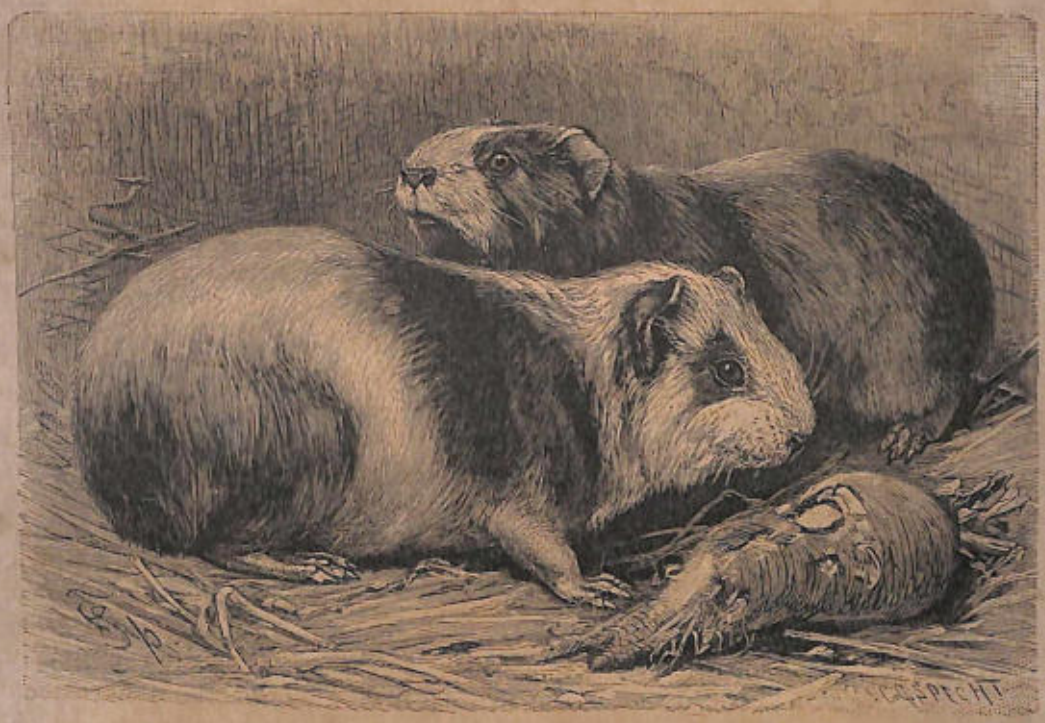
Restless Cavy.

One of the best known of the many species is the restless cavy (*Cavia porcellus*) of Uruguay and Brazil, which measures rather more than 10 inches in length, and attains a weight of about a pound. The colour of the rather long and coarse fur is greyish brown; and the incisor teeth are white. This species is common in certain districts in the neighbourhood of the Rio de la Plata, where it is known by the name of aperea. According to Darwin, it is occasionally found on the sandhills or the hedges of aloes and cactuses; but its more usual and favourite haunts are marshy spots covered with aquatic plants. In the latter situations it lives among the shelter of the vegetation, but in sandy districts it excavates burrows. It usually comes forth to feed in the evenings and mornings; but in cloudy weather may sometimes be seen abroad at all hours. In Paraguay Dr. Rengger states that it is invariably found in moist situations on the borders of the forest, where it lives in societies comprising from six to fifteen individuals, among the dense masses of bromelia. Here it makes regular beaten paths, and never wanders far afield. It breeds but once a year, producing only one or two young. Cutler's cavy (*C. cutleri*), from Peru, is a rather smaller species, distinguished by the general black hue of the fur, although the flanks and more especially the under-parts tend to brown.

Guinea-Pig.

Much discussion has arisen as to the origin of the domestic guinea-pig. It was long considered to have been derived from the restless cavy; although several writers pointed out that from its aversion to wet and cold such an origin was improbable. From the researches of Dr. Nehring of Berlin, it appears, however, that the real ancestor of the domestic breed is the above-mentioned Cutler's cavy. It has been ascertained that the latter species was domesticated by the Incas of Peru, from whence it was carried to Colombia and Ecuador; while, on the other hand, no cavy was ever domesticated in Brazil. The domesticated cavies of the Incas were either uniformly white or reddish brown, or a mixture of those two colours. In Europe guinea-pigs are generally either white or white marked with yellow and black. Occasionally, however, they may be white marked with pale yellow, and in such cases they invariably have pink eyes. Sometimes, again, they may be marked with brownish black, mouse-colour, or yellowish grey; while in certain cases the black may be replaced by ashy grey, when the eyes are pink. Of late years a breed has been formed with exceedingly long coarse hair, and of larger size than ordinary. Guinea-pigs were introduced into Europe by the Dutch during the 16th century, shortly after the discovery of America; the name being probably a corruption of Guiana-pig. From their pretty appearance and ways, as well as the ease with which they are kept and the rapidity with which they multiply, guinea-pigs have always been favourite pets with children; although it must be confessed that from their stupidity and want of affection they cannot be regarded as very interesting creatures. When, however, a number of these rodents are kept together, they certainly form a pretty sight; and the manner in which they follow one another round and round their place of confinement in unbroken order is very remarkable. In some respects they resemble rabbits in their habits, while in others they are more like mice. Their pace is by no means swift and consists

partly of a series of short springs; while the peculiar manner in which the body is elongated when creeping is familiar to all. Their food consists of roots, corn, and various vegetables; and it is essential to the well-being of these animals that the place where they are kept should be dry and warm. If supplied with abundance of fresh vegetables, guinea-pigs do not require water; and when they do drink they take but little, and this with a lapping action. When pleased, guinea-pigs utter a soft murmuring cry; when alarmed, this changes to a squeak; while a series of short grunts (from which they probably derive their name) appear to be their mode of expressing their wants and desires. The two sexes live in company,



THE GUINEA-PIG (½ nat. size).

but each male selects a partner from the herd; and during such selection conflicts not unfrequently take place between rival males.

Few animals exceed the guinea-pig in fertility, and this is the more remarkable, since, as we have seen, the wild cavies increase but slowly. In Europe the female will produce from two to three litters in a year, each of which will contain from two to five young; while in warmer regions the number produced at a birth may be as many as six or seven. The young are brought forth in a highly advanced state of development, with their eyes fully opened, and, curiously enough, their milk-teeth already shed. In a few hours they are able to run by the side of the mother; while by the second day they are able to nibble not only soft plants, but even corn. They are suckled for a fortnight, during which period they are carefully tended by the dam; but after this the parental affection rapidly wanes, and in three weeks (by which time the parents have again paired) the young are left to shift by them-

selves. In from five to six months the young guinea-pig is able to reproduce its kind, although it does not attain full maturity till eight or nine weeks. With care, these animals will live for six or eight years. Although guinea-pigs seem too stupid to display the slightest affection for their owners, they have the great advantage of never making any attempts to bite, and may therefore be handled by children with impunity.

Bolivian Cavy. The Bolivian cavy (*C. boliviensis*), which is of rather smaller size than the restless cavy, is interesting from its habitat. It lives among the higher regions of the Bolivian Andes at elevations of from ten to twelve thousand feet; dwelling in large societies, and forming burrows which completely undermine the whole ground in certain districts. In colour this species has the fur of the upper-parts grey, with a yellowish tinge, while the throat and under-parts are white, and the feet whitish. The incisor teeth are orange in front.

Rock Cavy. The last species of the genus that we shall notice is the rock-cavy (*C. rupestris*), differing from those mentioned above by the extreme shortness of its claws, which scarcely project beyond the toes. It has the fur greyish above, and whitish beneath. This species inhabits rocky districts in certain parts of Brazil, dwelling in cracks and crevices, and not constructing burrows. It is much hunted by the Indians, and it is known to them as the hoki.

Patagonian Cavy. The Patagonian cavy, or mara (*Dolichotis patachonica*), is readily distinguished from the true cavies by its longer limbs and ears, and the presence of a short tail, which is always turned to one side. Its skull is characterised by the extreme narrowness of the front portion of the palate; this being carried to such an extent that the premolar teeth of opposite sides are actually in contact at their front edges. In length it is from 30 to 34 inches, and it stands about 13 inches at the shoulder. Its fur is thick and crisp, and of a greyish colour on the upper-parts, while on the flanks it becomes rusty yellow, and beneath white. The rump is black, with a broad transverse band of white running from the hocks to just above the tail; and the limbs are rusty yellow, but greyish in front. The hair of the throat is elongated into a fringe. Both in habits and general appearance the mara has a superficial resemblance to the hare, but the legs are longer and the ears shorter and wider. It inhabits not only the barren country from which it derives its name, but likewise extends northwards into the grassy pampas of Argentina, where it ranges as far as Mendoza, in lat. 33° 30′. On the Atlantic coast, however, where the climate is moister, it only ranges as far north as 37° 30′; while its extreme southern limit is about the 48th parallel.

Habits. Absolutely dry and more or less desert-like districts are essential to the well-being of the mara; and it is probable that its original home was the Patagonian wastes. In Patagonia the mara is so common as to form almost a characteristic feature in the landscape, Darwin observing that it is usual "to see in the distance two or three of these cavies hopping one after the other in a straight line over the gravelly plains, thinly clothed by a few thorny bushes, and a withered herbage." Generally these rodents are found either in pairs or in parties of from four to eight individuals, but occasionally in large flocks of thirty or forty. They live in burrows, generally excavated by themselves; and



A SCENE IN SOUTH AMERICA WITH RHEAS AND PATAGONIAN CAVIES.

differ from the other cavies in being diurnal. To protect its eyes from the glare of the midday sun, the mara has well-developed eyelashes, which are wanting in its nocturnal allies. In disposition these cavies are extremely shy and timid, taking to flight at the least alarm, and generally trusting to their legs, rather than to the shelter of their burrows, for safety. Their food consists chiefly of grass and the roots and stems of such other plants as grow near their burrows. Of their reproduction, it is only known that the female produces twice in the year from two to five young, which are born and nurtured in the burrow. They have been introduced by Sir E. G. Loder into his park near Horsham, having bred there several times.

Maras are among the few mammals that habitually enjoy basking in the full sunshine. When thus reposing it usually lies stretched out on its side or flat on its belly; and in the latter posture, as shown in the central figure of our engraving, bend the fore-foot backward in a manner unlike any other rodent. When disturbed, they at once assume a sitting position, resting on their fore-feet and heels, and raising their heads as high as possible in order to see whence the danger comes. After taking to flight, they generally stop when they have run fifty or a hundred paces, and turn to look round; repeating this process after having again run a short distance. When caught young, they can be tamed without much difficulty, although they require to be tethered. By the natives mara are hunted for their flesh; but this, although white when cooked, is described as being dry and tasteless.

Fossilised remains of three species of these animals have been obtained from the caves of Lagoa Santa, in Brazil; one of these being probably inseparable from the existing form.

Carpincho. The carpincho or capivara (*Hydrochœrus capivara*), which takes its second name from a Spanish modification of the native term capugua, is the largest of living Rodents, reaching a length of about 4 feet, and weighing 98 lbs. From this large size, coupled with its bristly hair and grunting cry, the animal is often designated the water-hog. It is a rodent of bulky build, with moderately long legs, small ears, cleft upper lip, no tail, and short webs between the short-nailed toes. The neck is short; the head long, broad, and much flattened above; the eyes large and widely separated; and the ears with a notch in their hinder border. The hind-legs are considerably longer than the front pair. The skin is clothed somewhat sparsely with long and coarse hair, of a reddish brown colour above, and brownish yellow beneath; the bristles around the mouth being black. The upper incisor teeth are marked with a broad and shallow groove in front; while the molars are characterised by the great complexity of the last tooth of the series. Thus in the upper jaw the last molar comprises some twelve transverse plates, and exceeds the united length of the three teeth in front of it; while in the lower jaw the corresponding tooth is somewhat less complex, although still much larger than either of the others. This complexity of the last molar, which is quite unparalleled elsewhere among the rodents, presents a condition analogous to that existing in the wart-hogs.

Distribution. The carpincho is distributed over the whole of Eastern South America, as far south as the Rio de la Plata; and also extends westwards into the lowlands of Bolivia and Peru. The existing species occurs in the

caverns of Brazil; while in the Tertiary deposits of Argentina fossil remains indicate an extinct species of 5 feet in length, and another considerably larger.

Habits.

This gigantic cavy is thoroughly aquatic in its habits, frequenting the margins of lakes and rivers, and swimming and diving with great speed. Darwin, for instance, writes that these rodents "occasionally frequent the islands in the mouth of the Plata, where the water is quite salt, but are more abundant on the borders of fresh-water lakes and rivers. Near Maldonado three or four generally live together. In the daytime they either lie among the aquatic plants, or openly feed on the turf plain. When viewed at a distance, from their manner of walking, as well as from the colour, they resemble pigs; but when seated on their haunches, and attentively watching any object with one eye, they resume the appearance of their congeners the cavies. These animals were very tame; by cautiously walking, I approached within three yards of four old ones. This tameness may probably be accounted for by the jaguar having been banished for some years, and by the gaucho not thinking it worth his while to hunt them. As I approached nearer and nearer, they frequently made their peculiar noise, which is a low, abrupt grunt, not having much actual sound, but rather arising from the sudden expulsion of the air; the only noise I know at all like it is the first hoarse bark of a large dog. Having watched the four, from almost within arm's length for several minutes, they rushed into the water at full gallop, with the greatest impetuosity, and emitted at the same time their bark. After diving a short distance, they came again to the surface, but only just showed the upper parts of their heads."

In other places the carpincho occurs in larger herds, which may comprise twenty or more individuals. The usual pace of the animal is a long trot, of no great swiftness; but when pressed it will advance in a series of leaps. It has no regular lair, although the herd generally returns to the same part of the river-bank. The general food consists of water-plants and the bark of young trees; but in the neighbourhood of cultivated lands carpinchos will consume large quantities of water-melons, maize, rice, and sugar-cane. In disposition these animals are quiet and peaceful, not to say stupid; and they never appear to indulge in sportive gambols. They occupy their time either in feeding, or in reposing in a listless manner on the banks of the rivers or lakes they frequent. When thus reposing, one individual will from time to time raise its head to see if any foe be approaching; and if an alarm arise they soon plunge headlong into the water. In the settled portions of Uruguay they are but seldom seen, although their footprints, as the writer can testify, are very numerous on the sandy banks of the rivers.

The female produces from five to eight young ones in the year; but it is not yet ascertained whether a regular lair is prepared for their reception. The young follow their parents closely, although not exhibiting any marked signs of affection towards her. Azara states that each male appropriates two or three females. When captured young, carpinchos are capable of being completely tamed, and may be suffered to run about a house like a dog.



A HERD OF CARPINCHOS.

CHAPTER XXXIV.

Rodents,—*concluded.*

The Hare-Like Rodents.

Families *Lagomyidæ* and *Leporidæ*.

The whole of the Rodents described in the preceding chapters are characterised by having but a single pair of incisor teeth in the upper (as in the lower) jaw; and they are hence collectively spoken of as the single-toothed Rodents, or Rodentia Simplicidentata. On the other hand, the hares and rabbits, together with their cousins the picas, have a second smaller pair of incisors placed behind the large front pair in the upper jaw, as shown in the accompanying cut. These Rodents are accordingly regarded as constituting a group of equal value with the one containing all the other families, for which the term double-toothed Rodents, or Rodentia Duplicidenta, is adopted. In the young of this group three pairs of incisors are present in the upper jaw, but the hindmost pair soon disappear, and are not succeeded by permanent teeth. In addition to these extra incisor teeth, these Rodents are characterised by the enamel extending all round the large incisors, instead of being confined to their front surfaces. In the skull the palate is distinguished by the shortness of its bony portion, in which there are very large vacuities in front; while its hinder border is situated between, instead of behind, the molar teeth. In all cases the latter teeth have tall crowns without roots, and are divided into parallel transverse plates surrounded by enamel. In the hind-limb the bones of the lower leg (tibia and fibula) are united together. The upper lip is invariably cleft.



SKELETON AND TEETH OF HARE.

These Rodents, which are divided into two families, are all strictly terrestrial in their habits, and have a wide geographical distribution, although more abundant in the Northern than in the Southern Hemisphere.

The Picas.

Family *Lagomyidæ*.

Most travellers in the Himalaya are familiar with the pretty little Rodents, known as picas, tailless hares, or mouse-hares, which may be seen in the higher regions, cautiously poking their noses out from between broken rocks, and again disappearing with the rapidity of lightning directly they catch a glimpse of the intruder. These creatures constitute a family of the present group, of which there is but the single genus *Lagomys*, and present the following characteristics.

All the species are of comparatively small size, being considerably inferior in



SIBERIAN PICA (¼ nat. size).

this respect to a rabbit; and are easily recognised by their small ears, and the absence of any external traces of a tail. The fore and hind-limbs are short and of nearly equal length. In the skeleton the collar bones are complete; and the skull has no descending (postorbital) processes defining the hinder border of the socket of the eye. In the living species there are two pairs of premolar teeth, in addition to three molars, in each jaw. The picas have the soles of the feet well covered with hair; and the fur of the body is generally thick and soft.

Distribution. Picas, of which there are a considerable number of species, may be considered as especially characteristic of Northern and Central Asia, one species alone ranging into Eastern Europe, while another inhabits North America. In Asia the genus extends into Eastern Persia, Afghanistan, the Himalaya, and Tibet. The best known species is the Siberian pica (*Lagomys alpinus*), inhabiting the steppes of Eastern Europe, Siberia, and Kamschatka. This animal may be compared in size to a guinea-pig, its length being from 9 to

9½ inches. The general colour of the long and soft fur is greyish brown on the upper-parts, although the individual hairs are of a deep grey near the skin; while beneath it is grey tinged with yellow. The feet are pale, suffused with brownish yellow; and the ears have white margins. The common Himalayan pica (*L. roylei*), which ranges to elevations of from eleven thousand to fourteen thousand feet, or more, is a much smaller species, measuring only 6½ inches in length, with fur of a dark brown or bay colour. Other species from the inner Himalaya, such as the Ladak pica (*L. ladacensis*), are, however, larger; the one named measuring 9 inches in length, and inhabiting regions situated at an elevation of from fifteen thousand to nineteen thousand feet above the sea-level. During the Pliocene and Miocene divisions of the Tertiary period picas were common in Central and Southern Europe, while in Sardinia they lived on into the Pleistocene. Some of these Tertiary picas differed from the living forms in having only one pair of premolar teeth in the lower jaw; while in others there were but a single pair of these teeth in both jaws.

Habits. Picas inhabit only cold and desert regions, and, therefore, in the greater part of their range, are found at great elevations, although in Siberia they can exist at much lower levels. They either form burrows among rocks, or live in the crevices between the rocks themselves; in the Eastern Himalaya *Lagomys roylei* is, however, found in the pine-forests. Although mainly nocturnal in their habits, picas will often venture abroad in the daytime, especially if the sky be overcast; and the writer has several times seen them in the Himalaya darting about in the full glare of the sun. Their movements are so quick, that they are exceedingly difficult to shoot. Their food consists of various plants, more especially grasses; and of these a large store is accumulated for winter use. In Siberia this provender is piled up into heaps like small haystacks, which gradually disappear during the winter; unless they are plundered by the sable-hunters as fodder for their horses. None of the picas appear to hibernate, although in most of their haunts they must be buried deep beneath the snow for several months in the year. Although often found in the Himalaya in pairs or small parties, picas are generally more or less gregarious, sometimes associating in very large numbers. In Northern and South-Eastern Mongolia, where they are exceedingly abundant, their burrows consist of a vast number of separate holes, which may be counted by hundreds, or even thousands. From the peculiar loud chirping or whistling cries uttered by many of the species whilst feeding, picas are often termed piping-hares; but this habit does not appear to have been observed in the Himalayan forms.

All the picas drink but little. In summer some amount of rain falls in many of the districts they inhabit, while in winter the snow supplies them with as much liquid as they require; but in spring and autumn there is scarcely even dew in the Mongolian steppes, so that at such seasons they must exist entirely without water. According to Pallas, the females give birth at the commencement of the summer to about six naked young, to which she attends with the greatest care.

In Central Asia picas have many foes, among which the most prominent are the manul cat, the wolf, the corsac fox, and many eagles and falcons; while in winter they are harried by the great snowy owl. The fur-hunters of Siberia do not, however, consider these creatures worth the trouble of killing.

Hares and Rabbits.

Family *Leporidæ*.

The hares and rabbits, all of which are included in the single genus *Lepus*, constitute a family distinguished from the picas by their elongated hind-limbs, short recurved tail, long ears, and imperfect collar-bones. The skull is distinguished by the extremely narrow frontal region, and the presence of large wing-like (postorbital) processes defining the hinder border of the eye-sockets; while there are three pairs of premolars in the upper, and two in the lower jaw, the total



HARE IN ITS FORM.

number of cheek-teeth thus being $\frac{6}{5}$ on each side of the jaws. The eyes are large and full, and devoid of eyelids.

In all the species the fore-limbs are furnished with five, and the hinder pair with four toes each; the soles of the feet being as densely clothed with hair as are the legs. The inner sides of the cheeks are also lined with hair. The females have teats both on the breast and on the belly.

With the exception of one remarkable Indian species, noticed in the sequel, all the members of the family are very much alike in appearance and coloration; the usual tint of the fur on the upper-parts being a mixture of grey and reddish brown, although in some cases the red, and in others the grey tends to predominate. This coloration harmonises well with the general tint of the open country on which most of the species dwell. A noteworthy feature (which, however, is absent in the above-mentioned Indian species), is the pure white of the under-surface of the up-turned tail. This, in the case of the rabbit at least, is considered by Mr. Wallace as serving the purpose of a guiding signal to other individuals in the presence of danger, so that when the leader of a flock is in full retreat towards its hole, the remainder at once see in which direction to follow.

Distribution. Hares, as all the members of the family save the rabbit are called, have an almost cosmopolitan distribution, although none are indigenous to Australasia. Of some thirty known species, by far the greater majority are, however, confined to the Northern Hemisphere; the whole of South America having only a single species, the Brazilian hare (*Lepus brasiliensis*).

Habits. With the exception of the rabbit and the curious hispid hare of Northern India, all the members of the family dwell either in open country among grass and other herbage, or among rocks and bushes. They are solitary; and each inhabits a particular spot known as its *form;* such form being either a flattened resting-place among grass or bushes, or merely the sheltered side of some rock or stone. As a rule, a hare returns to its form, sometimes day by day, for a considerable portion of the year; but the situation is changed periodically. Hares are mainly nocturnal, going forth at evening in quest of food, and not returning to their forms till after sunrise. Their speed is great; but, owing to the great relative length of their hind-limbs, they are better adapted for running uphill than down. All the members of the genus are remarkable for their extreme timidity, and their long ears are admirably adapted to collect the least sound, and thus to give the earliest possible notice of danger. It will not fail to be observed that the ears are the shortest and the legs the less elongated in the rabbit and the hispid hare, both of which dwell in burrows, and have not, therefore, such need of protecting themselves by acuteness of hearing and extreme speed. All the members of the family breed with great rapidity; the young being able to reproduce their kind within about six months after birth. Whereas, however, the young of the true hares are born fully clothed with hair and with their eyes open, those of the rabbit, and probably also of the hispid hare, come into the world blind and naked.

The Common Hare (*Lepus europæus*).

Such a well-known animal as the common hare requires but a comparatively brief description, although it is necessary to point out such features as serve to distinguish it from the mountain-hare. The length of the head and body is generally a little short of 22 inches; the ears being rather longer than the head, with black tips. The general colour of the soft fur of the upper-parts and flanks is tawny grey, more or less mingled with rufous, but tending to a purer grey in winter than in summer. The under-parts are white; while the tail, of which the length is nearly equal to that of the head, is black above and white beneath. The usual weight is from 7 to 8 lbs.

Distribution. With the exception of the north of Russia, the Scandinavian Peninsula, and Ireland, the common hare is found over the whole of Europe, ranging as far eastwards as the Caucasus; but in the north of Scotland the species is confined to the low grounds and valleys. It may be mentioned here that this species is commonly alluded to under the name of *Lepus timidus;* that name was, however, applied by the Swedish naturalist Linné to the hares of his own country, and therefore clearly rightly belongs to the next species. In the more northern parts of its habitat the hare tends to become white in winter; while the maximum of rufous in its coloration occurs in the more southerly districts.

Habits. The hare, like other members of the genus, is an exclusively vegetable feeder, its food consisting of grass, corn, bark, etc. In cultivated districts hares often inflict much damage on growing wheat, and likewise on garden vegetables; while the destruction these animals cause among young trees by nibbling away the bark is sometimes very great. In fine weather hares are usually to be found in the open, while during rain they show a decided preference for cover; but while on some days they select the bare fallows, on others they



COMMON HARE (¼ nat. size).

repair to fields with long grass or other herbage. On some occasions, either when lying in the open or in their forms, they will almost allow themselves to be trodden upon before stirring; and it is then that they are sometimes captured by the poacher merely walking silently up and throwing himself suddenly upon them. On other occasions they are so wild that it is difficult for the sportsman to come within range; Prof. T. Bell observing that they are generally most wild in bad weather, and more so in the afternoon than in the morning. The hare will take readily to the water, not only to escape from pursuit, but likewise to obtain food

or a mate; and there is a record of one actually swimming across an arm of the sea about a mile in width. The author last mentioned writes that "on hearing an unusual sound the first impulse of a hare is to sit upright with erected ears to reconnoitre; then it either endeavours to conceal itself by 'clapping' close to the ground, or at once takes to flight. It is a cunning animal, and the sharp turns or 'wrenches' by which it strives to baffle the fleeter but less agile greyhound, constitute one of the principal beauties of the sport of coursing."

The female produces several litters in the course of the year, the earliest of which may arrive in January and the latest in November. The number of young



MOUNTAIN-HARE (¼ nat. size).

in a litter varies from two to five; and the "leverets" are suckled for about a month, after which they are left to shift for themselves.

Mountain-Hare. The mountain or Alpine hare (*Lepus timidus*) is a species with a very wide distribution, ranging over the greater part of Northern Europe and Asia, from Ireland in the west to Japan in the east, and also met with in the Alps, the Pyrenees, and the Caucasus. It is represented by a variety known as the Polar hare in Arctic America, which extends as far south as Nova Scotia. In the British Isles this species is not met with except in Scotland and Ireland; and in the former country is commonly termed the blue hare. Its present distribution is doubtless to be accounted for by the glacial period, when it was able to exist

in the lowlands of the greater part of Europe; but it is somewhat curious that it should find the wild climate of Ireland suitable to its existence.

The mountain-hare is intermediate in size between the common hare and the rabbit; and has a relatively smaller and more rounded head, with shorter ears, hind-legs, and tail than the former. Throughout the year in Ireland and the south of Sweden, and during summer in the greater part of the rest of its habitat, the general colour of the pelage is light fulvous grey; the tips of the ears being black. With the commencement of winter, however, except in the regions named, the fur gradually becomes more and more flaked with white, until at length it assumes a uniformly white hue, save on the black tips of the ears. It is believed, however, that in the extreme north the fur is white throughout the year.

In general habits the mountain-hare appears to agree very closely with the common species. Its "form" is generally made in the clefts of rocks, or between stones; and during the winter its food consists largely of lichens and pine-seeds. In summer it ascends the higher mountains, produces from four to six young at a birth, and it is doubtful if there is more than one litter in a year. It seems to be more inclined to seek shelter under tree-stems, thick evergreens, etc., than the common hare; and the young are believed to be produced in sheltered cover. In Arctic America the Polar hare remains active throughout the winter, feeding chiefly on the berries of the arbutus and the bark of dwarf willows.

North American Hare. In addition to the polar hare, North America is the home of several species of the genus, two of which turn white in winter, although the bases of the hairs retain their normal colour. The two species in question are the prairie-hare (*L. campestris*), distinguished by its large size, long ears, and the white hue of both surfaces of the tail; and the smaller varying hare (*L. americanus*), with shorter ears, and the tail dark above.

Of the North American species, which do not turn white in winter, the best known is the small wood-hare (*L. sylvaticus*), not unfrequently termed the grey rabbit; the usual colour of the upper-parts being grey, varied with black, and more or less tinged with yellowish brown, while the under-parts are white. This hare is a southern species, not ranging further north than the Adirondack region of New York. In habits this species approximates somewhat to the rabbit, frequently dwelling in hollow tree-stems or the deserted burrows of other mammals. Mr. Kennicott states that it "is very prolific, producing young three or four times a year, and usually from four to six at a birth. In open ground the female scratches a shallow hollow, in which to bring forth her young. In this she forms a nest of soft leaves and grasses, well lined with fur from her own body; and when she is absent the young are always completely covered and concealed in the nest, which they leave at an early age, and separate from the mother as soon as able to take care of themselves." The Brazilian hare (*L. brasiliensis*) is very closely allied to the wood-hare, but has the under surface of the tail yellowish brown.

Asiatic Species. There are a large number of species of hares inhabiting Central Asia, India, and the regions to the eastward. Of these the Indian black-naped hare (*L. nigricollis*) is distinguished by the presence of a black patch on the back of the neck, which is wanting in the common Indian hare (*L. ruficaudatus*). Both these species appear to be much less prolific than the European

species; and when pursued generally take refuge in holes. Of the Tibetan species, the Afghan hare (*L. tibetanus*), which is found as low as five hundred feet above the sea, is distinguished by the black upper surface of the tail; while in the woolly hare (*L. oiostolus*) and upland hare (*L. hypsibius*) both surfaces of the tail are nearly or quite white. The latter species does not occur below fourteen thousand or fifteen thousand feet; and I have found it in swarms among eleagnus bush in the higher valleys of the Ladak.

The most remarkable of the Indian species is, however, the hispid hare (*L. hispidus*), inhabiting the foot of the Eastern Himalaya. In this hare the ears are shorter than the skull, the eyes small, the ears coarse and bristly, the tail dark both above and below, and the hind-legs scarcely longer than the front pair. Although not gregarious, this species is said to burrow like a rabbit; and probably, therefore, produces blind and naked young. Its flesh is reported to be white. An allied species (*L. nitscheri*) inhabits Sumatra.

African Species. In Africa hares are found from Egypt to the Cape; those from South Africa afford but poor sport, as their speed is not great, and when pursued they almost invariably run to ground. Moreover, some of them at least, are very foul feeders. The Egyptian hare (*L. ægyptius*) is considerably smaller than the common species, but with relatively longer ears, and paler fur. Of the Cape species, the rock-hare (*L. saxatilis*) is nearly equal in size to the common European hare, and has relatively long limbs and ears, with the fur rufous above and dirty white below. The Cape hare (*L. capensis*) differs by its shorter legs, and the absence of a rufous tinge on the back of the neck, and the yellowish colour of the throat; when hunted, it always carries the ears erect. Lastly, we have the small thick-tailed hare (*L. crassicaudatus*), which is not larger than a rabbit, and is of a foxy-red colour above, paler beneath, with the large and thick tail of the same rufous tint as the body. This species, which has very short legs, is confined to the highlands, ranging from the Cape Colony to the Transvaal.

The Rabbit (*Lepus cuniculus*).

From the foregoing account of the non-European species of hares it will be gathered that some of them show a transition, both as regards form and habits from the European hare in the direction of the rabbit, although none of them are as gregarious as the latter, and, with one probable exception, none produce blind offspring. On these grounds the rabbit cannot be separated generically from the hare. The rabbit is characterised by its small size, relatively short ears, which about equal the length of the head, its small head, and the comparatively slight elongation of the hind-legs. The general colour is greyish brown, with the neck reddish fawn, the under-parts and lower surface of the tail white, and, at most, only the margins of the tips of the ears white. Black, fawn, or parti-coloured individuals are, however, at times met with even in the wild state. The length of the rabbit is usually about 16½ inches; and its weight from 2½ to 3 lbs., although it may occasionally reach as much as 5 lbs.

These rodents which, as compared with the hare, are deficient in speed, are eminently gregarious, forming in suitable soils numerous burrows, collectively termed "warrens." Sandy soils, especially those clothed with heath or gorse, are

their favourite resorts; but in damp situations rabbits sometimes content themselves with forming a series of runs among the thickly-matted gorse or heather. Occasionally, it is stated, they will take possession of a hollow tree, and ascend the stem for a considerable height. Although mainly nocturnal, rabbits when undisturbed may be seen abroad at all hours; but their favourite feeding-times are in the evening and early morning. The prolific nature of the rabbit



RABBIT (¼ nat size).

is proverbial; several litters being produced in the course of a year, both during the summer and the winter, and the number of young in each litter usually varying from five to eight. The young are born in a blind and nearly naked condition; and at the age of six months are themselves able to breed. The ordinary burrow usually has two entrances, but the young are born in a special excavation to which there is but a single approach. In this breeding-burrow the mother forms a soft nest from her own fur; and during her absence in the day she covers over the entrance with earth. It does not appear to be generally known that these animals can swim; but a rabbit startled by a dog belonging to the present writer, from a tuft of grass on the margin of a river, at once plunged into the water and reached

the opposite bank in safety. Rabbits, from their numbers, do even more damage to young plantations than is inflicted by hares. The chief foes of these animals are weasels, stoats, and polecats, which either hunt them in the open, or attack them within the recesses of their subterranean haunts; the curious kind of paralysis which seems to seize the rabbit when pursued by one of these carnivores has been already mentioned under the heading of the stoat.

Distribution. Although now widely distributed, it is believed that the original home of the rabbit was in the countries on both sides of the western portion of the Mediterranean, where it is still abundant at the present day. Thence it is considered to have spread northwards, and to have reached England and Ireland by human agency. In Scotland it has increased and spread enormously of late years, having been formerly but sparsely distributed, and unknown in the more northern parts of the country. On the continent its distribution is somewhat local; and it is unknown in the more northern and eastern parts of Europe. It should be observed that remains of rabbits occur in the caves of England in company with those of the mammoth and other extinct mammals, which would seem at first sight to disprove the view that these rodents are immigrants from the south. It is, however, quite probable that the association of the remains of the rabbit with those of extinct mammals may be due to its burrowing habits.

In Australasia. The rabbit has been introduced by human agency into several countries beyond Europe, where it has flourished and multiplied to a degree beyond conception;—so much so, indeed, that in Australia and New Zealand these animals have become a perfect pest and a serious hindrance to agriculture. Rabbits were first introduced at the period of the highest prosperity of Australia and New South Wales by a patriotic gentleman who thought it would be a good thing to import a few rabbits into the colony, as they would serve for food and for sport. He accordingly imported three couple of rabbits, and they were turned loose. It was not long before it was found that the district in question had been transformed into a gigantic rabbit warren. Indeed it was discovered that a single pair of rabbits, under favourable circumstances, would in three years have a progeny numbering 13,718,000. The inhabitants of the colony soon found that the rabbits were a plague, for they devoured the grass, which was needed for the sheep, the bark of trees, and every kind of fruit and vegetables, until the prospect of the colony became a very serious matter, and ruin seemed inevitable. In New South Wales upwards of fifteen million rabbit skins have been exported in a single year; while in the thirteen years ending with 1889 no less than thirty-nine millions were accounted for in Victoria alone. To prevent the increase of these rodents, the introduction of weasels, stoats, mungooses, etc., has been tried; but it has been found that these carnivores neglected the rabbits and took to feeding on poultry, and thus became as great a nuisance as the animals they were intended to destroy. The attempt to kill them off by the introduction of an epidemic disease has also failed. In order to protect such portions of the country as are still free from rabbits fences of wire-netting have been erected; one of these fences erected by the Government of Victoria extending for a distance of upwards of one hundred and fifty geographical miles. In New Zealand, where the rabbit has been introduced little more than twenty years, its increase has been so

enormous, and the destruction it inflicts so great, that in some districts it has actually been a question whether the colonists should not vacate the country rather than attempt to fight against the plague. The average number of rabbit skins exported from New Zealand is now twelve millions.

In other Countries. Tame rabbits were introduced into the island of Porto Santo, near Madeira, in the year 1418 or 1419, and their descendants have now formed a breed distinguished by their small size, the reddish colour of the fur of the upper-parts, and the grey tints of that below. So different, indeed, are these rabbits from the ordinary kind, that the two kinds will not even breed together; and if the history of the Porto Santo race were not known, it would undoubtedly be regarded as a distinct species. Tame rabbits which have run wild in Jamaica and the Falkland Islands have not reverted to the ordinary wild form, but still exhibit distinct traces of their origin. Introduced rabbits are also numerous in Teneriffe and the Crozet Islands. In Teneriffe, where the breed is small, they do not burrow, but live in crannies among the rocks.

Domesticated Rabbits. The rabbit has long been kept in a domesticated state, in which it varies not only in colour but likewise in size, in the length of the fur, in the form and direction of the ears, and also to some extent in the conformation of the skull. The usual colours are brown, fawn, reddish brown, or black, more or less mingled with white; and there is also an albino race with pink eyes.

Lop-Eared Breeds. Among the most remarkable changes produced by domestication is the assumption of a pendent position by one or both ears, which become greatly enlarged, accompanied by a modification in the skull. Whereas in the ordinary wild rabbit the length of the ears from tip to tip when extended is rather less than 8 inches, and the breadth of each not more than 2 inches; a "lop-ear" has been exhibited in which these dimensions were respectively 23 and 5½ inches. The weight of these rabbits is, moreover, frequently from 8 to 10 lbs.; while, according to Mr. Darwin, it has been known to reach 18 lbs. When only one ear hangs down the rabbit is called a "half-lop"; and in some cases this pendent ear is larger than the upright one. Many lop-eared rabbits have large dewlaps, or folds of skin beneath the throat. Neither whole nor half-lops breed at all truly; and in all lop-eared rabbits the skull is proportionately longer than in the wild race.



LOP-EARED RABBIT.

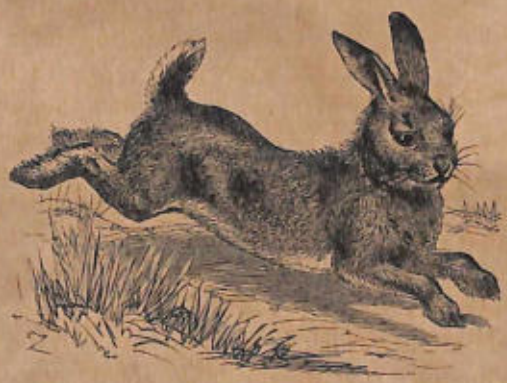
Angora. The Angora breed is readily distinguished by the length and fineness of its fur, which is even of considerable length on the soles of the feet. Mr. Darwin states that these rabbits are more sociable in disposition than the other domestic breeds; and that the males do not exhibit that tendency to destroy their offspring which is so characteristic of the rest.

Other Breeds. The hare-coloured or Belgian rabbit differs mainly from other large breeds by its colour; while other strains which breed true to

colour are the so-called silver-greys and chinchillas, which are born black, and assume their characteristic colours later on. Silver-greys generally have black heads and legs, and the fine grey fur of the body is intermingled with a number of long black and white hairs. These rabbits have long been kept in warrens; and when crossed with the wild breed, one-half of the progeny, or thereabouts, takes after the one parent, and the second half after the other. On the other hand, chinchillas, or tame silver-greys, have short, paler, mouse-coloured, or slaty fur, among which are long, black, slate-coloured, and white hairs. Darwin remarks that silver-greys may be regarded as black rabbits, which become grey at an early period of life. By crossing silver-greys with chinchillas a certain number of the resulting offspring belong to what is known as the Himalayan breed. When first born these rabbits are generally true albinos, having pure white fur and pink eyes; but in the course of a few months they gradually become blackish brown on the ears, nose, feet, and the upper surface of the tail. In spite of their sudden production, Himalayan rabbits generally breed true; and Darwin suggests that their remarkable change in coloration may be due to both chinchillas and silver-greys having descended from a cross between black and albino parents. Lastly, we have the Nicard or Dutch rabbit, distinguished by its very small size; some examples not weighing more than a pound and a quarter.



"HALF-LOP" RABBIT.



CHAPTER XXXV.

The Edentates,—Order Edentata.

The Mammals described in this chapter, which include the sloths, ant-eaters, and armadillos of South America, together with two Old World groups, are collectively characterised by the total absence of front teeth, while in a few instances their jaws are entirely toothless. Strictly speaking, therefore, the title of the group applies only to those of its representatives as present the latter feature; but if we



THE GREAT ANT-EATER.

regard the term as indicating the absence of front teeth alone, it will be applicable to the whole group, so far as existing forms are concerned.

In addition to this absence of front or incisor teeth, the Edentates are also characterised by the simple structure of their cheek-teeth, which are composed solely of ivory and cement, without any trace of enamel. Moreover, these teeth never form distinct roots, but grow continuously throughout life, and have their pulp-cavities open inferiorly. Then, again, these animals usually lack a functional series of milk-teeth; although in two instances such teeth are developed, which in one case cut the gums and come into use.

The foregoing are almost the only characters common to the whole of the Edentates. It may be added, however, that all these animals are of a comparatively low degree of organisation, although many of them are specialised for particular modes of life. In general their brains are relatively small, with the hemispheres, or anterior portion, devoid of convolutions, and not extending backwards to overlap and conceal the hinder portion or cerebellum. In some cases, however, the hemispheres of the brain are distinctly convoluted. Very frequently the shoulder-blade, or scapula, is characterised by the great development of the anterior portion of its lower extremity; this so-called coracoidal portion (of which we shall have to speak more fully when we come to the Egg-laying Mammals), being sometimes, as shown in our figure of the skeleton of the sloth, marked off from the remainder of the bone by a perforation, and suturally united with it. Certain members of the order, such as the armadillos and their extinct allies, are peculiar among Mammals in possessing a bony cuirass in the skin; while the pangolins are equally remarkable for the coat of overlapping horny scales with which the entire body is invested.

From the absence of enamel in their teeth, and the presence of rudimental milk-teeth in some of their representatives, it is probable that the Edentates should be regarded as somewhat degenerate types, descended from ancestors provided with a double set of enamel-coated teeth. There are, however, no indications of any close relationship between the Edentates and any other of the Mammalian orders; and it is accordingly pretty evident that they are descended from extinct primitive Mammals quite independently of all other members of the class.

Distribution. As already mentioned, the sloths, ant-eaters, and armadillos, are entirely confined to the New World; and since it is these alone which form the typical Edentates, the order is essentially an American one. Indeed, there is a considerable degree of doubt whether the Old World pangolins and aard-varks, which form its only other representatives, are rightly included within the order; their organisation being very different from that of the typical forms. Be this as it may, the typical Edentates appear to have been always confined to the New World, in the southern half of which they attained their greatest development; for while fossil forms are abundant in America, they are unknown elsewhere.[1] Some of these extinct types are of the greatest importance to the zoologist, since they serve to connect together most intimately such widely different forms as the arboreal sloths and the terrestrial armadillos.

Mode of Life. Although varying greatly in their mode of life, the whole of the Edentates—both living and extinct—are either arboreal or terrestrial, none of them being modified either for flight in the air or for swimming in the water. While the purely arboreal sloths are entirely vegetable feeders, all the other members of the order, of which a few are likewise more or less arboreal in their habits, subsist on flesh or insects. Moreover, several of these carnivorous forms are burrowing animals; and it is remarkable that the members of three distinct groups, namely, the ant-eaters, the pangolins, and the aard-varks, subsist mainly, or exclusively, on white ants or termites; the only other purely ant-eating members of the class belonging respectively to the Pouched Mammals and the Egg-

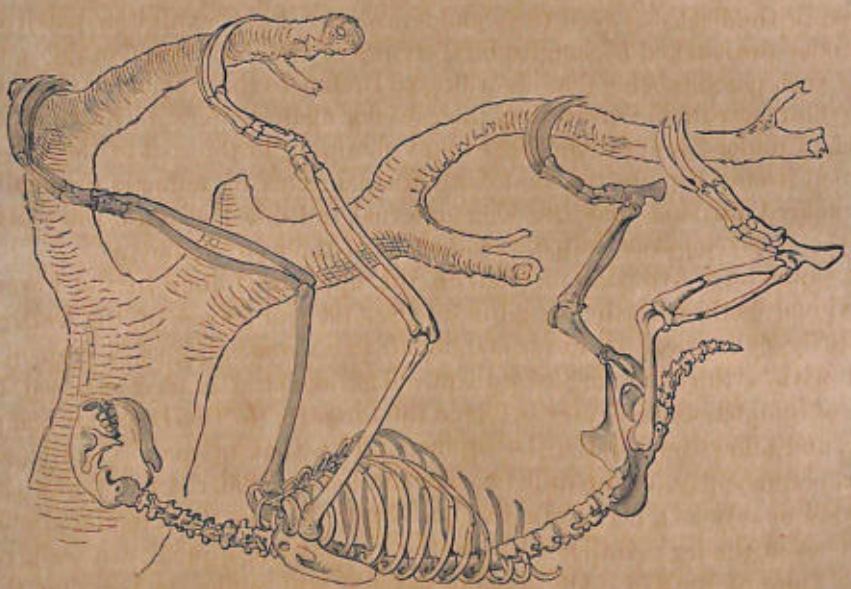
[1] Certain remains from the Tertiary rocks of France have been considered to belong to armadillos, but this determination is exceedingly doubtful.

laying Mammals. It is further noteworthy that while among the ant-eating Edentates the true ant-eaters and the pangolins have entirely lost their teeth, those organs are retained in a comparatively high state of development among the aard-varks. At the present day the Edentates are evidently a waning group, the whole of the larger members of the order having died out; while those which remain have sought protection by the acquisition of either arboreal or burrowing habits, or by the development of a protective coat of mail to their bodies.

The Sloths.

Family *Bradypodidæ*.

Although by the older zoologists the sloths were regarded as ill-formed creatures destined to lead a miserable life on account of their misshapen limbs, no animals are in reality better adapted to their peculiar mode of existence. We



SKELETON OF THREE-TOED SLOTH.

see this not only in their elongated limbs, which have been modified into hook-like organs of suspension, with the removal of all superfluous digits and the great development of the claws of those which remain; but likewise in the extraordinary resemblance of their coarse coat of hair to the shaggy lichens clothing the gnarled and knotted boughs of their native forests. It is noteworthy that while the monkeys of the same regions have mostly acquired a fifth limb by the development of the prehensile power in their tails, the sloths have almost dispensed with tails altogether.

Characteristics. The sloths are characterised externally by their short and rounded heads, in which the ears are very small and buried among the fur, their rudimentary tails, and the excessive elongation of their fore-limbs, of

which the length far surpasses that of the hinder-pair. Both pairs of limbs are furnished with long and slender feet, in which there are never more than three toes; while the toes themselves are invested for nearly their whole length in a common skin, and terminate in long curved claws of great strength. The thick coat of long, coarse, and somewhat brittle hair with which the whole of the body and limbs is invested, is generally of a brownish or dull ashy-grey colour, mingled with a greenish tint; each individual hair having a fluted or roughened external surface. The most remarkable feature connected with the pelage is, however, the growth of a vegetable—a kind of alga—on the hairs themselves; the alga attaching itself to the aforesaid flutings, and growing luxuriantly in the moist atmosphere of the South American forests, although quickly withering when the animals are brought to Europe. It is this extraneous vegetable growth which communicates the greenish tinge to the hair during life; and its object is doubtless to render the coloration of these creatures in still closer harmony with their inanimate surroundings than would have been otherwise possible. It may be mentioned here that it is almost impossible to conceive that any sort of so-called natural selection could have given rise to this peculiar and unique kind of protective resemblance. In the region of the back between the shoulders many sloths exhibit a patch of fine woolly under-fur marked by longitudinal stripes of rich brown and orange; the exposure of such patches being due, according to Brehm, to the animals having abraded the long hair by rubbing or resting their backs against trees. The coloration of this patch of under-fur approximates to that obtaining in the coat of the ant-eaters, from which it may be inferred that both these groups of animals originally had bright-coloured fur, and that the long external dull-hued coat of the sloths has been a special development suited to the needs of their environment.

The sloths have five pairs of teeth in the upper, and four in the lower jaw; the individual teeth, with the exception of the first pair in one of the two genera, being nearly cylindrical in form, and in all cases consisting of a core of ivory invested with a thick coating of cement. The skeleton is characterised by the presence of complete collar-bones; while in the fore-arm the two bones are completely separate, and allow the hand to be supinated like that of man. The claws are, however, permanently fixed parallel to one another, so that the hand, like the foot, can be used merely as a claw. In the hind-limb the foot is articulated obliquely to the bones of the leg; so that when on the ground the animal can walk only on the outer sides of its feet. Of the soft parts, it will suffice to mention that the tongue is short and soft; while the large stomach, as in so many leaf-eaters and grass-feeders, is divided into several compartments. The windpipe is peculiar in being folded before reaching the lungs,—a feature found elsewhere only in certain birds. Finally, the female sloth has but a single pair of teats on the breast.

Three-Toed Sloths. The typical members of the family are commonly known as three-toed sloths, or, from their native title, aïs, and constitute the genus *Bradypus*, readily characterised by the presence of three toes on both the fore and the hind-feet. The teeth are all of nearly the same height, with their grinding surfaces deeply cupped; the first tooth in the upper jaw being considerably smaller than either of the others, while the corresponding lower tooth is broad and compressed. The most remarkable peculiarity connected with the genus is, how-

ever, the presence of nine, instead of the usual seven, vertebræ in the neck; that is to say, it is the tenth vertebra from the head which first carries ribs articulating with the breast-bone, although the ninth, and occasionally the eighth vertebra, is furnished with a pair of free floating ribs, which stop short of the breast-bone. There are several species of the genus characterised by differences in coloration, or by the relative length of the hair on the face; but the precise number of species is



THE COMMON THREE-TOED SLOTH (¼ nat. size).

not yet definitely ascertained. In some kinds the coloration is uniform, while in others there is a dark stripe across the shoulders; the presence of the above-mentioned bright-coloured patch on the back cannot, however, as was once thought, be regarded as a specific character. The typical *B. tridactylus* inhabits the drier regions of the forests, while others, as noticed below, frequent the permanently flooded districts. As a rule, these animals appear to be silent; but it is recorded that a captive specimen, when dragged from the branch to which it was clinging, uttered a shrill scream.

Two-Toed Sloths. The two-toed sloths, or unaus, of which there are two well-defined species, constitute the genus *Cholœpus*, characterised by having only two functional toes on the fore-foot; these two digits representing the index and middle finger of the human hand. The hind-foot has, however, three toes, as in *Bradypus*. The unaus are further distinguished by the characters of their teeth; the first pair in each jaw being longer and stouter than the others, from which they are separated by a considerable interval. These anterior teeth assume, indeed, the characters of tusks, and have their summits obliquely worn away by mutual attrition. That they do not correspond to the true tusks, or canines, of other mammals is shown, however, by the circumstance that the lower ones bite behind, instead of in front of those of the upper jaw. In the common unau (*C. didactylus*) the number of vertebræ in the neck is the usual seven, but in Hoffmann's sloth (*C. hoffmanni*) it is reduced to six. Of these two species the former is restricted to Brazil; while the latter extends from Ecuador to Costa Rica. Hoffmann's sloth utters at rare intervals a cry like the bleating of a sheep, while when suddenly seized it gives vent to a loud snort.

Habits. The haunts of the sloths are the primeval forests of South and Central America, where vegetation attains its highest development, and the warm air is heavily laden with moisture. The darker and denser the forest, the more thickly is it tenanted by these creatures, which are as thoroughly arboreal as the squirrels and spider-monkeys, and seldom or never descend of their own accord to the ground. Indeed, on the ground the sloth is but a helpless creature, walking uneasily on the edges of its in-turned feet, and seeking as soon as possible to regain its native trees. Writing of the habits of the common three-toed sloth (*B. tridactylus*), Bates observes that the Indians call it aï ybyreté, or sloth of the mainland, to distinguish it from the *B. infuscatus*, which has a long black and tawny stripe between the shoulders, and is called aï ygapo, or sloth of the flooded lands. Some travellers in South America have described the sloth as very nimble in its native woods, and have disputed the justness of the name which has been bestowed upon it. "The inhabitants of the Amazon regions, however, both Indians and descendants of the Portuguese, hold to the common opinion, and consider the sloth as the type of laziness. . . It is a strange sight to watch the uncouth creature, fit production of these silent shades, lazily moving from branch to branch. Every movement betrays, not indolence exactly, but extreme caution. He never loosens his hold from one branch without first securing himself to the next, and when he does not find a bough to immediately grasp with the rigid hooks into which his paws are so curiously transformed, he raises his body, supported on his hind-legs, and claws around in search of a fresh foothold." Bates goes on to say that after watching its movements for some time, he shot the specimen under observation; its body remained, however, firmly suspended to the bough to which it was clinging, and it was not till the muscles became relaxed that it fell. He adds that on another occasion he saw a three-toed sloth swimming a river, about five hundred yards wide.

Sloths are mainly nocturnal; and in their usual attitude they hang suspended back downwards. When sleeping, they roll themselves into a ball, with the head tucked between the arms; in this position they somewhat resemble the

pottos among the lemurs, and it is then that they present the most striking resemblance to a lichen-clad knot. They are found usually either in pairs or in small family parties; and are harmless and inoffensive in disposition. They are most active in the dusk and at night; and will then wander slowly for considerable distances through the forest. Their food consists exclusively of leaves, young shoots, and fruits, the moisture contained in which renders drinking unnecessary. Their favourite food is afforded by the large-leaved and milky cecropia trees, which are so abundant in the South American forests; and it is said that they seldom desert a cecropia so long as it affords them nutriment.

The sense of hearing in these animals seems but imperfectly developed; and their small, dull and reddish eyes do not appear capable of very acute vision. Indeed, on first observing a sloth its eyes look so devoid of brightness as to give the impression that the creature must be blind. But a single young is produced at a birth. When it first comes into the world the young sloth is fully developed, having the body thickly clothed with hair, and the claws on the toes of the same proportionate length as in the adult. With these claws it clings fast to the long hair of its mother, clasping its arms around her neck.

Sloths are capable of enduring deprivation from food for protracted periods, and they are also remarkable for the severe bodily injuries they are capable of sustaining, while they appear to be unaffected by doses of poison which would immediately prove fatal to other animals of larger size. It is related that on one occasion a three-toed sloth kept in captivity at Turin took no food for upwards of a month, and appeared none the worse at the end of its long fast. All these circumstances clearly point to the low organisation of these animals; it being a well-known fact that reptiles exhibit a far greater tenacity of life than the higher mammals. Indeed, as a rule, the lower we descend in the animal kingdom, the greater becomes the power of sustaining injury.

The Extinct Ground-Sloths.

Family *Megatheriidæ*.

No account of the Edentates would be complete without some reference to the gigantic ground-sloths which were formerly so abundant in South America, as it is by their aid alone that we are able to comprehend the relationship of the true sloths to the ant-eaters. The best known of these creatures is the megathere, which rivalled the elephant in bulk; while the mylodon and scelidothere were somewhat smaller forms. They may be described as possessing the skulls and teeth of sloths, and the back-bones, limbs, and tails of ant-eaters. The megathere differs from most of the others in having the crowns of the teeth square and divided into wedge-shaped transverse ridges, owing to the variation in the hardness of their constituents; but in most cases the teeth were subcylindrical, with depressed centres. They agreed with the sloths in having large and complete collar-bones; but, as we infer from the conformation of the lower jaw, they approximated to the ant-eaters in the elongation of their tongues. The majority of the ground-sloths were South American; but one species of megathere ranged into North America, while an allied genus, *Megalonyx*, was apparently exclusively North American.



THE TWO TOED SLOTH.

That the ground-sloths were herbivorous is evident from the structure of their teeth; while it is obvious that creatures which must have weighed several tons when in the flesh could not have been climbers. Their bodies were probably clothed with coarse hair somewhat like that of the ant-eater; but there is evidence that the mylodon had also a number of small bony plates embedded in its skin. From the enormous width and massiveness of the pelvis of the ground-sloths, coupled with the extraordinary size of the bones of the tail, it is probable that these creatures were in the habit of procuring their food by supporting themselves on the tripod formed by their hind-limbs and tail, and rearing their bodies against the trunks of trees, from which the boughs were then dragged down by the powerful arms. Possibly, however, the megathere, as suggested by the late Prof. Parker, may in some cases have bodily uprooted trees, by first digging a hole at their roots with its powerful front claws, and then grasping the trunk with its arms, and swaying it to and fro till it fell with a crash. It may be added that the ground-sloths resembled the ant-eaters and sloths in walking on the outer sides of their enormous fore-feet; but they differed from the latter in also applying only the outer side of the hind-feet to the ground. All these gigantic forms lived during the Pleistocene period; but in the lower Tertiaries of Patagonia they are represented by the much smaller *Eucholœops*, in which the skull was only some 5 inches in length; the teeth resembling those of the megathere.



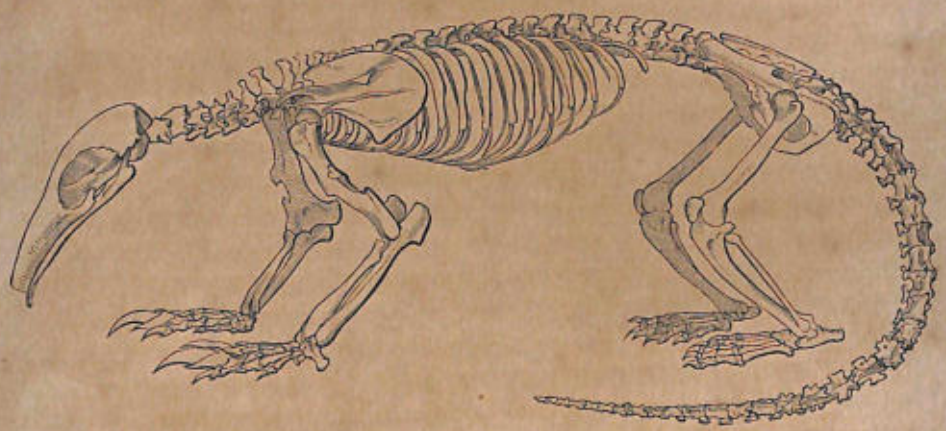
PALATAL VIEW OF SKULL OF EXTINCT GROUND-SLOTH (MYLODON).—After Owen.

The Ant-Eaters.

Family *Myrmecophagidæ.*

The ant-eaters, or, as they are often called, ant-bears, differ so widely in appearance and structure from the sloths that it is difficult to believe at first sight in their close relationship; indeed, had it not been for the fortunate preservation of the remains of the ground-sloths, it may be questioned whether even zoologists would have fully understood the alliance of the two. As it is, we have an excellent example of the effects of adaptation to widely different modes of life in modifying the organisation of nearly allied animals. In the present instance the extinct ground-sloths are probably the least removed from the original common type. In the sloths the needs of a purely arboreal life have led to a great elongation of the fore-limbs, coupled with the reduction of the digits to a few hook-like claws, and the functional loss of the tail. In the other group, the ant-eating habit has led to an extraordinary elongation of the skull, with the loss of all traces of teeth.

All the ant-eaters are characterised by the body being clothed with hair, and by the more or less marked elongation of the head, in which the mouth is tubular, and provided with a long worm-like tongue, while teeth are wanting. The mouth has only a small aperture at its extremity, through which, when feeding, the long extensile tongue, coated with viscid saliva, is rapidly protruded and as instantaneously withdrawn. The tail is always long, and in two species is prehensile. In the fore-feet the middle toe is enlarged and furnished with an enormous curved claw, while the other digits are reduced in size, and some of them may be rudimentary. The hind-limbs are as long as the front pair; and their feet terminate in four or five equal-sized and clawed toes. In the skeleton the collar-bones are generally rudimentary, although in one genus well-developed; and the ribs are remarkable for their breadth. In the soft parts the stomach is comparatively simple, the brain much more convoluted than in the sloths. The heart is very small. As their name implies, ant-eaters are purely insectivorous.



SKELETON OF GREAT ANT-EATER.

Great Ant-Eater. The great, or maned ant-eater (*Myrmecophaga jubata*)—known in Paraguay as the yurumi, and in Surinam as tamanoa—is the largest member of the family. Externally it is characterised by the extreme elongation of its narrow head, and the enormous mass of long hair clothing the tail. The anterior portion of the head forms a kind of cylindrical beak, which is of far greater length than the hinder half, and carries the small nostrils at its tip. The eyes are minute; and the oval ears small and erect. The body is somewhat compressed laterally, and is about equal in length to the tail, which is not prehensile. In the fore-feet claws are present upon all the toes except the fifth; that of the third being far larger than either of the others; when walking the toes are bent back, and the weight of the body supported on the upper surfaces of the third and fourth, aided by a hard pad at the extremity of the fifth. The hind-feet, in which the toes are of nearly equal length, are comparatively short,[1] and have the soles applied to the ground in walking. The hair is stiff and bristly; although short on the head it is of considerable, though varying, length on the body. On the neck and back it forms an upright mane; while on the fore-

[1] They are somewhat too long in the figure.

limbs and flanks it becomes still more elongated and pendent, but attains its maximum development on the tail, where it may measure as much as 16 inches in length. The general colour of the hair over a large part of the body is ashy grey mingled with black, this tint prevailing on the head, neck, back, flanks and hind-quarters, fore-legs and tail. The throat, chest, under-parts, hind-feet, and under-surface of the tail are blackish brown; while a broad black band, margined with white, extends obliquely upwards and backwards to terminate in a point on the loins. The length of the head and body is about 4 feet, the height at the shoulder being about two.



THE GREAT ANT-EATER, WITH THE TAIL ELEVATED ($\frac{1}{12}$ nat. size).

In addition to these external features, there are certain points in the internal anatomy of this ant-eater which demand some attention. In the first place, the exceedingly elongated skull is characterised by the zygomatic or cheek-arch being incomplete; and also by the circumstance that the passage above the bony palate, through which the creature breathes, instead of stopping short near the middle of the skull, is prolonged nearly to its hinder extremity. This is brought about by the union in the middle line of descending plates from the bones known as pterygoids; this feature occurring elsewhere among mammals only in certain dolphins and one genus of armadillo. In consequence of this arrangement the posterior or inner nostrils of the great ant-eater open at the back of the skull.

instead of near its middle. Another peculiarity of the skull is the absence of any postorbital process defining the hinder border of the socket of the eye, which is consequently continuous with the temporal fossa, or large open space at the side of the hinder portion of the skull. Then, again, the lower jaw is very long and slender, with an extremely short union in front between its two lateral branches, and without the process which usually ascends behind the socket of the eye for the attachment of the muscles of mastication. Like the sloths, the females of the great ant-eater have but a single pair of teats on the breast.

Distribution and Habits. Although distributed over the whole of the tropical portions of South and Central America, the great ant-eater is nowhere common; and from its nocturnal habits but seldom seen. It frequents either the low, wet lands bordering the rivers, or swampy forests; and is strictly terrestrial in its habits. Its strong claws might lead to the supposition that the creature was a burrower, but this is not the case. It has, however, usually a regular lair, or at least an habitual place of resort, generally situated among tall grass, where it spends the day in slumber, lying on one side, with its head buried in the long fur of the chest, the legs folded together, and the huge tail curled round the exposed side of the body. Except in the case of females with young, the ant-eater is, as a rule, a solitary creature. Its usual pace is a kind of trot, but when pursued it breaks into an awkward, shuffling, slow gallop. The food of the great ant-eater consists exclusively of termites and ants, together with their larvæ. In order to obtain these insects, the ant-eater tears open their nests or hillocks with the powerful claws of its fore-feet. As soon as the light of day is let into their domicile, the ants or termites rush to the surface in order to investigate the cause of the disturbance, and are forthwith swept up by hundreds adhering to the viscid tongue of the ant-eater, which is protruded and withdrawn with lightning-like rapidity.

The breeding-habits of the animal are still very imperfectly known. A single young is, however, produced by the female in spring, which is carried about on the back of its parent for a considerable time. The period of suckling lasts for several months; and even when the young ant-eater has taken to feeding on insects, it does not leave its parent until she is again pregnant.

Usually the ant-eater is a harmless, inoffensive creature, which may be driven in almost any direction so long as it is not pressed too hard. If, however, driven to close quarters, it turns furiously on its assailants, whom it attacks by hugging with its immensely muscular arms. It has been asserted, on the authority of the natives, that the ant-eater will even face and attack the jaguar; and although the truth of this statement was denied by the traveller Azara, a later explorer believes that it may be founded on fact. Like the sloths, ant-eaters are exceedingly difficult to kill, their skin being so tough that an ordinary small hunting-knife will make no impression on it, while their skulls may be battered with a heavy stone without producing any other effect than temporarily stunning the creatures.

These ant-eaters thrive fairly well in captivity in Europe; but spend most of their time in sleep, with the head, limbs, and tail folded up in the manner already mentioned. On awakening, the animal generally unfolds itself with considerable deliberation, usually sitting up at first on its hind-quarters, with its legs stretched out rigidly in front, and its bird-like head swaying slowly from side to side. "In

its slow and measured walk," writes Sclater, "the tail is stretched out in a straight line with the back (as in the illustration on p. 211), and the animal then presents a length of between 6 and 7 feet, of which the head occupies 1 foot, and the tail 3." The small mouth and face are cleaned from any of the viscid saliva which may have adhered to them by being rubbed from time to time against the slightly bent knee. The flesh of the great ant-eater, although black in colour, and musky in odour, is largely eaten by the natives and negroes of South America.

Tamandua.

The lesser ant-eater, or tamandua (*Tamandua tetradactyla*) is an animal of scarcely half the size of the preceding, from which it is distinguished by its much shorter head, longer ears, uniformly short bristly hair,



THE TAMANDUA ($\frac{1}{2}$ nat. size).

and the prehensile tail, of which the extremity, together with the whole length of the inferior surface, is naked and scaly. The three middle toes of the fore-foot have well-developed claws, of which that on the third is much larger than either of the others; while the first toe has only a minute claw, and the fifth is clawless, and concealed within the skin. The hind-foot is very similar to that of the great ant-eater, and has five subequal clawed toes. The structure of the skull is essentially the same; and the collar-bones are likewise rudimentary. The whole length of the head and body is about 2 feet, and that of the tail 6 inches less. As regards coloration, there is a great amount of individual variation. The general hue of the fur is, however, yellowish white, with a more or less marked rusty tinge; but a broad black band extends from the sides of the neck along the flanks, and becomes so deep on the hind-quarters as to appear the predominating colour. The tip of the snout, together with the lips, eyelids, and the soles of the feet, are naked and black; and the ears are but sparsely haired.

Distribution and Habits. The tamandua (which, by the way, is the Portuguese term for the creature, the native name being caguari) ranges through the tropical forests of South and Central America. It is mainly an arboreal animal: its climbing powers being largely aided by the prehensile tail. Generally nocturnal, it may be sometimes seen abroad during the day. Its movements are more rapid than those of the great ant-eater; and when asleep it lies on its belly, with the head bent under the chest and covered with the fore-feet, while the tail is curled along the side. Its food apparently consists mainly of ants, and termites—probably belonging to arboreal species; but it has been suggested that honey may likewise form a portion of its diet. Like the great ant-eater, it produces only a single young one at a birth. It is a much commoner animal than the tamanoa, and is said to be generally found on the borders of the forests. Frequently it ascends



TWO-TOED ANT-EATER (¼ nat. size).

to the top of the tallest trees. When pursued, it endeavours to escape by flight; but if hard pressed it turns on men or dogs in the same manner as its larger cousin, sitting up on its hind-quarters, and trying to hug its foes in its arms.

Two-Toed Ant-Eater. The third and last representative of the family (*Cyclothurus didactylus*) is no larger than a rat. Its skull is only slightly elongated. The length of the head and body is only 6 inches, and that of the highly prehensile tail a little over 7 inches. The fore-feet have four toes, of which those corresponding to the index and third fingers of man alone have claws; the claw of the third toe being very much larger than that of the second. In the hind-feet there are four nearly equal-sized toes, which are placed close together so as to form a hook-like organ somewhat after the fashion of the foot of a sloth. The fur is soft, thick, and silky; its colour being generally foxy red above and grey beneath, with the individual hairs greyish brown or black at the base, and yellowish brown at the tips. The skull differs from that of the other ant-eaters

by its shorter muzzle, and by the absence of the backward prolongation of the nasal passage on the palate, to which allusion has been already made. The lower jaw is less widely removed from the ordinary type. Another peculiarity in the skeleton is the presence of well-developed collar-bones; and it may also be noted that the ribs are so extraordinarily wide as to come nearly in contact with one another, and thus render the bony casing of the body well-nigh continuous.

Distribution and Habits.

The two-toed ant-eater is an exclusively arboreal animal, with a somewhat restricted geographical range. It inhabits Northern Brazil, Guiana, and Peru, between the 10th parallel of south and the 6th parallel of north latitude, and it also extends into Central America; its range thus including the very hottest portions of the continent. In the mountains it ascends to an elevation of some two thousand feet above the sea. It is either a rare creature, or one but seldom seen, even by the natives; frequenting the thickest portions of the forests, and escaping observation through its arboreal habits and diminutive size. Like its larger relatives, it leads, except during the pairing-season, a solitary existence; and it is likewise nocturnal, sleeping during the day among the boughs. Its movements are generally slow and deliberate; but when so disposed, it can climb quickly, always with the aid of the tail. Ants, termites, bees, wasps, and their larvæ, are its food. When it has captured a large insect, it sits up on its haunches like a squirrel, and conveys the prey to its mouth with its paws. Bates had one of these ant-eaters brought to him which had been captured while slumbering in a hollow tree. He kept it in the house for twenty-four hours, where "it remained nearly all the time without motion, except when irritated, in which case it reared itself on its hind-legs from the back of a chair to which it clung, and clawed out with its fore-paws like a cat. Its manner of clinging with its claws, and the sluggishness of its motions, gave it a great resemblance to a sloth. It uttered no sound, and remained all night on the spot where I had placed it in the morning. The next day I put it on a tree in the open air, and at night it escaped."

The Armadillos.

Family *Dasypodidæ.*

The armadillos, together with their near ally the pichiciago, constitute a well-defined South American family distinguished from other living mammals by the development of a number of bony plates in the skin, so as to form a more or less complete shield enveloping the body; and it is from the presence of this bony cuirass that the members of the family derive their distinctive Spanish title of armadillos. In general the bony shield of the back is formed by the union of quadrangular or many-sided plates, and is divided into an anterior and posterior solid portion, separated by a series of movable transverse bands, varying in number from three to thirteen. The anterior shield, into which the head and fore-limbs may be more or less completely withdrawn, is termed the scapular shield; while the posterior portion, which is notched for the tail, is known as the lumbar, or pelvic shield. The movable bands are composed of parallel rows of similar plates connected together by flexible skin: and in some cases the degree of flexibility in this region

is so great as to allow of the animal rolling itself into a complete ball. One peculiar genus of extinct armadillo differs from all living forms in that the whole body-shield was composed of these movable plates. Usually a certain number of hairs protrude between the bony plates of the armour; and in some cases these are so numerous as almost to conceal the armour, and give the appearance of a furry animal. Each bony plate is sculptured, varying in pattern in the different genera; and it is overlain by a horny shield, developed in the cuticle or epidermis; the bones themselves belonging to the true skin. The upper surface of the head is also protected by an armour of similar structure; and the tail is usually encircled by a series of bony rings. The limbs are likewise protected externally by a number of bony plates embedded in the skin, which do not, however, articulate together by their edges. The fore-feet are provided with very powerful curved claws adapted for digging, and varying in number from five to three; while in the hind-feet the claws are of smaller size, and invariably five in number. The numerous teeth are small and simple, looking like small pegs fixed in the jaws; and in one genus the anterior teeth are preceded by a deciduous milk series. The tongue is considerably elongated, although to a less extent than in the ant-eaters.



SKELETON OF ARMADILLO.

The elongated skull is characterised by the full development of the zygomatic or cheek arch; and the collar-bones are complete. In the hind-limbs the bones of the second segment—tibia and fibula—differ from those of the other existing members of the order by being united together at their lower extremities. Another peculiarity is that a variable number of the vertebræ in the middle of the neck are likewise immovably welded together. In the development of additional facets for mutual articulation, the vertebræ of the loins of the armadillos resemble those of the ant-eaters. The ribs are of considerable width; and the upper lateral processes of the back are specially developed for the support of the carapace. Most of the species are of comparatively small size; the largest living one not exceeding 3 feet in length, exclusive of the tail; but in the Pleistocene of Argentina there occurs the gigantic *Dasypotherium*, with a skull about a foot in length. In the Argentine pampas the armadillos are as a rule diurnal, in other districts many appear to be crepuscular or nocturnal. The majority are mainly or exclusively insectivorous, but one species consumes not only flesh, but vegetable substances. In disposition these Edentates are mostly harmless and inoffensive little creatures; a Gaucho remarking to Mr. Darwin, as he sharpened his knife on the back of one, "they are so quiet (*son tan mansos*"). All of them burrow in the ground; and so rapid is the act of burrowing, that, as the writer has witnessed, if a horseman sees one of these animals, it is almost necessary for him to tumble off his horse in order to capture it before it disappears in the soft soil of the pampas. They run with considerable speed, some of the species merely touching the ground with the tips of

their claws, and carrying the body elevated high on the limbs. They are found both on the open pampas and in the forests; and, with the exception of a single species which ranges as far north as Texas, they are restricted to the warmer parts of South and Central America. Their burrows are frequently found in the neighbourhood of the mounds erected by ants and termites; and although most of the species wander abroad in search of food, a few lead an almost exclusively subterranean and mole-like life. Except in the pairing-season, armadillos are solitary creatures; and they nearly always prefer flat, open country for their habitations. Although generally found in dry districts, they are said to be able to swim well and swiftly. In spite of the nature of their food (which in addition to ants and other insects includes snails and worms), the flesh of most armadillos is free from unpleasant flavour.

Pichiciago. The smallest, and at the same time the most curious representative of the whole group, is the tiny creature known as the pichiciago, or pink fairy armadillo (*Chlamydophorus truncatus*), which differs so remarkably from the true armadillos as to constitute a subfamily by itself. This Edentate was discovered by the American naturalist Harlan, at Mendoza in 1824, much to the astonishment of the natives, who had no knowledge of its existence. For many years it was known only by two examples—the one preserved in London and the other at Philadelphia; but of recent years a considerable number of specimens have been obtained; and it has been kept alive in the Zoological Gardens at Buenos Aires.

The pichiciago is only about 5 inches in length; and, while the shield or mantle covering the head and body is pink, the fur is of a snowy white. The head is short, widest behind, and gradually tapering to the muzzle, where it terminates in a short and abruptly truncated snout, with small and rounded nostrils. The small and almost rudimentary eyes are nearly concealed among the long hair;[1] and the ears are quite invisible, having scarcely any external conchs. The mouth is very small, with the lips hard and stiff; and the rather long and fleshy tongue is conical, and covered above with warty protuberances. The teeth, of which there are eight in the upper and eight or nine in the lower jaw, are small and nearly cylindrical; those in the middle of the series being larger than at the two extremities. The neck is short and thick; and the body long and depressed, becoming gradually wider from the shoulders to the abruptly truncated hinder extremity. The limbs are short, and the front pair much more powerfully made than the hinder ones. Both are provided with five toes; but whereas in the fore-limbs these are connected nearly to the bases of the claws, in the hind-pair they are entirely free. The second claw in the fore-foot is the largest, and the fifth the smallest; while the claws of all the hind-toes are comparatively small. The tail, which protrudes through a notch in the lower border of the bony shield on the hind-quarters, is short and inflexible, terminating in a flattened and pointed paddle-like expansion, and covered with a leather skin, dotted over with small horny plates. The whole of the upper surface of the body is covered with a continuous shield, or mantle, of quadrangular horny scales, underlain by very thin bony plates. This mantle commences in a point a short distance above the muzzle, and

[1] They are made too conspicuous in our figure.

gradually increases in width to the hinder extremity of the body, where it is abruptly truncated. Instead of being firmly attached to the body throughout its extent, the mantle is only affixed along the line of the backbone, and consequently lies quite loosely on the hairy sides of the body; on the head it is, however, firmly joined to the bones. There are usually about twenty transverse rows of plates in the mantle; and while the number of plates in each row at the hinder extremity of the head varies from seven to eight, on the loins there may be as many as twenty-four in a row. The abruptly truncated hinder extremity of the body is protected by a solid shield, composed of firmly welded plates of bone, overlain by thin scales of horn. This shield is slightly convex, and forms a segment of a circle, the centre of which would be the notch in its inferior border through which protrudes the tail. It is firmly welded to certain bony processes arising from the pelvis, and



THE PICHICIAGO (½ nat. size).

comprises five or six concentric rows of plates; the number in the uppermost row being about twenty, and that in the lowest only six. The entire shield is placed in a nearly vertical plane. Both externally and internally the mantle is smooth and devoid of hair. With the exception of the tail, the soles of the feet, the snout, and the chin, which are nearly naked, the whole of the skin is covered with a coat of long, silky hair, forming a fringe along the edges of the mantle. This hair is longest on the flanks and limbs, and shortest on the upper surface of the feet, where it is intermingled with wart-like masses of horn. The female pichiciago has a single pair of teats situated on the breast, as in the armadillos.

Distribution and Mode of Life. The pichiciago is a rare animal, confined to the western part of Argentina, and is least uncommon in the neighbourhood of Mendoza; where, as elsewhere, it frequents open, sandy dunes, or their proximity, the vegetation in such spots consisting of thorny brushwood and cacti. The best account of the habits of this creature is given by Mr. E. W. White, who writes that, when walking, the pichiciago "plants both the fore and hind-feet on the soles, and

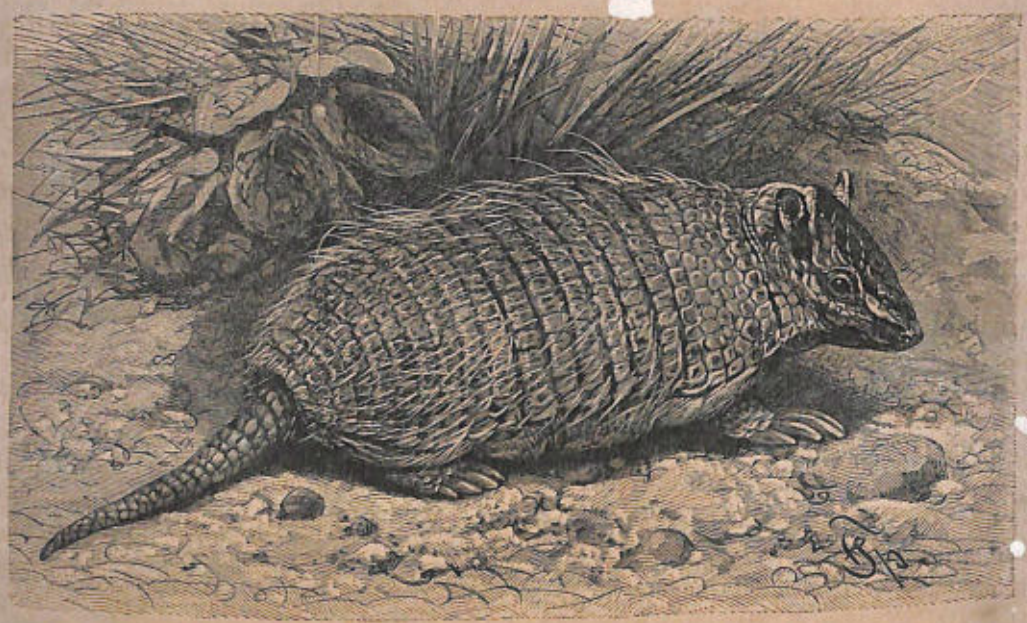
not on the contracted claws, carrying its inflexible tail, which it has no power to raise, trailing along the ground, and much inclined downwards from the body. As it commences to excavate, the fore-feet are first employed; and, immediately afterwards, supporting its body on the tripod formed of these and the extremity of the tail, both hind-feet are set to work simultaneously, discharging the sand with incredible swiftness. The burrows, which are never left open, usually have but slight, if any, inclination to the horizon. Sluggish in all its movements, except as a fodient, in which capacity it perhaps excels all other burrowing animals, the *Chlamydophorus* performs the operation of excavation with such celerity that a man has scarcely time to dismount from his horse before the creature has buried itself to the depth of its own body." Mr. White believes that the use of the bony shield at the hinder extremity of the body is to act as a rammer in closing up the entrance to its burrow, and he is further of opinion that when the creature desires to come above ground, it emerges by digging a new exit. When in search of a spot in which to burrow, the pichiciago utters a sniffing sound, but is otherwise silent. "So extremely sensitive is this delicate little burrower to cold," writes Mr. White, "that my living example, after passing a night in a box of earth covered with flannels, was found the following morning in a very exhausted condition. Wrapped in warm clothing, and placed near a fire, it soon revived. On taking it in my hand under a Mendozan midday sun it shivered violently; but whether through fear or chill it is impossible to say. Its normal paradise seems to be when the temperature of its residence is such as is produced by sand so hot as almost to scorch the hand; and yet, if cold be unfriendly, no less so is wet, for although its winter is spent beneath the earth, a fall of rain quickly drives it from its retreat. During summer it leaves its burrow at dusk to search for food; and being truly nocturnal, moonlight nights are very favourable for discovering it." A second, and rather larger species of pichiciago (*C. retusus*) inhabits Bolivia, and is distinguished from the typical form by the mantle being attached to the skin of the back throughout its whole extent.

True Armadillos. The remaining members of the family, with the exception of the peba armadillo and its allies, are included in a single subfamily, characterised by the division of the bony carapace on the back into scapular and lumbar shields, separated from one another by a variable number of movable bands. They all have moderate-sized ears, set at a considerable distance apart; and the first and second claws of the fore-feet are, when present, slender; while the females have but a single pair of teats on the breast.

Six-Banded Armadillos. The weasel-headed, or six-banded armadillo (*Dasypus sexcinctus*) is the type of a genus characterised by having usually six or seven, but occasionally eight, movable bands in the carapace; each bony plate of which is marked by an elliptical row of punctures. The head is broad and flattened, with an obtusely pointed muzzle, and rather small or moderate-sized ears; and the body is broad and much depressed. In length the tail is less than the head and body; and the plates on its basal portion form well-defined rings. Of the five toes in the fore-feet, the first is the most slender, the second is the longest, while the three outer ones are the stoutest, and gradually diminish in size from the third to the fifth. They have a rounded inner border, and a sharp outer and lower edge.

The teeth may be either nine in the upper and ten in the lower jaw, or one less in each; they are of large size, and the first upper pair are generally implanted in the premaxillary bones. The figured species, which attains a length of about 16 inches, exclusive of the tail, inhabits Brazil and Paraguay; but is replaced in Argentina by the closely allied peludo, or hairy armadillo (*D. villosus*). The fleecy armadillo (*D. vellerosus*), from Argentina and the north of Patagonia, and the pichi, or pigmy armadillo (*D. minutus*) of Argentina, are much smaller forms; of which the second is distinguished by the absence of any teeth in the premaxillary bones.

Habits. The different species of the genus vary somewhat in habits; the pichi being mainly diurnal, while in the cultivated districts of Argentina the peludo has become nocturnal. The pichi, according to Mr. Darwin,



THE WEASEL-HEADED ARMADILLO (½ nat. size).

prefers a very dry soil; and the sand-dunes near the coast, where for many months it can never taste water, are its favourite resort; it often tries to escape notice by squatting close to the ground. All of the species live in burrows, where in winter or spring the young are born; the number in a litter varying from two to four, although the female has but a single pair of teats with which to afford them nourishment. The young are born blind, but with their armour fully formed, although soft and flexible. They grow with great rapidity, and remain for several weeks in the burrows; it is believed, however, that they are not suckled for any very lengthened period, and that they soon learn to shift for themselves. The armadillos of this genus are usually found alone; and most of them feed chiefly on ants and other insects, although they will also attack and devour small snakes. On the other hand, the peludo is omnivorous. Dr. E. Peard writes that this species "comes forth for a short time only by day; on a moonlight night he may be met

with at any hour. I have very often made a peludo post-mortem examination, and several times found his last meal consisted of putrid flesh, as well as insects and vegetable fibre. I do not mean to assert that he cannot live on vegetables alone; but he evidently does not prefer them, and looks on a dead lamb or other animal as a *bonne bouche* by no means to be despised. A fresh peludo-burrow may almost invariably be found by or underneath a stinking carcase. This is not merely that the occupant may avail himself of the maggots bred in the carrion, for pieces of the flesh may frequently be seen drawn partly into the burrow, and the softer parts chewed and eaten." These flesh-eating propensities of the peludo frequently lead to its destruction, since these animals often devour the poisoned meat spread for wandering dogs and foxes. It is also stated that in some districts, where peludoes are so numerous as to render riding dangerous, on account of their burrows, flesh poisoned with strychnine is exposed for their destruction. The foregoing observations are confirmed by Mr. W. H. Hudson, who writes that the peludo, like its fast-disappearing congeners, "is an insect-eater still, but does not like them seek its food on the surface and on the ant-hill only; all kinds of insects are preyed on, and by means of its keen scent it discovers worms and larvæ several inches below the surface. Its method of taking worms and larvæ resembles that of probing birds for it throws up no earth, but forces its sharp snout and wedge-shaped head down to the required depth; and probably while working it moves round in a circle, for the hole is conical, though the head of the animal is flat. Where it has found a rich hunting-ground, the earth is seen pitted with hundreds of these neat symmetrical bores. It is also an enemy to ground-nesting birds, being fond of eggs and fledglings; and when unable to capture prey it will feed on carrion as readily as a wild dog or vulture, returning night after night to the carcase of a horse or cow as long as the flesh lasts. Mr. Hudson adds that this armadillo resorts to a vegetable diet only when animal food fails; and states that on such occasions it will eat not only clover, but likewise grains of maize, which are swallowed whole. The peludo also displays marked intelligence in capturing some of the animals on which it preys. Mr. Hudson had a tame one which was an adept at catching mice in a most ingenious manner. After stating that the creature had a most keen sense of smell, and was in the habit of trotting along with its nose to the ground like a beagle, Mr. Hudson writes that "when near his prey he became agitated, and quickened his motions, pausing frequently to sniff the earth, till, discovering the exact spot where the mouse lurked, he would stop and creep cautiously to it; then, after slowly raising himself to a sitting posture, spring suddenly forwards, throwing his body like a trap over the mouse or nest of mice concealed in the grass." Still more remarkable is the manner in which a peludo has been observed to kill a snake, by rushing upon it and proceeding to saw the unfortunate reptile in pieces by pressing upon it closely with the jagged edges of its armour, and at the same time moving its body backwards and forwards. The struggles of the snake were all in vain, as its fangs could make no impression upon the panoply of its assailant; and eventually the reptile slowly dropped and died, to be soon after devoured by the armadillo, which commenced the meal by seizing the snake's tail in its mouth, and gradually eating forwards.

Hunting. Both the peludo and the weasel-headed armadillo are hunted for the sake of their flesh, with dogs specially trained for the purpose. A moonlight night is generally selected for the pursuit; and the hunter arms himself with a stout cudgel, pointed at one end. As soon as the armadillo perceives the dog, it either makes straight for its burrow, or endeavours to bury itself by digging a hole where it stands. If the dog come up with the creature before it gain its retreat, its fate is sealed. As the carapace affords no hold, the dog generally seizes the armadillo by the head, or a paw, and holds it till the arrival of his master, by whom it is despatched with a blow on the head from his stick. A specially clever dog will, however, endeavour to overthrow the armadillo as it runs by thrusting his nose under the edge of the carapace. The creature is then promptly seized by the soft under-parts, and soon killed; the teeth of the dog crunching up the edges of the carapace as readily as an egg-shell is crushed in the hand.

Broad-Banded Armadillo. The tatouay, or broad-banded armadillo (*Lysiurus unicinctus*), of Surinam, Brazil, and Paraguay, is the best known representative of a small genus distinguished from the last by the presence of twelve or thirteen movable bands in the carapace, and likewise by the teeth. The latter are either eight or nine in number on each side of both the upper and lower jaw, and are of moderate size; while in the upper jaw the last of the series is placed considerably in advance of the hinder extremity of the bony palate, instead of close to it, as in the preceding group. The head has the same general form as in the six-banded armadillos, with rather widely separated, large, and rounded ears; and by the presence of from twenty to twenty-five teeth on each side of the jaws. The slender tail, which is considerably shorter than the body, is nearly naked, except for a few bony plates on its under-surface and near the tip. In the fore-foot the third toe has a huge curved claw, much larger than that on either of the others; the claws of the first and second toes being slender. The hind-feet have short triangular nails, of which the first is the shortest and the third the longest. The bones of the armour are ornamented with an indistinct granular sculpture. Next to the under-mentioned giant armadillo, the present species is the largest of the group. Its habits are probably very similar to those of the six-banded armadillo, although our information is somewhat scant on this point.

Giant Armadillo. By far the largest living member of the family is the giant armadillo (*Priodon gigas*), from the forests of Surinam and Brazil, which attains a length of nearly a yard from the tip of the snout to the root of the tail, and is the sole representative of its genus. While agreeing with the broad-banded armadillo in the number of five bands in the carapace, and the general structure of its feet, this species is distinguished by the still greater relative development of the third toe, and the small size of the claw of the fifth. It is further characterised by the small size and elongated form of the head, on which the ears are oval and rather small; and by the tail, which is nearly equal in length to the body, being covered with large scales arranged in spiral rows. There are ten rows of plates in the scapular, and sixteen or seventeen in the pelvic shield. With the exception of the head, tail, and a band on the sides, which are whitish, the colour is blackish brown. The immensely powerful front claws of this armadillo

clearly proclaim its fossorial habits; and it is said to feed chiefly on ants and termites, although not averse to carrion.

Three-Banded Armadillos.

The common three-banded armadillo, or apar, (*Tolypeutes tricinctus*), is the typical representative of a genus comprising three rather small species, distinguished by the great development and solidarity of the scapular and lumbar shields of the carapace, and the reduction of the movable bands to three. The teeth, of which there are nine on each side of the lower jaw, and either nine or eight in the upper jaw, are relatively small, and extend back



THE GIANT ARMADILLO (¼ nat. size).

nearly to the end of the palate. The head is long and narrow, with the elongated and oval ears placed rather low down on its sides. The third claw in the fore-feet is even more developed than in the giant armadillo; the first and fifth claws being very minute or wanting. In the hind-foot the three middle toes have short hoof-like nails; while those of the first and fifth digits are smaller and compressed. The plates of the carapace are small and polygonal, with a strongly-marked granular sculpture. Both the scapular and lumbar shields of the carapace are very large, and much produced on the sides of the neck and tail, thus forming large chambers into which the limbs, tail, and head, can be withdrawn. The conical tail is less than a third the length of the body, and is covered with bony tubercles. The total length of the head and body is about 15 inches; and

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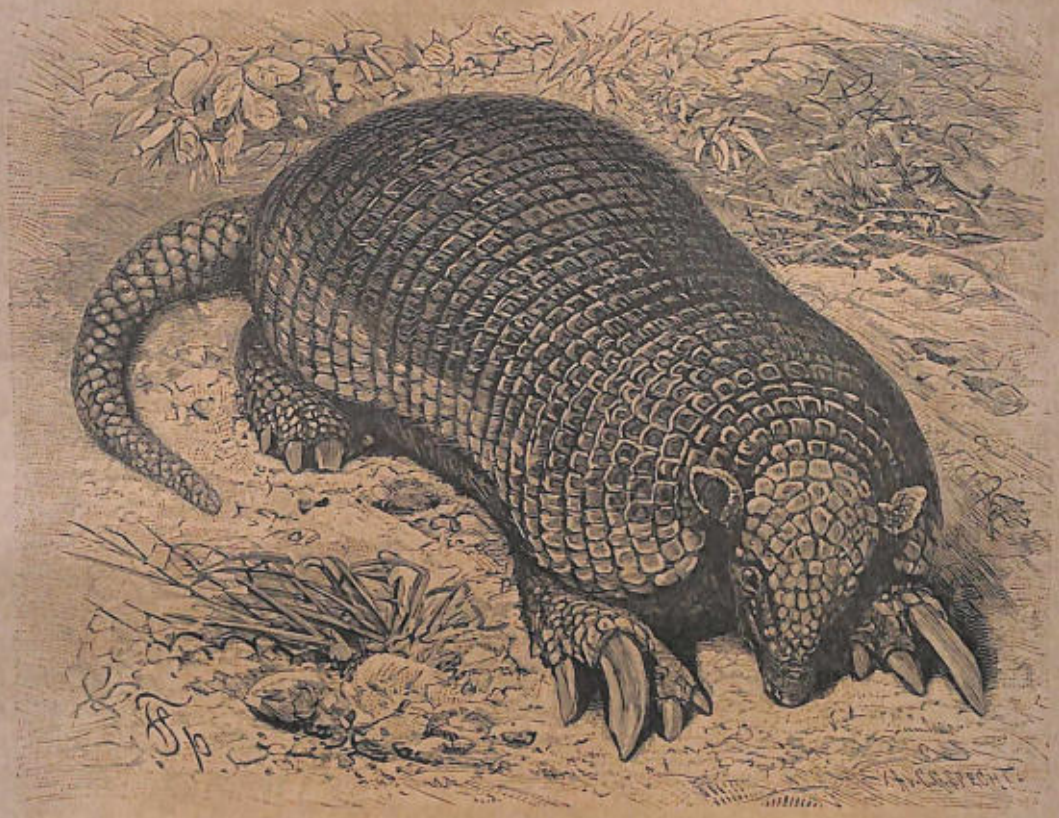
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Three-Banded Armadillos.

The common three-banded armadillo, or apar, (*Tolypeutes tricinctus*), is the typical representative of a genus comprising three rather small species, distinguished by the great development and solidarity of the scapular and lumbar shields of the carapace, and the reduction of the movable bands to three. The teeth, of which there are nine on each side of the lower jaw, and either nine or eight in the upper jaw, are relatively small, and extend back

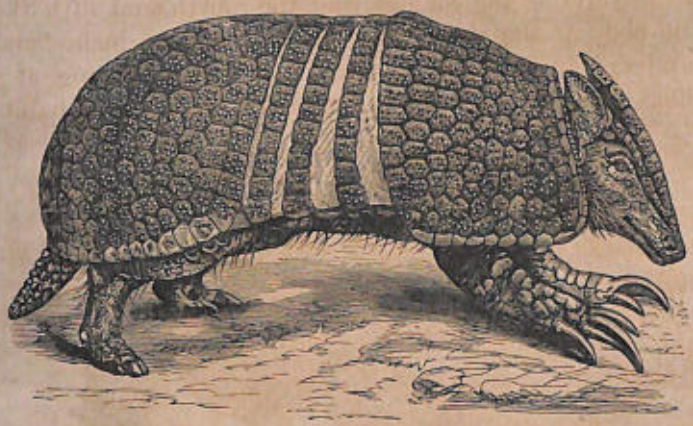


THE GIANT ARMADILLO ($\frac{1}{6}$ nat. size).

nearly to the end of the palate. The head is long and narrow, with the elongated and oval ears placed rather low down on its sides. The third claw in the fore-feet is even more developed than in the giant armadillo; the first and fifth claws being very minute or wanting. In the hind-foot the three middle toes have short hoof-like nails; while those of the first and fifth digits are smaller and compressed. The plates of the carapace are small and polygonal, with a strongly-marked granular sculpture. Both the scapular and lumbar shields of the carapace are very large, and much produced on the sides of the neck and tail, thus forming large chambers into which the limbs, tail, and head, can be withdrawn. The conical tail is less than a third the length of the body, and is covered with bony tubercles. The total length of the head and body is about 15 inches; and

the general colour is dark grey, with a more or less marked brown tinge; the skin between the movable bands being whitish, while that on the under-surface of the body is dusky.

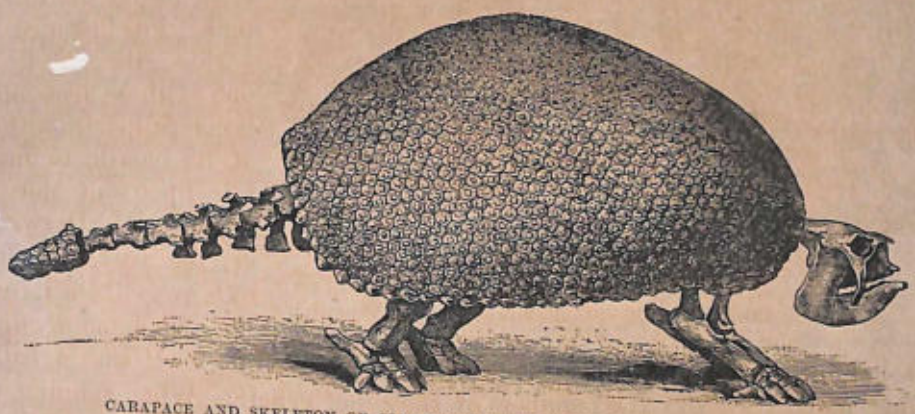
The apar is found throughout the Argentine pampas; and, in common with the other two members of the genus, differs from the rest of the armadillos in being able to roll itself up into a complete ball, with the shield of the head and the bony upper-surface of the tail packed away side by side, and thus completely filling up the notches in the scapular and lumbar shields. In this state the creature is perfectly safe from nearly all foes save man. For instance, when a dog attempts to seize one of these armadillos, it is compelled, from the size of its mouth, to make a bite upon one side, upon which, as Mr. Darwin tells us, the ball immediately rolls away from its grasp. The apar is mainly diurnal in its habits; and trusts for defence to its power of rolling itself into a ball, not dwelling in burrows like the members of the other genera. When running, these armadillos tread only on the tips of the claws of the fore-feet, and consequently have the edges of the carapace raised high above the ground. Our figure represents a specimen with the fore-legs stretched out in front preparatory to digging up an ant's nest. In captivity these armadillos will eat fruit and green vegetables; although, on account of the small size of their mouths, it is necessary that all the food with which they are supplied should be chopped up into small pieces. Fossil remains of armadillos of this species, together with others belonging to all the genera except *Priodon*, are met with in the cavern-deposits of Lagoa Santa, in Brazil; and are mostly referable to species still existing in the country.



THE THREE-BANDED ARMADILLO.

Peba Armadillo. The Peba armadillo (*Tatusia novemcincta*), ranging from Texas to Paraguay, together with the mulita—"little mule"—(*T. hybrida*), of Argentina and other parts of South America, and certain allied species, differ from all the members of the family yet noticed by the elongated ears being closely approximated at their roots, by the female having a pair of teats on the abdomen, in addition to the two on the breast, and by the circumstance that the permanent teeth, with the exception of the last pair in each jaw, are preceded by deciduous milk-teeth, each furnished with two roots. The permanent teeth, which are either seven or eight in number in each side of both the upper and lower jaws, are very small in proportion to the size of the skull, and do not come into use until the animal has well-nigh attained its full dimensions. The head is narrow, and produced into a nearly cylindrical snout, obliquely truncated at the extremity; and the bony palate of the skull has a backward prolongation formed in the same manner as

that of the great ant-eater. The body is long and narrow, with from seven to nine movable bands between the scapular and lumbar shields; the former being produced on either side of the shoulders, and having a deep notch at the neck. Each bony plate is ornamented with a series of pits arranged in the shape of a V. The tail is nearly or quite as long as the body, and surrounded for the greater part of its length with complete bony rings. The fore-feet have four long claws, of which the inner pair are considerably larger than the others; while the hind-feet carry five claws, of which the third is the longest, and the fourth and fifth the shortest. The length of the body of the peba armadillo is about 16 inches, and that of its tail some 2 inches less. In producing from six to twelve young at a birth the peba armadillo differs from all the species hitherto noticed. It inhabits



CARAPACE AND SKELETON OF GLYPTODON, WITH THE TAIL-SHEATH IMPERFECT ($\frac{1}{12}$ nat. size).—After Zittel.

burrows in the open plains, and feeds largely on carrion, which is said to be stored up in the burrows for future consumption. In spite of this unsavoury diet, the peba is much hunted for its flesh, which is stated to be of delicate flavour.

Other Species. The above-mentioned mulita is a smaller species, with a relatively shorter tail. A very remarkable form is the rare shaggy armadillo (*T. pilosa*) from Peru, in which the cheeks and the whole of the carapace, except the front margin, as well as the upper parts of the limbs and the under surface of the body, are covered with a thick coat of light brown hair, of about an inch and a half in length. So dense is this hairy covering that the carapace is completely concealed, giving to the creature, save for its mail-clad head, the appearance of an ordinary hairy mammal.

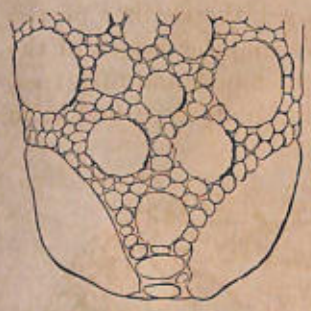
The Extinct Glyptodonts.

Family *Glyptodontidæ*.

As we have seen, the carapace of the largest existing armadillo scarcely exceeds a yard in length; but during the Pleistocene, or latest, geological period, there existed in South America a number of gigantic armadillo-like animals, in some of which the carapace attained a length of between 6 and 7 feet. All these Edentates differed from the living armadillos in having complex teeth (eight in

number on each side of the jaws), which were divided into three prisms by a pair of deep vertical grooves on each side. In all of them the carapace consists of a single solid shield, formed of a number of polygonal bony plates, which are firmly united together by suture. A peculiar form from Brazil known as the chlamydothere serves in some respects to connect the glyptodonts with the armadillos, having the carapace of the latter, and the teeth approximating to those of the former. The typical species was about the size of a rhinoceros; but others were smaller.

In all the glyptodonts the skull was short, the feet were short and massive, generally with five toes in front and four behind; and the limbs were likewise short and massive. In the larger forms the bony plates of the carapace were fully an inch in thickness; and in all the species the head was protected by a bony shield, somewhat similar in structure to the carapace. In the larger types, constituting the genus *Glyptodon*, the carapace was much vaulted, and its margins ornamented with a number of large projecting tubercles; while the tail was protected by a series of bony rings, also ornamented with bosses, gradually diminishing in size from root to tip. In one species the total length, along the curve of the back, from the nose to the end of the tail was 11½ feet, while the carapace measured 7 feet in length and 9 in width, inclusive of the curves. On the other hand, in the mostly smaller forms known as *Lomaphorus*, the carapace was less vaulted, and devoid of bosses on the margin; while the tail had several movable smooth rings at the root, and terminated in a long bony tube of more than a yard in length. The extremity of such a tube, showing the large bony plates with which its surface is covered, is shown in the accompanying cut.



END OF SHEATH OF TAIL OF A GLYPTODONT, MUCH REDUCED.

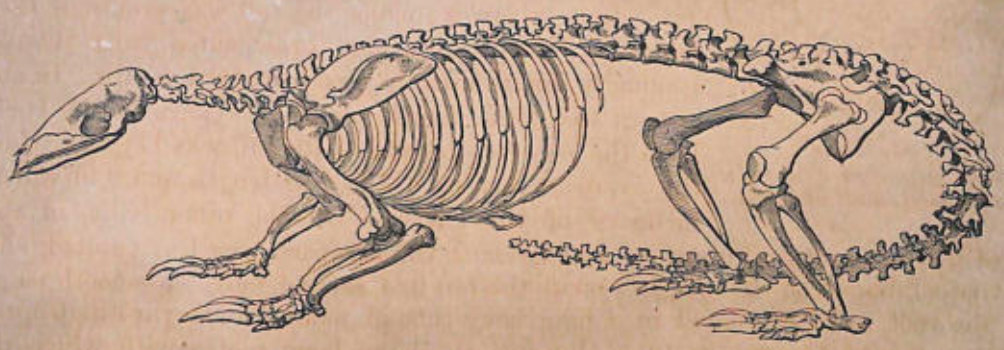
Another gigantic kind from the pampas, distinguished by the tail terminating in a huge flattened club, armed during life with horns, is known as *Dædicurus*. In the Miocene beds of Patagonia all the glyptodonts were of smaller size.

The Pangolins.

Family *Manidæ*.

Stranger even than the armadillos are the Edentates commonly known as pangolins, or scaly ant-eaters, which may be compared in appearance to an animated spruce-fir cone furnished with a head and legs. These creatures constitute a family by themselves, in which there is but a single genus—*Manis*, and, like the remaining representatives of the order, they are confined to the Old World. As already mentioned, the relationship of the pangolins to the typical New World Edentates, is remote; and it may be even questioned whether the group is rightly included in the same order. Their internal anatomy is of a different type; and the joints of the backbone lack the additional articular processes characterising most of the American Edentates.

The pangolins may be briefly characterised as a family by the total want of teeth, and by the upper surface and sides of the body and the whole tail being covered with a number of large, overlapping horny scales. Their limbs are short, with five toes on each foot; and the long, worm-like tongue is capable of being protruded a great distance from the small mouth. The head is small, long, and pointed, with the eyes small, and the external conchs of the ears minute or rudimentary. The scales of the body extend on to the outer sides of the limbs; but they are absent from the inner surfaces of the latter, as well as from the sides of the head and the inferior aspect of the body, all of which are sparsely covered with hair. There are often a few coarse, bristly hairs arising from between the scales. All the toes have slightly curved claws, which are much longer in the front than in the hind-feet, and of which the third is larger than either of the others. In walking, the front toes are bent under the feet, and the weight of the body supported mainly on the upper and outer sides of the fourth and fifth toes. On the other hand, the hind-feet are of the ordinary plantigrade type, and have



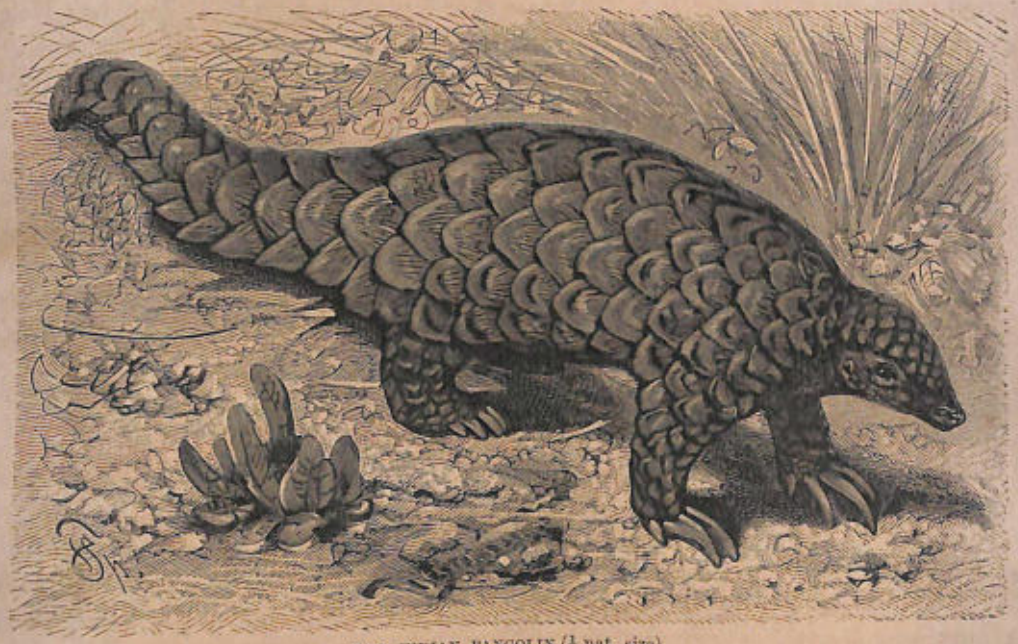
SKELETON OF PANGOLIN.

the whole sole applied to the ground in walking. The female has a pair of teats situated on the breast. In the skeleton the skull is remarkable for its smooth and solid structure, and almost conical form. The zygomatic, or cheek-arch, is incomplete, and there is no distinction between the sockets of the eyes and the fossæ at the hinder extremity of the skull; while the palate is much produced backwards. The lower jaw is extremely slight and slender, without any ascending or descending processes. In many of these respects the skulls of the pangolins approach those of the true ant-eaters; but it must be remembered that such resemblances are purely adaptive, and are brought about by the identical modes of life of the two groups. Two other points may be noticed in the skeleton;—firstly, that collar-bones are wanting; and, secondly, that the terminal joints of the claws are deeply cleft.

Distribution and Mode of Life. The pangolins, of which the largest species attains a length of about 6 feet, are exclusively confined to Africa south of the Sahara, and South-Eastern Asia. Africa possesses the largest species, and the greater number of forms. The pangolins are essentially burrowing and nocturnal animals, feeding exclusively on ants and termites, which are captured on the long extensile tongue. They have the power of rolling themselves into a ball as a

protection against foes; and when thus coiled up their muscular strength is such as to set at defiance any attempt to unroll them.

Asiatic Pangolins. Asia is inhabited by three species of the family, namely, the Indian pangolin (*Manis pentadactyla*), confined to India and Ceylon, and represented in the accompanying figure; the Chinese pangolin (*M. aurita*), ranging from Nipal and Assam to China; and the Malayan pangolin (*M. javanica*), inhabiting the regions to the westward of the Bay of Bengal as far as Celebes, and also occurring in North-Eastern India. All these species agree with one another in having the whole of the outer surfaces of the limbs covered with scales, and in their tapering tails, on which the middle upper rows of scales is continued uninterruptedly to the extremity. In the first two species the front

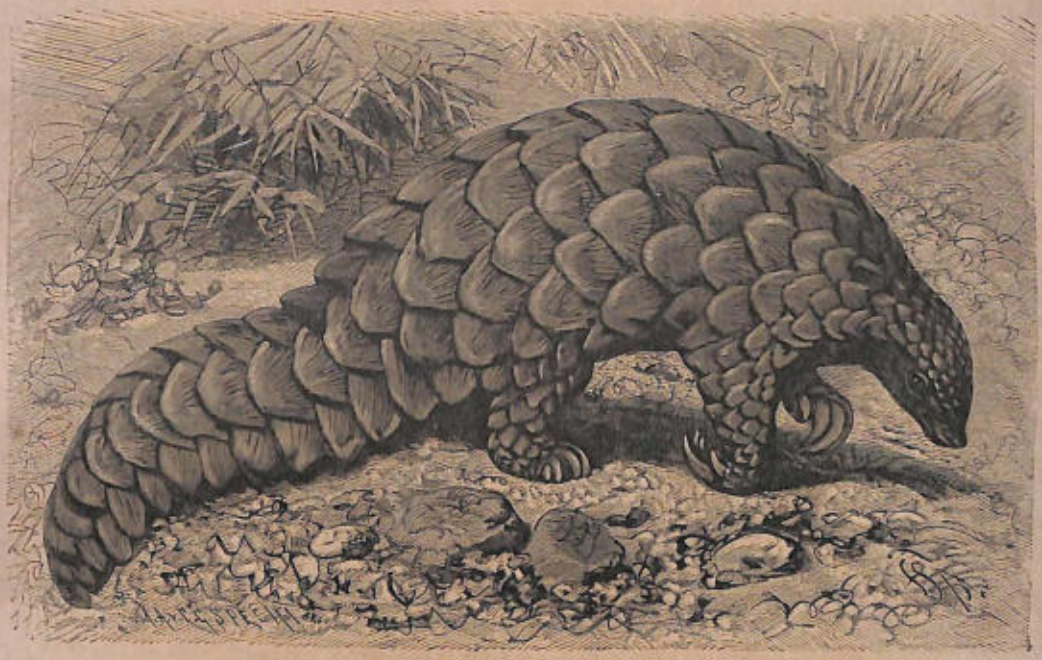


THE INDIAN PANGOLIN (⅛ nat. size).

claws are about twice the length of the hinder ones; the Indian pangolin being distinguished by having from eleven to thirteen rows of scales round the body, against from fifteen to eighteen in the Chinese species. On the other hand, the more slenderly-built and longer-tailed Malayan pangolin differs from both the others in having the claws on the fore-feet only slightly exceeding in length those of the hind-feet. In the Indian pangolin the length of the head and body is just over 2 feet, and that of the tail a foot and a half.

Habits. The habits of all the three kinds are believed to be similar, although the Malayan species is probably less of a burrower than the others. The Indian pangolin dwells either among the crevices and clefts of rocks, or in burrows of its own construction; such burrows extending to a depth of from eight to twelve feet below the surface, and terminating in a large chamber, which may be as much as six feet in diameter. Here a pair of these animals take up their abode, and in the winter or early spring give birth to their young. The

young, which are one or two in number, are covered with soft scales at birth, but it does not appear to be ascertained whether they are born blind. When inhabited, the entrance to the burrow is stopped with earth; and it is rarely that its occupants are seen abroad after sunrise. The food consists chiefly of termites; the pangolin tearing open the nests of these insects with its powerful front claws, and thrusting its long glutinous tongue into their runs. The tongue is rapidly withdrawn with a swarm of the white ants clinging to it. In captivity pangolins will readily eat finely-chopped raw meat, hard-boiled eggs, and rice. Their stomachs have a somewhat gizzard-like structure; and frequently contain a few small pebbles, probably introduced to aid in triturating the food. In captivity pangolins drink freely by rapidly extending and withdrawing the tongue; but Mr. Blanford



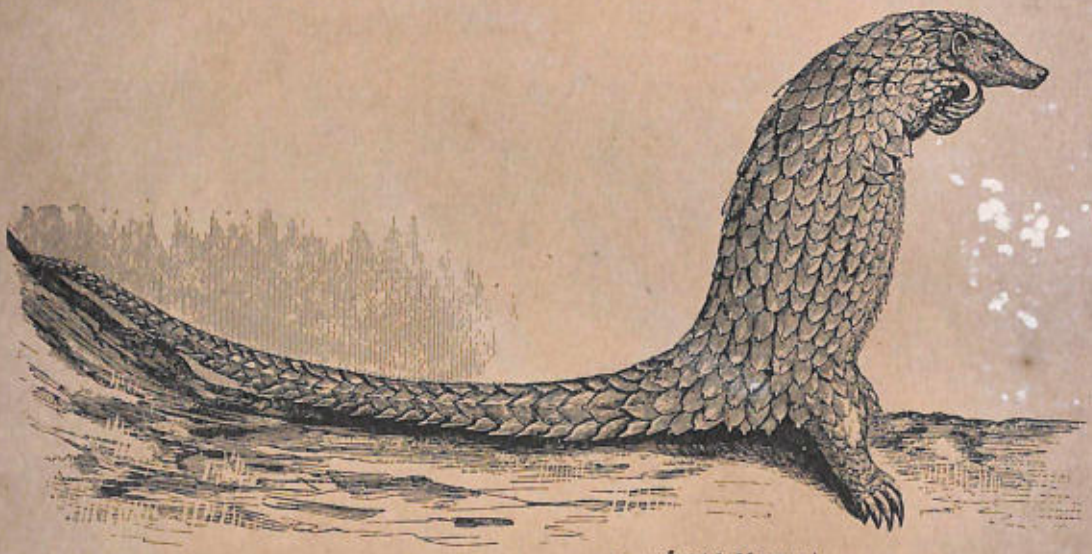
THE SHORT-TAILED PANGOLIN (⅓ nat. size).

doubts whether this habit is natural to them, as they are often found in places where there is no water. When irritated, pangolins will give vent to a hissing sound; but at other times they are believed to be silent.

African Pangolins. There are four African species of pangolin, all of which are characterised by the middle row of scales on the upper surface of the tail bifurcating at a short distance from the tip. They are also distinguished by the absence of any external conch to the ear, and the lack of any hairs growing between the scales; while in some of them the scales do not extend all the way down the outer surfaces of the limbs. Of the four species, the long-tailed pangolin (*M. macrura*) is easily recognised by the great length of its tail, which is nearly twice as long as the body, and also by the absence of scales at the lower part of the outer surface of the fore-limbs. A nearly allied form is the white-bellied pangolin (*M. tricuspis*), distinguished by its larger and tricuspidate scales, and

the white under-parts. The short-tailed pangolin (*M. temminckii*) is readily distinguished by its short and blunt tail, in which the under surface of the tip lacks the bare patch found in all the other species except the next. The outer surfaces of the limbs are also fully scaled. The giant pangolin (*M. gigantea*) is sufficiently distinguished from the last by its superior size. It is remarkable that the remains of a closely-allied species have been found in a cavern in Madras. The whole of the four African species inhabit the West Coast; but the short-tailed species also extends to South Africa and ranges across the Continent to Zanzibar and Southern Somaliland.

Habits. The general habits of the African pangolins appear to be very similar to those of their Asiatic cousins. While, however, the long-tailed and the white-bellied pangolins are partially arboreal, the other two are purely terrestrial. Most of the observations as to their habits have, however, been made



WHITE-BELLIED PANGOLIN. (From *Guide to British Museum.*)

from captive specimens. In 1878, Mr. F. Holwood, in sending a young example of the short-tailed pangolin to the London Zoological Gardens, wrote as follows to the secretary. These pangolins "always appeared to burrow in hard or stony ground, and I saw them always in the daytime. The mother of the specimen I sent you lived three months in Zanzibar. She only fed at night, and remained curled up in a ball all day. She regularly retired to the dark corner of my harness-room at daylight, and left for the garden at sunset. There were very few ants, but she seemed to get plenty of insects. She burrowed at intervals all round the garden walls, but this was evidently only trying to escape, as she never made a hole large enough to give cover." Although the scales of this young pangolin were quite soft at birth, they had completely hardened by the second day. Mr. L. Fraser relates how his pangolins would climb the somewhat roughly-hewn square posts, which supported a building, and sometimes roll up into a ball and throw themselves down, apparently without suffering any inconvenience from the fall.



CAPE AARD-VARKS AT HOME.

The Aard-Varks.

Family *Orycteropodidæ.*

The name aard-vark, or earth-pig, has been applied by the Dutch Boers of the Cape to the southern representative of the second group of Old-World Edentates, of which there are two living species exclusively confined to Africa. To the English colonists of South Africa the Cape species is known as the ant-bear; while by the zoologist the aard-varks are termed *Orycteropus*, and collectively constitute a very distinct family group. In addition to the two living forms, the remains of



THE ETHIOPIAN AARD-VARK. (From Sclater, *Proc. Zool. Soc.*, 1876.)

an extinct species have been discovered in the Pliocene deposits of the island of Samos; while those of another have been recorded from the Oligocene beds of France.

In appearance both species of aard-vark are singularly ungraceful, not to say ugly. Thus the body, which may be either almost naked or sparsely clad with bristly hairs, is heavy and ungainly; the head greatly elongated, with a small tubular mouth, and somewhat pig-like snout; the ears of enormous length, and the tail thick, cylindrical, and tapering, and nearly equal in length to the body. The neck is very short; the fore-quarters are short compared with the hinder part of the body; and the back is much arched. The tongue is long and extensile, although not so completely worm-like as that of the pangolins; and the round nostrils are situated at the extremity of the truncated muzzle. The fore-limbs are rather short, but very powerful; they have four toes, with moderate-sized, strong nails; and, in walking, the entire sole of the foot is applied to the ground. The hind-feet have five toes of nearly equal size, each carrying a nail. The skin

is of remarkable thickness; its general colour being yellowish brown, with a tinge of red on the back and sides, while the head and under-parts are light reddish yellow; and the hind-quarters, the root of the tail, and the limbs brown. A full-grown aard-vark measures a little over 6 feet in total length.

The jaws are furnished with a considerable number of well-developed teeth, of which all but the last three in each jaw have milk-predecessors, which do not, however, cut the gum. In full-grown specimens there are usually five teeth on each side of both upper and lower jaws; but the total number of teeth developed is from eight to ten in the upper, and eight in the lower jaw; the anterior ones falling out as the animal attains maturity. When unworn, these teeth, which are of considerable size, have rounded summits. They are composed of a number of closely-packed denticles, which by mutual pressure assume a polygonal form, and are traversed by a series of radiating tubes; such a structure being unknown elsewhere in the whole mammalian class. The skull has a complete cheek-arch; and the lower jaw is far less slender than in the pangolins. It has been considered that the aard-varks are nearly-allied to the pangolins, but the result of more recent observations has been to disprove this view; and it is even doubtful whether they should be included in the Edentate order, with the typical forms of which these animals have but little in common, except so far as regards the want of front teeth, and the absence of cement in the teeth of the cheek-series.

Distribution. The typical Cape aard-vark (*Orycteropus afra*) inhabits South and South-Eastern Africa; it is replaced in North-Eastern Africa by the Ethiopian aard-vark (*O. æthiopicus*); the former being distinguished by the thicker coating of hair, more especially on the back and flanks, as well as by the thicker and less elongated tail, and the longer head and ears.

Habits. The aard-varks are essentially nocturnal and burrowing in their habits; and feed exclusively on termites and ants. In South Afr. a their deep burrows are generally constructed in the neighbourhood of the tall conical mounds formed by the termites; and, in the old days, before these animals were hunted for their skins, it used to be said that wherever termite-hills were numerous, there an aard-vark might confidently be expected. Wherever these animals are abundant, a number of half-formed holes are seen in the ground and on the sides of the ant-hills, which have been commenced and abandoned. Aard-varks usually spend the whole of the day asleep in their burrows, but may occasionally be seen abroad in the early morning. Their powers of digging are so great, that in a few minutes they can bury their large bodies, even when the ground is hard and sun-baked. In digging, they work with their fore-feet, and throw out huge clods of earth between their hind-legs. Aard-varks are quick of hearing, and very shy, making off at the slightest sound to their burrows with considerable speed. But little definitely is known as to their breeding-habits; although it has been ascertained that the Ethiopian species gives birth during May or June to a single offspring. At birth the young is naked and flesh-coloured; and is suckled by its parent for a long period.



BENNETT'S WALLABY.

CHAPTER XXXVI.

The Pouched Mammals, or Marsupials.

Order Marsupialia.

Distinctive Characters. The whole of the Mammals treated of in the preceding chapters are collectively characterised by certain peculiarities connected with the development of their young. In all of them the young are brought into the world in a more or less high state of development; this high grade of development being due to the circumstance that during the greater portion of intra-uterine life the circulatory system of the fœtus is connected with that of the maternal parent by a special vascular organ termed the placenta; this placental connection between the blood-vessels of the parent and offspring allowing the blood of the latter to be oxygenated almost as completely as by breathing. On account of the development of this placenta, the whole of the foregoing orders of Mammals are brigaded together into a single large group, or subclass, and are collectively termed either Placental, or Eutherian Mammals; the latter term referring to their general high degree of development, as compared with those remaining for consideration.

On the other hand, in the Mammals of which we have to treat in the present chapter, the young are born at a very early stage of development, and in an exceedingly imperfect and helpless condition,—being, in fact, little more than

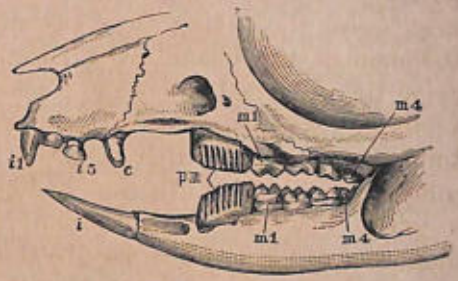
animated lumps. Previous to birth there is no placental communication between the blood-vessels of the fœtus and the parent; and at birth the rudimental young are transferred to the teats of the female, to which they adhere tightly for a long period, their lips being specially modified into a cylindrical sucking-organ. In most cases the young thus suspended are protected by a fold of skin on the abdomen of the female, which forms a pouch in which the teats are contained. From the universal absence of a placenta, these Mammals are regarded as forming a subclass of equal rank with the Placentals or Eutherians, and are spoken of as Implacentals or Metatherians; the latter term indicating their lower position, as compared with the Eutherian, or highest Mammals.

The Placental, or Eutherian Mammals are, as we have seen, divided into numerous orders; and it may be thought that similar divisions could be instituted among the Implacentals or Metatherians. It happens, however,—so far at least as existing forms are concerned,—that this is not the case; but so as to render our classification symmetrical, it is necessary to have a name for the one order of Implacentals, the term Pouched Mammals, or Marsupials, has been selected, and we shall speak of these Mammals under either of these terms; it must, however, be constantly borne in mind that they also have the higher designation of Implacentals, or Metatherians, ranking with the term Placentals, or Eutherians.

In addition to the primary distinction of the absence of a placenta, the Pouched Mammals present certain other more or less distinctive peculiarities. Mention has already been made of the general presence of a pouch, or marsupium, in which the abdominally-placed teats of the female are concealed; and to this it may be added that, with the single exception of the thylacine, the front brim of the pelvis always has a pair of divergent splint-like bones projecting forwards in the form of the letter V. These so-called marsupial bones—shown in all our figures of the skeletons of this group—were originally considered to be for the purpose of affording support to the pouch; but this view is discredited by their presence in both sexes. A peculiarity of the skull of all Pouched Mammals save one, is that the so-called angle, or lower posterior projection of the lower jaw, is more or less bent inwards, or inflected, as seen in the figure of the skull of Gray's rat-kangaroo, given in the sequel. This peculiarity is not, however, distinctive of the order, since it also occurs in some of the Insectivores. The skull of every marsupial is further characterised by the presence of larger or smaller vacuities, or unossified spaces, in the bony palate. As regards their brains, it may be observed that all the Pouched Mammals display a low grade of organisation; the whole brain being small in proportion to the size of the body, while the foldings on the surface of its hemispheres are never of a very complex nature, and only developed at all in the largest members of the order. The reproductive organs of the female are likewise constructed after a lowly fashion; the oviducts always remaining perfectly separate from one another, and never uniting, as they do in so many of the Eutherian Mammals, to form a common chamber, or womb.

Teeth. Certain peculiarities connected with the number and mode of replacement of the teeth also aid in distinguishing marsupials from other Mammals. In the first place, as shown in the figure of the skull of the Tasmanian devil given later on, there may be more than three pairs of front or

incisor teeth in the upper jaw; and in such cases the number of pairs of these teeth in the upper jaw always exceeds those in the lower by one. More important is the circumstance that but a single tooth on each side of both the upper and lower jaw ever has a milk predecessor. This tooth, marked *pm* in the accompanying figure, corresponds to the fourth or last premolar of the dog (Vol. I. p. 10); and consequently all the four teeth behind it are molars. Now, as we have already seen, it is but very rarely that there are more than three of these molars in Placental Mammals, whereas in the present order there are nearly always at least four. On the other hand, there are never more than three premolar teeth, which in the adult of some forms, as in the figure, may be reduced to one. It may be added that, according to recent researches, all the teeth in advance of the last premolar appear to represent the milk-series of the higher Mammals, which are here permanently retained.



JAWS AND TEETH OF THE RUFOUS RAT-KANGAROO.

The letters *i* indicate the front or incisor teeth; *c*, the upper tusk, or canine; *pm*, the premolars; and *m*, the molars.

Mode of Suckling Young. The fact that the new-born young of the Pouched Mammals, when first transferred to the teats of the mother, are little more than mere animated lumps of flesh, renders it imperative that some special arrangement should be made for their nutrition, as they are quite incapable of sucking by themselves. For this purpose the mammary gland of the female is overlain by certain specially-developed muscles, the periodical contraction of which injects a supply of milk into the stomachs of the helpless young. In order to prevent the young marsupials from being choked during this injecting process, their throats are provided with an arrangement similar to that obtaining permanently in the Cetaceans. That is to say, the larynx, or upper terminal expansion of the wind-pipe, is prolonged upwards so as to extend into the hinder aperture of the nostrils at the back of the palate; and consequently there is a closed tube from the nostrils to the lungs, on either side of which the milk can flow without danger of choking the young animal. When there is no longer any necessity for this special arrangement, the larynx is shortened, and respiration and swallowing are carried on after the usual manner. It may be added, that in the Pouched Mammals the teats are confined to the region of the abdomen, and that the number of teats is frequently greater than that of the young. Such teats as have been in use may always be recognised by their great elongation, owing to the weight of the young suspended from them.

Geographical Distribution. With the exception of the opossums, which are confined to America, and are most numerously represented in the southern half of that continent, the living representatives of the order are restricted to Australia, New Guinea, and the adjacent islands as far west as Celebes and Lombok. Exclusive of the Egg-laying Mammals, the Marsupials form almost the whole Mammalian fauna of Australia, where the chief other types are certain Rodents and Bats. In the more western islands they are, however, mingled with

Placental Mammals, thus showing that these islands have had some connection with those of the Malayan region. The channel separating Lombok and Celebes from Java and Borneo is, however, of much greater depth than those dividing the other islands; and it may accordingly be inferred that any land-connection which formerly existed between the two groups must have been remote.

In the Tertiary period opossums were distributed over a large portion of Europe; and recent discoveries indicate the existence during the same epoch of marsupials allied to the Australian thylacine in South America. In the preceding Secondary period, as we shall show later on, Pouched Marsupials appear to have ranged over the whole world, and were then, together with Egg-laying Mammals, the chief, if not the sole representatives of the class.

The Kangaroos and their Allies.

Family *Macropodidæ*.

We commence our survey of the Pouched Mammals with their most aberrant and specialised representatives, or those commonly known as kangaroos, wallabies, rat-kangaroos, etc. And it may be mentioned here, that whereas kangaroos are very frequently spoken of as typical Marsupials, this is really very far from being the case. It is true that they conform in all essential characteristics to the Marsupial type of structure; but they have been specially modified for a particular kind of progression — namely, leaping. This has profoundly modified their whole organisation, and rendered them some of the most specialised of all Mammals; and they retain accordingly but little resemblance to what may be termed a typical, or generalised marsupial, such as a bandicoot, or thylacine.



SKELETON OF KANGAROO.

The kangaroos belong to a group or suborder of Marsupials characterised by the adaptation of their teeth to a vegetable diet. Thus the front, or incisor teeth, as shown in the figure on p. 239, are never more than three in number on each side of the jaws, and are usually three in the upper and one in the lower jaw; while in all cases the innermost pair in each jaw are of large size,

and adapted for cutting. As a rule their upper canine teeth, or tusks, are small, or wanting; and this invariably holds good for those of the lower jaw. As regards their molar teeth, these are invariably characterised by having broad, flattened crowns, surmounted either by tubercles or transverse ridges, and adapted for the trituration of vegetable substances.

The members of the kangaroo family vary greatly in size, and in the relative length of the hind-limbs, but they are collectively characterised as follows. In the upper jaw there are three pairs of incisor teeth, with sharp and cutting edges; while the lower jaw is furnished with a large single pair inclining forwards, and sometimes biting against one another with a scissor-like action. The upper canine, or tusk, if present at all, is of small size, as in the accompanying figure; while there is no corresponding lower tooth. In the adult the cheek-teeth are five in number on each side, of which the first is a premolar; this condition obtaining in the figured skull. In young animals there are, however, two milk-molars in place of this premolar; the number of cheek-teeth then being six on each side. The molar teeth themselves may carry either a pair of transverse ridges, or four blunt tubercles. A characteristic feature of the family is to be found in the lower jaw, which has a deep pocket in the outer side of the hinder portion, communicating at its base by a large perforation with the canal on the inner side. The pocket is shown in the accompanying figure, but the communicating aperture is concealed by its outer wall. In all the members of the family the fore-limbs are short and feebly developed, with five complete digits. The hind-limbs, on the contrary, are very powerful, and more or less elongated. Usually they have but four toes, of which the one corresponding to the fourth in the typical series of five is much larger than either of the others, and terminates in a huge claw. The outermost toe is considerably smaller, but still stout. The two toes on the inner side of the large one, corresponding to the second and third of the typical series, are, however, reduced to small slender rods, lying parallel to one another, and enclosed in a common skin. These rudimental digits are of course useless in progression, and their aborted condition is technically known as syndactylism. The head, especially in the larger forms, is small in proportion to the body, and tapers towards the muzzle. Generally the tail is long, cylindrical, and tapering; while it frequently aids in supporting the body, and may be prehensile. The female is provided with a large pouch, of which the aperture looks forwards.



SKULL OF LESUEUR'S RAT-KANGAROO.

c, tusk, or canine tooth.

All the members of the kangaroo family are purely vegetable feeders, and are mainly confined to Australia and Tasmania, where, before the introduction of sheep and cattle, they took the place of the ruminants of other regions. They are divided into numerous genera, of which the first includes the true kangaroos and wallabies.

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The True Kangaroos and Wallabies.

Genus *Macropus*.

In the summer of the year 1770, when Captain Cook was refitting his vessel at the mouth of the Endeavour River in New South Wales, a party of his crew who had landed to procure food brought back reports of a strange animal of large size, which sat upright on its hind-limbs and tail, and progressed by a series of enormous leaps. Excitement among those on board was naturally raised to the highest pitch by this account—especially as a naturalist, Sir Joseph Banks, was a member of the expedition;—and soon after a specimen of the animal in question was killed. This creature was the one we now know by the name of the great grey kangaroo (*Macropus giganteus*); and was the first member of the family which came fully under European notice, although one of the smaller forms from the Aru Islands had been partially made known as early as the year 1711. The name kangaroo, it may be observed, is said to be of Australian origin, although it appears to be now unknown to the natives. The kangaroos and wallabies, which include the largest members of the family, are characterised by the great length and powerful development of the hind-limbs as compared with the front pair; and the enormous size of the tail, which is regularly tapering, and evenly covered with fur from end to end. In the hind-foot the claw of the fourth toe is enormously developed, and the first toe is wanting. The head is small, with an elongated and usually completely naked muzzle, and large upright ears. The females have four teats. The skull is characterised by its smooth and rounded contours, and the absence of any inflation in the bulla of the internal ear. The tusk in the upper jaw is minute, and shed at an early period; and the upper incisor teeth are of nearly equal length, and form a regular open curve. The lower incisor teeth have sharp inner edges capable of cutting against one another in a scissor-like manner; and the crowns of the molar teeth carry a pair of transverse ridges, which are nearly



THE GREAT GREY KANGAROO, WITH YOUNG IN POUCH.

always connected by a longitudinal bridge. The true kangaroos and wallabies comprise twenty-three living species, as well as several which are extinct; and they are found not only in Australia and New Guinea, but also in some of the islands to the eastward. While the larger species are as tall as a man, the smallest do not exceed the dimensions of a rabbit. They may be divided into three groups, distinguished by size, and partly also by coloration.

True Kangaroos. Under the common title of true kangaroos may be included all the larger forms, characterised by their generally uniform and sombre coloration, and their large and massive skulls, in which the hinder portion of the skull is well ossified. The best known of all the species is the great grey kangaroo (*M. giganteus*)—the "boomer," "old man," or "forester" of the colonists, to which allusion has been already made, and which is represented in the figure on p. 240. A full-grown male will measure 63 inches from the tip of the nose to the root of the tail, the length of the tail being 52 inches; while the entire animal will weigh some 200 lbs. This species is of rather slender and graceful build, with soft woolly hair, which is greyish brown above, and nearly white beneath on the under-parts and limbs, without any white markings on the face. It is further characterised by the middle of the muzzle being hairy between the nostrils, and also by the shortness from back to front of the permanent premolar tooth. It is an inhabitant of open plains, and is found over the great part of Australia and Tasmania.

On the other hand, the red kangaroo (*M. rufus*), represented in our coloured Plate, and the antelopine kangaroo (*M. antilopinus*), together with certain allied species, are inhabitants of rocky districts, and have their muzzles completely naked, and the permanent premolar tooth of greater length from back to front. Their colours also may be more brilliant. The great red kangaroo is of slender build, with reddish coloured and very soft woolly fur, which corresponds to the under-fur of other species; the face having light markings and a black streak. This species inhabits South and Eastern Australia. The antelopine kangaroo, from North Australia, is distinguished by its massive build, and heavy, clumsy head, as well as by its short, coarse, straight, reddish hair, without any under-fur, and the absence of face-markings. It is stated to attain a weight of from 120 to upwards of 170 lbs. Another well-known species is the wallaroo (*M. robustus*), from Queensland, New South Wales, and South Australia, in which the fur is long and thick, and of smoky grey colour; the build being also stout and heavy.

Large Wallabies. Under the designation of large wallabies, or brush-kangaroos, may be included a group of smaller and brighter coloured species, distinguished by the more incomplete ossification of the hinder part of the bony palate, and by the third incisor tooth of the upper jaw having a single distinct notch near the middle of the crown. All these species frequent dense scrub-jungle, known in Australia as "brush"; and their leaping powers are nearly as great as those of the true kangaroos. One of the largest species is the red-necked wallaby (*M. ruficollis*), in which the length of the head and body may be as much as 41 inches, and that of the tail 31 inches. It occurs in New South Wales and Victoria, and is represented in Tasmania by a smaller variety known as Bennett's wallaby. Other well-known species are the black-tailed wallaby (*M. ualabatus*),

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from New South Wales, Victoria, and Queensland; Parry's wallaby (*M. parryi*), from mountain districts in Queensland and the north of New South Wales; and the agile wallaby (*M. agilis*) of New Guinea, Queensland, and part of South Australia, distinguished from all the others by the uniform sandy colour of the short fur of the back, and the presence of a distinct white stripe on the hips.

Small Wallabies.

The "padamelon" wallaby of the colonists (*M. thetidis*), which is very common in New South Wales and Victoria, and measures 26 inches from the muzzle to the root of the tail, is one of the best known representatives of the group of small wallabies, several of which are not larger than a rabbit. All the species are lightly built, with perfectly naked muzzles, and the outer incisor tooth smaller than in the last group. Their hind-feet are also relatively shorter;



THE PADAMELON WALLABY (⅛ nat. size).

and their jumping powers, therefore, probably proportionately less. This group has a wider distribution than either of the others, the Aru Island wallaby (*M. brunii*)—the earliest known member of the family—occurring in the islands from which it takes its name. Other well-known species are the rufous-bellied wallaby (*M. billardieri*), from South Australia, Victoria, and Tasmania; and the small short-tailed wallaby (*M. brachyurus*), from Western Australia; the latter being remarkable for the shortness of its tail, and the small size of its ears.

Habits.

As already mentioned, all the kangaroos are exclusively vegetable feeders, the larger kinds browsing solely on grass and other herbage, while many of the smaller wallabies also eat roots. Although, when feeding, kangaroos occasionally move about in an awkward manner on four feet, their habitual position is the upright one, when they are supported by the hind-limbs aided by the tail; and the whole structure of their skeleton is modified to suit

this position. Thus, as shown in the figure of the skeleton on p. 238, the bones of the lower leg (tibia and fibula) are immensely elongated, while the thigh-bone (femur) is comparatively short, and the narrow pelvis set very obliquely to the axis of the back-bone. Consequently, when the animal is resting in the usual position, with the whole of the foot applied to the ground, the knee-joint forms the summit of a solid support from which the whole body is suspended, as it were on pivots. The kangaroo can, however, raise itself so as to be supported only by the tips of the toes and the tail; and when in this position is enabled to take a wide survey of the country, and thus to obtain early warning of approaching danger. "When running," says the *Old Bushman*, "it springs from the ground in an erect position, propelled by its powerful hind-legs and balanced by its tail, holding its short fore-arms well into the chest, after the manner of a professional runner. Thus it bounds lightly and easily along, clearing any obstacles, such as fallen trees, and even low fences, in its stride. I never fairly measured one of these strides or springs, but I am certain, when hard pressed, an 'old man,' or 'flying doe,' will clear nearly ten yards at a spring. The long tail materially assists them in running, and its measured thumps may be heard on the ground long before the kangaroo itself appears in sight in the thick forest. It is a curious fact, that a wounded kangaroo very often breaks the hind-leg in struggling; and I once knew an 'old man' snap the bone just above the hock, as short as a carrot, in taking a spring." In general habits, the writer continues, kangaroos much resemble sheep and deer. "Timid and shy, their senses of sight, hearing, and smell are most acute. Like the hare, they appear to be unable to see an object directly in front of them when running;—at least I have often stood still and shot one down as it came running up to me in the open forest. They are very gregarious, and are always to be met with in smaller or larger droves. I have often seen as many as one hundred and fifty in a drove, and our general 'mobs' used to average fifty or sixty. After the rutting-season, the 'old men' will often draw away from the 'mobs,' and retire by themselves to the thickest scrub. Each drove frequents a certain district, and has its own particular camping and feeding-grounds. The 'mobs' do not appear to mix, and when the shooter once obtains a knowledge of the country, he has no difficulty in planting himself for a shot. Their camping-grounds are generally on some open timbered rise, and they have well-trodden runs from one ground to another. They feed early in the morning and at twilight, and I think also much at night. The kangaroo lies up by day, during the hot summer weather, in damp, thickly-scrubbed gullies; in the winter, on dry, sandy rises. Here, unless disturbed, they will remain quiet for hours; and it is a pretty sight to watch a 'mob' camped up, some of them playing with each other, some quietly nibbling the young shrubs and grass, or basking in the sun half asleep on their sides. About Christmas the young ones appear to leave their mothers' sides, and congregate in 'mobs' by themselves; I have seen as many as fifty running together, and very pretty they looked." When on the move, kangaroos invariably follow a leader; and when once started, it is impossible to divert a drove from the direction they have taken. Except during the pairing-season, when the males engage in fierce contests, these animals are as peaceful and harmless as sheep. When hard pressed, a kangaroo will take readily to the water: and there is an

instance on record of one swimming across an arm of the sea two miles in width,—half of the distance being against a strong wind and current.

The writer just quoted states that the principal food of kangaroos "appears to be the tender sprouts of small shrubs and heather, quite as much as grass; but there is a small kind of spike-grass, brown on the under-side, called the kangaroo-grass, to which they are very partial. They will also come at night into the small bush-enclosures, and nibble off the young blades of wheat, oats, etc." When feeding off the ground, they do not always use the fore-paws as a support, but often merely crouch down. Occasionally they may be seen in the upright position, browsing from trees. As regards breeding-habits, it appears that in the great grey kangaroo the pairing-season is either in January or February, although there is some irregularity in this respect. Only a single young is produced at a birth, after an exceedingly short period of gestation; and when first transferred to the pouch of its mother, the length of the offspring is scarcely more than an inch. When the young kangaroo is sufficiently developed to move freely by itself, it becomes detached from the teat to which it at first adhered; but it remains chiefly in the pouch till able to run by the side of its parent. "Even then, when danger is near, it tumbles head-over-heels into the pouch for protection; and it is wonderful how quickly the old doe can pick up the 'joey' when running at full speed, and shove it into the pouch, its pretty little face always outside. There she carries it till hard pressed, when the love of life overcomes the love of the mother, and she then casts it away to save herself." The "joeys" become strong runners; and by Christmas, leave their parents and learn to shift for themselves.

Rock-Wallabies.

The half-dozen medium-sized species collectively known as rock-wallabies, one of which is represented in the accompanying illustration have the extremity of the muzzle completely naked, and differ from the true wallabies by the shortness of the claw of the fourth hind-toe, and also by the long cylindrical tail being thinner and more or less distinctly tufted at its extremity. None of them have any trace of a tusk in the upper jaw. The yellow-footed rock-wallaby (*Petrogale xanthopus*)—that given in our figure—is the largest species, and is distinguished from the rest by its brilliant coloration, more especially the alternate brown and pale yellow rings on the tail. The general colour of the long and silky fur is grey on the back, with a well-defined black streak running from between the long ears to the middle of the trunk. The cheeks are marked by an oblique white stripe below the eye, and by a yellow spot above the same. The ears are yellow externally, with their inner sides edged with white, except at the tips; and the sides of the body are marked by a pure white stripe from the elbow to the hip. The chin and under-parts are also pure white; and there is likewise a patch of the same colour on the outer side of the knee; while the lower portions of the limbs, including the feet, are yellow. On the tail the rings occupy only the upper surface, the inferior aspect being uniformly yellowish. This species is restricted to South Australia. The common brush-tailed rock-wallaby (*P. penicillata*), from the coast districts of the eastern side of the continent, is more soberly coloured; the general tint of the coarse hair being dull brown, tending to rufous on the hind-quarters. In the male, the length of the head and body reaches 28½ inches; and that of the tail, exclusive of the hair

at the tip, 24 inches. The remaining four species are all smaller; the north-western short-eared rock-wallaby (*P. brachyotis*) being distinguished by the character from which it takes its name. The whole of the rock-wallabies are confined to continental Australia, and, as their name implies, frequent rocky districts, whereas the true wallabies are plain-dwelling animals. Their tails lack the stiffness of those of the latter, and appear to be used rather in balancing the body when leaping, than as a third support. The brush-tailed rock-wallaby,



YELLOW-FOOTED ROCK-WALLABY ($\frac{1}{10}$ nat. size).

according to Gould, collects in large flocks, and forms regular well-beaten tracks on the mountain-sides.

Spur-tailed Wallabies. Three species of wallaby differ from all other mammals, with the single exception of the lion, in having the extreme tip of the tail furnished with a horny spur or nail, the use of which is at present unknown. They are further distinguished by the hairy muzzle, by the length and narrowness of the fourth toe of the hind-foot, and by the length of the tapering tail, on which the hair is short. The upper incisor teeth are relatively small, and decrease in size from the first to the third. They are all of moderate or small size, with short hair, and are some of the most graceful members of the family. The nail-tailed wallaby (*Onychogale unguifera*) is of a general fawn-colour, and distinguished by the great length of the tail, and the large size of its terminal nail: the length of the head and body being 26 inches, and that of the tail an inch more. It is a rare species

from North-Western and North-Central Australia. The bridled wallaby (*O. frenata*) and the crescent wallaby (*O. lunata*) are smaller species, with relatively shorter tails; the former inhabiting Eastern, and the latter, which is not larger than a rabbit, West and South Australia. All the species appear to frequent rocky and arid districts.

Hare-Wallabies.

The hare-wallabies, so called from their resemblance in size, and in some respects appearance, to the common hare, likewise form a group of three species exclusively confined to Australia. They are characterised by the muzzle being partially or completely covered with hair, by the claw of the fourth toe of the hind-foot being long and not concealed by hair, while the tail is rather short and evenly furred, without either a brush of hair or a spur



THE COMMON HARE-WALLABY (⅓ nat. size).

at the tip. Their skulls are characterised by the shortness of the interval between the incisor and cheek-teeth; and by the inflation of the auditory bulla on the inferior surface—the latter feature at once distinguishing these animals from the true wallabies. The upper tusk is always present; and the incisor teeth in the same jaw are small.

Our illustration represents the common hare-wallaby (*Lagorchestes leporoides*), from South Australia and New South Wales, which measures 19½ inches to the root of the tail; and is clad in fur closely resembling that of the common hare in general colour. This species is fairly abundant in the open country of the interior, more especially near the Murray River. Its habits are in many respects very similar to those of the hare.

The West Australian rufous hare-wallaby (*L. hirsutus*), distinguished by the ruddy tinge of the hair on the rump, and the absence of a black patch on the

elbow, appears to be very similar in its habits. In the north of the continent, and on some of the small adjacent islands, the genus is represented by the spectacled hare-wallaby (*L. conspicillatus*), distinguished by its broader and heavier muzzle, shorter ears, the rufous tinge round the eyes; and the presence of two light bands on the flanks.

Dorca Kangaroos. Müller's kangaroo (*Dorcopsis muelleri*) is one of a group of three Papuan species connecting the true kangaroos with the undermentioned tree-kangaroos. They are medium-sized animals, the length of the head and body in Müller's kangaroo being about four inches greater than in the brush-tailed rock-wallaby; while in *D. luctuosa* it is about as much less. These kangaroos differ from the forms hitherto noticed in that the hair on the nape of the neck is either completely or partially directed forwards; while the disproportion between the fore and hind-limbs is very much less marked. The large and broad muzzle is devoid of hairs, the ears are small, the tail has an almost naked tip, and the claws of the hind-feet are not concealed by hair. The teeth are distinguished by the great length, from front to back, of the permanent premolar in each jaw, which has a development similar to that which obtains in the potoroos. There is a well-developed upper tusk; and the molar teeth have low, rounded crowns, in which there is scarcely any trace of a longitudinal bridge connecting the two transverse ridges. Moreover, instead of converging at their extremities, the two series of cheek-teeth run nearly, or quite parallel. Müller's kangaroo has short, close, and glossy fur, of a general uniform chocolate-brown: but with a white stripe on the front of the hips, and the fore-arms and feet whitish. Externally this animal presents a remarkable resemblance to the Aru Island Wallaby (*Macropus brunii*).

Tree-Kangaroos. In the dense tropical forests of New Guinea and the north of Queensland are found tree-kangaroos; and it is evident that these are specially modified types which have taken to this mode of life, and are in no way connected with the ancestral forms of the family. The tree-kangaroos are easily recognised by the general proportions of the two pairs of limbs to the body being normal: the length of the front pair being only slightly less than that of the hinder. The broad muzzle is only partially naked; and the hair of the nape, and in one species that of the back also, is directed forwards. In the hind feet the claws of the united second and third toes are nearly as large as those of the others: the latter being curved. The tail is very long, and thickly furred. In the teeth, the permanent premolar is less elongated from front to back than in the last genus. Of the four well-defined representatives of the genus, the figured black tree-kangaroo of New Guinea (*Dendrolagus ursinus*) is characterised by its general black colour and whitish face; the length of the head and body of the female being 20½ inches, and that of the tail 23 inches. On the other hand, the brown tree-kangaroo (*D. inustus*) of New Guinea, and the Queensland tree-kangaroo (*D. lumholtzi*), have the back greyish, and the face (and in the Queensland species the paws) black. Finally, Doria's tree-kangaroo (*D. dorianus*), of south-eastern New Guinea, differs from all the others in having the fur of the back directed forwards.

Comparatively little is known of any of the species in their native haunts; although it appears that they spend most of their time in the trees. Dr.

Guillemard, who had two of these animals alive on board ship, which he had captured in New Guinea, writes that the tree-kangaroo "is as yet a tyro in the art of climbing, performing this operation in the slowest and most awkward manner. Our pets, for instance, would take a full minute or more in ascending the back of a chair, but their hold is most secure; and if we wished to pull them off, we had considerable difficulty in doing so, so tightly do they cling." It is added that the tail, although not actually prehensile, is pressed against the branches in climbing, and appears to be of considerable assistance. Of the Queensland species,



THE BLACK TREE-KANGAROO (¼ nat. size).

locally known as the bungari, Dr. Lumholtz, its discoverer, writes that it frequents the densest and most inaccessible portions of the highest mountainous scrubs, where even the aborigines are scarcely able to penetrate. From the marks of its claws on the trees of the more open districts, the animal appeared to have been once common there, but is now nearly exterminated by the blacks. When disturbed, these kangaroos are stated to travel considerable distances; and they are also reported by the blacks to be most commonly seen abroad on moonlight nights. Two or three are often found sleeping in the same tree; and it is stated that they affect only one particular kind of tree, which grows to a considerable height. In rainy weather, lower trees are selected.

Banded Wallaby. The little banded wallaby (*Lagostrophus fasciatus*), of Western Australia, which is about the size of a hare, and is easily recognised by the dark transverse bands crossing the hind-quarters, forms the single representative of a genus. It is specially characterised by the presence of long bristly hairs on the hind-feet, which completely conceal the claws. The muzzle is naked; and the ears are small and rounded. The skull is characterised by its narrow muzzle, and inflated auditory bulla; while there is no tusk, the two series of upper incisor teeth meet in an angle, and the two halves of the lower jaw are welded together at their union. These pretty little wallabies inhabit the scrub-jungle and the margins of swamps on the west coast of Australia and the small adjacent islands. On the islands they form tunnels beneath the dense bushes by gnawing off the lower branches on certain lines; and they can only be beaten out from their cover by the aid of dogs. On the mainland they are said to skulk in the open like hares.

Rat-Kangaroos. The whole of the members of the family hitherto considered form a single subfamily primarily characterised by the circumstance that the three incisor teeth of the upper jaw are of nearly equal height, while the tusk, or canine tooth, if present at all, is very minute. We now come to a second group or subfamily, including a number of small forms known as rat-kangaroos or potoroos, which differ in many important respects from the preceding. These creatures, none of which are larger than an ordinary rabbit, are characterised by having the first incisor tooth on each side of the upper jaw (as shown in the figures on pp. 237 and 239) considerably taller than either of the others, and narrow and curved in form; while there is always a rather large and blunted upper tusk. Then, again, whereas in the preceding subfamily, with the exception of Müller's kangaroo and its allies, the permanent premolar tooth is comparatively short from front to back, in the group under consideration the same tooth, as shown in the aforesaid figures, is much elongated in this direction, and has a straight cutting-edge, and its two surfaces generally marked by vertical grooves and ridges. Sometimes, moreover, the same tooth may be bent slightly outwards, instead of forming a continuation of the line of the molars. The latter have blunt tubercles at their four angles, instead of complete transverse ridges; and the last of the series is, instead of being larger, always smaller than the one in front of it. The rat-kangaroos are further distinguished by their narrow fore-feet, in which the three middle toes are much longer than the other two, with long, narrow, and slightly-curved claws; whereas in the broader front paws of the preceding group, the whole five toes are nearly equal in length, and have highly-curved claws. All the rat-kangaroos have small rounded ears, and long furry tails, of which the extremities are partially prehensile in some of the species. Externally, the rat-kangaroos cannot well be distinguished in general appearance from some of the smaller short-eared representatives of the preceding group; and it is accordingly of prime importance that the foregoing distinctive characteristics should be thoroughly understood. The group comprises nine species, which are confined to Australia and Tasmania, and are divided into four genera.

Common Rat-Kangaroo. The common rat-kangaroo (*Potorous tridactylus*), that figured in the illustration on the following page, may be taken as our representa-

tive of the first of the four genera. The distinctive characters of the genus being the long and slender form of the head, the few (three or four) perpendicular ridges on the permanent premolar tooth in both jaws, the shortness of the foot, the naked muzzle, and the rather large ears. In the skull the auditory bulla is somewhat swollen, and the unossified spaces in the palate are large. The figured species, which is the largest of its genus, is confined to Eastern Australia and Tasmania, and is variable both in size and colour; the length is, however, frequently about 15 inches, exclusive of the tail. It is specially characterised by the great elongation of the muzzle; the general colour of the coarse, long, and straight hair being dark grizzled greyish brown, with a more or less marked tinge of rufous. The



COMMON RAT-KANGAROO (⅓ nat. size).

West Australian *P. gilberti* is a smaller allied form; while *P. platyops*, from the same side of the continent, is still smaller, and has a broader and shorter muzzle.

Brush-tailed Rat-Kangaroo.

The brush-tailed rat-kangaroo (*Bettongia penicillata*), represented in the figure on p. 251, appears to be the commonest and most widely spread of the group, and is one of four species having the following characteristics in common. The head is comparatively short and wide, with very small and rounded ears, and a naked muzzle; the foot is elongated; and the permanent premolar tooth (figure on p. 237) is characterised by its numerous (fourteen or fifteen) and slightly oblique ridges. The tail is thickly furred, with the hairs longer on the upper than on the lower surface, and somewhat prehensile. In the skull the auditory bulla is generally much swollen; and the unossified spaces in the palate are large. The figured species is a somewhat smaller animal than the common rat-kangaroo; and is characterised by the great development of the tuft of hair on the upper surface of the end of the tail, of which the under surface is brown. It inhabits nearly all Australia, but is replaced in Tasmania by the much larger jerboa-kangaroo (*B. cuniculus*), in which the tail-tuft is scarcely developed. Lesueur's rat-kangaroo (*B. lesueuri*), of which the skull is figured on p. 239, is a South and West Australian species distinguished from the one here figured by the small size of the tail-tuft, which is almost always white at the tip.

The plain rat-kangaroo (*Caloprymnus campestris*) of South Australia, differs from the foregoing by the naked portion of the muzzle extending somewhat less backwardly on the nose, and the absence of any crest or tuft of hair on the tail; and on these and other grounds it is made the type of a distinct genus.

Rufous Rat-Kangaroo. The largest member of the group is the rufous rat-kangaroo (*Æpyprymnus rufescens*), of New South Wales, distinguished from all the others by the partially hairy muzzle, and the unusually broad and short head; the tail being evenly furred. The permanent premolar tooth in each jaw has a medium number (seven to eight) of vertical ridges; and the skull is characterised by the absence of any unossified spaces on the palate, and the



BRUSH-TAILED RAT-KANGAROO (¼ nat. size).

unswollen auditory bulla. The head and body of this species may measure as much as 20 inches, and the tail about 4 inches less. The general colour of the long and soft fur is bright rusty red on the upper-parts, more or less pencilled with white; while the under-parts are dirty white, and the ears black.

Habits. Although the different groups of rat-kangaroos vary to a certain extent in habits, the whole of them agree in being nocturnal, and in feeding not only on leaves, grass, etc., but likewise on roots and bulbs, which are grubbed up with the fore-paws. They generally frequent scrub-jungle, and get up before the sportsman after the manner of rabbits. Usually but a single young is produced at a birth; and, as appears to be the case with all Marsupials, there is not more than one birth during the year. In accordance with the reduced size of their hind-feet, the leaping powers of the common rat-kangaroo are less developed than those of the other genera. It is stated, indeed, that although these species habitually stand on their hind-limbs alone, when running they employ both pairs

of limbs in a kind of gallop. Moreover, they never kick out with their hind-legs after the manner of kangaroos and wallabies. The brush-tailed rat-kangaroo and its kindred employ their prehensile tails in carrying grass and other substances for the construction of their nests; the extremity of the tail being curled downwards below the bundle. The nest, according to Mr. Gould, is made in a hollow specially dug in the ground for its reception; and as its upper surface thus becomes level with the herbage, only the practised eyes of the blacks are able to detect its presence. During the day either one or two of these animals occupy a nest, in which they completely conceal themselves by dragging herbage over the entrance. Here they remain till evening, when they sally forth in quest of food. The rufous rat-kangaroo may either form a somewhat similar nest beneath a fallen tree-trunk, or under the shelter of some low bush, or may repose during the day in a seat among the herbage like the "form" of a hare. On being pursued, this species runs for a short distance with great speed, but as it always takes shelter in hollow trunks it falls a prey to the blacks, by whom it is relished as food.

Five-toed Kangaroo.

The rat-like little animal, scientifically known as *Hypsiprymnodon moschatus*, and which may be termed in popular language the five-toed kangaroo, is one of those connecting links so interesting to the evolutionist, but so extremely inconvenient to the systematic zoologist. This creature stands, indeed, almost exactly midway between the common rat-kangaroo and the phalangers, to be immediately mentioned; although the kangaroo-like structure of its lower jaw has led to its being placed in the present family.

The five-toed kangaroo is confined to Queensland, and is very nearly the size of a large rat, to which it also presents a general external resemblance. The body is clothed with close, crisp, velvety fur, of a grizzled rusty orange-grey colour; the orange tinge being strongest on the back, and almost disappearing on the lighter under-parts. The head is sharply pointed, with rather large and nearly naked ears; and the tapering cylindrical black tail is likewise naked, and also scaly. The relative proportions of the fore and hind-limbs are not far removed from the ordinary mammalian type. The fore-paws are small, with five toes, each provided with a delicate claw; and the hind-feet differ from those of all the other members of the family in having a first or "great" toe, in addition to the usual four. This first toe is clawless and opposable to the others, and is placed high up on the foot, near the heel; the second and third toes, as in all the other members of the family, are slender and united in a common skin. The teeth generally resemble those of the rat-kangaroos, but the permanent premolar in each jaw is short from front to back, and is bent outwards from the line of the other teeth in the manner characteristic of the phalangers.

The best description of the habits of the animal is the one given by Mr. P. Ramsay, who writes that the five-toed kangaroo "inhabits the dense and damp portions of the scrubs which fringe the rivers and clothe the sides of the coast-range in certain districts. The animal is by no means rare, yet, from its retiring habits, and the dense nature of the parts frequented by it, it is at all times difficult to obtain. Its habits are chiefly diurnal, and its actions when not disturbed by no means ungraceful; it progresses in much the same way as the rat-kangaroos, but procures its food by turning over the débris in the scrubs in

search of insects, worms, and tuberose roots, frequently eating the palm-berries, which it holds in its fore-paws after the manner of the phalangers, sitting up on its haunches, or sometimes digging the bandicoots. Seldom more than one or two are found together, unless accompanied by the young." It is added that, at least in some instances, there are two young at a birth; and that the breeding-season is during the rains, which last from February to May.

Extinct Kangaroo-like Marsupials.

In addition to those of several of the existing species of kangaroos, wallabies, and rat-kangaroos, the caverns and superficial deposits of Australia contain numerous remains of kangaroos, or kangaroo-like types, some of which attained gigantic dimensions. One of these (*Macropus titan*) was allied to the great grey kangaroo, but of larger size; while others, as *M. brehus*, appear to have been gigantic wallabies, with skulls of as much as a foot in length. Other species, distinguished by the characters of their permanent premolar teeth, or by the bony union of the lower jaw, constitute extinct genera, which have been named *Sthenurus*, *Procoptodon*, and the *Palorchestes;* the skull of the single representative of the latter measuring upwards of 16 inches in length.



SKULL OF AN EXTINCT KANGAROO-LIKE ANIMAL (THE DIPROTODON).—After Sir R. Owen.

All the above-mentioned types may be included in the Kangaroo family, but there were other forms which cannot be included in any existing group. Largest of these is the gigantic diprotodon, with a skull of about a yard in length, huge chisel-like first upper incisor teeth, and no perforation in the side of the lower jaw. This creature, which must have been fully as large as the largest rhinoceros, evidently walked on all four limbs in the ordinary manner. Another allied but somewhat smaller animal was the notothere, characterised by its extremely short skull; it appears to have been to some extent intermediate between the kangaroos and the wombats.

The Phalanger Tribe.

Family *Phalangeridæ.*

Under the general term of phalangers—a name referring to the union of the second and third toes of the hind-foot—may be included a large number of small

or medium-sized Australasian marsupials of arboreal habits, which are so closely connected with the kangaroo tribe through the five-toed kangaroo as to render the distinction between the two families a matter of some difficulty.

The whole of these animals are characterised by their thick, woolly coats; and, with the single exception of the koala, they have long tails, which are frequently endowed with the power of prehension. The fore and hind-limbs instead of presenting the disproportionate relative lengths characterising most of the kangaroos, are of the normal proportions; and the front paws are provided with five nearly equal-sized and clawed toes. The structure of the hind-feet is essentially the same as in the five-toed kangaroo; that is to say, there is a nailless first toe which can be opposed to the others, while the second and third are slender and enclosed in a common skin. Whereas, however, in the five-toed kangaroos the fourth toe is much longer and more powerful than all the others, in the phalangers it is not much larger than the fifth. The whole group differs from the kangaroos in the absence of any pit on the outer sides of the hinder portion of the lower jaw, as shown in the accompanying figure of the skeleton; while if there is any perforation in this portion of the jaw, it is extremely minute. As regards the dentition, there are always three pairs of upper incisor teeth, of which the first is elongated, and likewise a well-developed tusk or canine; while in the lower jaw the single functional pair of incisors are large and pointed, although they lack the scissor-like action characterising those of the kangaroos. In the adults there are usually five functional cheek-teeth, of which the last four are molars, and the other the permanent premolar. The premolar in each jaw has a tall cutting crown, set obliquely to the line of the molars; while the latter, of which the fourth may be absent, have usually blunt tubercles on their crowns, although they may be of a cutting type. In young animals there are two milk-molars in advance of the first molar in each jaw; and between the first of these and the functional front teeth there occur several minute teeth in each jaw, very variable in number and quite useless, which it is impossible to name correctly, several of these rudimentary teeth usually persisting throughout life. While some of the phalangers are mainly or exclusively herbivorous, others are more or less omnivorous; and it is in this family alone among Marsupials that we meet with species endowed with the power of spurious flight.



SKELETON AND JAWS OF PHALANGER.

Long-snouted Phalanger. The elegant little creature known as the long-snouted phalanger (*Tarsipes rostratus*), may be compared in form and size to the common shrew; and is the sole representative of a special subfamily of the phalangers. In spite, however, of this superficial resemblance to a shrew, the creature is a true marsupial, the female having a well-developed pouch for the young. Externally, the most characteristic feature of this animal is the extremely long and pointed muzzle, in which the opening of the mouth is very small. From this tiny mouth

can be protruded at will a long, slender, and highly extensile tongue, sharply pointed at its extremity. The rather small ears are rounded and clothed with very short hairs; and the beady black eyes are small and prominent. The feet are of the same general type as in the typical phalangers; but from the small size of their nails, which are mostly embedded in fleshy parts, they appear more adapted for grasping small twigs than for ascending tree-trunks. The tail slightly



THE LONG-SNOUTED PHALANGER (⅓ nat. size).—After Gould.

exceeds the length of the head and body, and is cylindrical and tapering, with but a scanty clothing of extremely short hairs, and endowed with prehensile power. The fur is short, close, and somewhat coarse. The colour is subject to considerable individual variation, but its general tint is grey, more or less suffused with rusty red above and yellow beneath. A black line runs from the head along the middle of the back to the root of the tail; and on either side of this line are two greyish bands, each bordered by a rusty brown stripe passing imperceptibly into the rufous of the flanks. The upper part of the head is brown, passing into

rufous on the sides of the face. Although the central pair of lower incisors are relatively large and well-developed, all the other teeth, of which the number is very variable, are simply conical, and placed at considerable intervals apart. This rudimentary condition of the teeth, together with the peculiar characters of the tongue and mouth, clearly indicate that the creature is a very specialised member of the family.

Habits. The long-snouted phalanger is an inhabitant of Western Australia, where it is known to the natives as the tait. Although in some districts stated to be very rare, in others it appears to be far from uncommon; its favourite resorts being low scrubby bushes. It is strictly nocturnal; and constructs its nests in the taller plants and shrubs, among the branches of which it climbs in search of its favourite food, honey. This food is procured by thrusting the long extensile tongue into the cups of the flowers; and as nearly all the Australian flowering plants are honey-yielders, it is obtainable at all seasons.

The Cuscuses. With the beautiful animals commonly known by the name of cuscus, one of which (*Phalanger maculatus*) is represented in the accompanying figure, we come to the first generic group of the typical phalangers, which present the general characteristics noticed under the heading of the family. The members of the present genus are relatively large or medium-sized animals, with thick woolly coats and long prehensile tails, of which the terminal portion is completely naked. Their ears are short or of medium length, invariably covered with hair externally, and sometimes also on their inner surface. In the fore-feet the toes are of nearly equal length, and furnished with long, stout, and curved claws; while the soles of both fore and hind-feet are naked and striated, with several large and ill-defined fleshy pads. The crowns of the molar teeth have four cusps; of which the outer pair in those of the upper jaw are somewhat compressed from side to side.

Altogether there are five different species of cuscus, mostly of about the size of a large cat; and among these the spotted cuscus herewith figured is by far the handsomest. In the male of this species the ground-colour of the fur of the back is usually a dirty yellowish white, marked with numerous irregular blotchings of reddish brown and black; the chin and under-parts being white, often tinged with yellow or red, and the head or limbs grey or reddish. There is, however, great individual variation, some specimens being almost uniformly grey or red. The smaller female (as shown on the right side of our figure) is generally of a uniform grey and black above, and white beneath, although sometimes red. A much more sober-hued animal is the black cuscus (*P. ursinus*), of Celebes, in which the fur is of a uniform black or dark brown colour, with the exception of that on the inside of the ears, which is white.

With the exception of the spotted species, which ranges to North Australia, the cuscuses are mainly confined to the islands of the Indo-Malayan region, as far westwards as Celebes. Only the spotted cuscus and one other species are even found in New Guinea; and they are the sole Old World Marsupials occurring to the westward of that island. The grey cuscus (*P. orientalis*), of Amboyna, Timor, and some of the smaller islands, was the first Australasian mammal known in Europe, having been discovered and described as far back as the year 1611.

All the species of cuscus are dull and sleepy creatures by day, but become more active at night, which is their chief feeding-time; the comparatively large size of their eyes being in accordance with nocturnal habits. Mr. Wallace writes that these animals "live in trees, feeding upon the leaves, of which they devour large quantities. They move about slowly, and are difficult to kill, owing to the thickness of their fur, and their tenacity of life. A heavy charge of shot will



THE SPOTTED CUSCUS (⅓ nat. size).

often lodge in the skin and do them no harm, and even breaking the spine or piercing the brain will not kill them for some hours. The natives everywhere eat their flesh, and as their motions are so slow, easily catch them by climbing, so that it is wonderful they have not been exterminated. It may be, however, that their dense woolly fur protects them from birds of prey, and the islands they live in are too thinly inhabited for man to be able to exterminate them." These animals appear to be nowhere common, and in most parts of their habitat are very rare. In addition to leaves and fruit, they will catch and eat birds and other small

animals, and are indeed reported to be more carnivorously inclined than any of the other members of the family. They frequent only forests containing large trees, and pass from the boughs of one tree to another after the manner of squirrels, sometimes swinging themselves by the tail in order to reach a branch which would otherwise be inaccessible. There are four teats in the pouch of the female, which usually contains from two to four young; and it is said that a female is never killed without at least one being in the pouch. So tightly do the young adhere to the nipples, that they cannot be torn away without causing blood to flow.

The True Phalangers. The true phalangers (*Trichosurus*), of which there are two species, from Australia and Tasmania, where, in common with the members of the next genus, they are called opossums, are readily distinguished from the cuscuses by the character of their tails. Thus, instead of being tapering and naked for about half its length, this appendage is thickly covered with bushy hair up to its very tip, which, together with a narrow line on the lower surface extending about a third of the length, is alone naked. The ears are more or less hairy behind; and there is also hair on the hind-feet behind the heel. The relative lengths of the toes of the fore-feet are somewhat different from those obtaining in the cuscuses; and there is also a gland on the chest not found in the latter. The common phalanger (*Trichosurus vulpecula*) is one of the most abundant animals in Australia, where it is found everywhere in forest-regions, with the exception of the Cape York peninsula; it is represented by a variety in Tasmania. Deriving its specific name from its general resemblance in size and form to a small fox, it is especially characterised by its comparatively long and narrow ears, in which the length considerably exceeds the width. In the ordinary form the general colour of the soft and close fur is grey above and yellowish white beneath; the ears being white, and the tail black. In the larger and stouter-built Tasmanian variety the fur is longer, and of a more decided brown or rufous colour, with little or no white on the ears. The short-eared phalanger (*T. caninus*), of Queensland and New South Wales, comes very close to the latter variety, from which it differs by its short and rounded ears.

While the common phalanger inhabits forests, the short-eared species frequents scrub-jungle; but in other respects the habits of the two are probably very similar, both being purely nocturnal creatures. During the daytime the common species lies securely curled up in some hole in a giant gum-tree, but soon after sundown issues forth to prowl in search of food, and remains abroad until the laughing jackass commences its morning notes. Leaves—especially those of the peppermint-gum—constitute their chief food; but their diet is occasionally varied with the flesh of a bird. In their movements among the forest trees they are very nimble; and they are much aided in their evolutions by their highly prehensile tails. They utter, especially during the pairing-season, a loud, chattering cry, which echoes far through the forest stillness. The female phalanger gives birth to one or two young, which are retained for a long period in the pouch, but afterwards cling to the back of their parent till able to shift for themselves.

Crescent-Toothed Phalangers. Very similar in external appearance to the true phalangers are a group of ten species, which, from the peculiar structure of their

molars may be termed crescent-toothed phalangers. Externally they differ from the preceding group by the tail being tapering, and having shorter hair on its terminal third and under surface than elsewhere, with the lower surface of the tip naked for a short distance. There is, moreover, no gland on the chest; and the two inner toes of the front paw are very markedly opposable to the other three. In addition to certain features in the skull, these phalangers are readily distinguished from the last by having the whole four cusps on their upper molar teeth distinctly crescent-shaped; thus simulating those of the ancestors of the Ruminant Ungulates.

These phalangers inhabit Australia, Tasmania, and New Guinea; and are divided into two groups each containing five species. In the first group, as represented



COMMON PHALANGER.

by the Herbert River phalanger (*Pseudochirus herbertensis*), and the widely spread ring-tailed phalanger (*P. peregrinus*), first discovered by Captain Cook, the ears are of medium length, and longer than broad, while the tail is tipped with white. This group is confined to Australia and Tasmania. In the second group, on the other hand, the ears are very short, and wider than long; while, with one exception, the tail is not white at the tip. The exceptional species is Archer's phalanger (*P. archeri*), of Queensland, which is the only representative of the group found of New Guinea. Consequently, all the Australian crescent-toothed phalangers are distinguished from those of Papua by their white tail-tips.

Great Flying-Phalanger.

The flying representatives of this family belong to three groups, severally allied to as many non-volant types. The largest of these forms is the great or taguan flying-phalanger (*Petauroides volans*), of Queensland and Victoria, which is the sole representative of its genus, and appears indeed to be nothing more than a crescent-toothed phalanger which has acquired a flying-

membrane; being like it in skull and teeth, while the tail, which is prehensile, is similarly naked on the under surface of the tip. The flying-membrane extends from the wrist to the ankle, but is reduced to a narrow strip on the fore-arm and lower leg. In size this species may measure as much as 20 inches to the root of the tail. It is characterised by its large and thickly-haired ears and long silky coat; its general colour being blackish brown with white beneath.

Striped Phalanger. The striped phalanger (*Dactylopsila trivirgata*), ranging from New Guinea to Queensland, together with a second Papuan species (*D. palpator*), represent a non-flying genus, agreeing with the two last in having the under surface of the tip of the tail naked, but distinguished by having the fourth toe of the fore-foot much longer than either of the others. These phalangers, which are of medium size, are, moreover, easily distinguished from their kindred by the back being ornamented with broad longitudinal stripes of black and white. Although nothing definite is known as to their habits, it is probable that the elongated fourth digit of the fore-paw is for the purpose of extracting insects and grubs from beneath the bark, or out of holes in trees.

True Flying-Phalangers. The true flying-phalangers (*Petaurus*), of which there are two exclusively Australian species, and one common to Australia and New Guinea, are small or medium-sized forms, closely allied to Leadbeater's phalanger, noticed below. They are readily distinguished from the preceding groups by the tail being evenly bushy to its extreme tip, without any naked portion, and not prehensile. The flying-membrane is broad, and extends from the outermost toe of the fore-foot to the ankle. The best known species is the squirrel flying-phalanger (*Petaurus sciureus*)—the sugar-squirrel of the colonists—which is the one represented in our illustration. It is confined to Eastern Australia. The length of the head and body in this pretty little animal is about 9 inches, and that of the tail rather more. The ears are of medium length, the tail extremely bushy, especially near its root, and the fur very soft. The general colour is a delicate ashy grey; but a longitudinal black band commencing near the nose runs down the back, to stop short of the root of the tail. The eyes are ringed with black; the ears are black at the base externally but white at the hinder angle; the cheeks are white, save for a black patch immediately below the ear; while the chin, under-parts, and edges of the flying-membrane are also white. The tip of the tail is black, and there is a black line on each side of the flying-membrane internally to the white margin.

The following excellent account of the habits of the yellow flying-phalanger (*P. australis*), from mountain districts in New South Wales and Victoria, is given by Gould, who says that "this animal is common in all the bushes of New South Wales, particularly in those which stretch along the coast from Port Phillip to Moreton Bay. In these vast forests trees of one kind or another are perpetually flowering, and thus offer a never-failing supply of the blossoms upon which it feeds; the flowers of the various kinds of gums (eucalyptus), some of which are of great magnitude, being the principal favourites. Like the rest of its genus, it is nocturnal in its habits, dwelling in holes and in the sprouts of the larger branches during the day, and displaying the greatest activity at night while running over the small leafy branches, frequently even to their very

extremities, in search of insects and the honey of the newly-opened blossoms. Its structure being ill-adapted for terrestrial habits, it seldom descends to the ground except for the purpose of passing to a tree too distant to be reached by flight. When chased or forced to flight, it ascends to the highest branch and performs the most enormous leaps, sweeping from tree to tree with wonderful address; a slight ascent gives its body an impetus which, with the expansion of its membrane, enables it to pass to a considerable distance, always ascending a little at the extremity of the leap; by this ascent the animal is prevented from receiving the shock it would otherwise sustain."



SQUIRREL FLYING-PHALANGER (⅓ nat. size)

Leadbeater's Phalanger. The little Leadbeater's phalanger (*Gymnobelideus leadbeateri*), which is rather smaller than the lesser flying squirrel, is of interest as being apparently a representative of the parent form from which the true flying squirrels were derived. This animal may, indeed, be concisely described as a flying squirrel, *minus* the flying-membrane. It is an inhabitant of Victoria.

Dormouse-Phalangers. The dormouse-phalangers, of which there are four species from Western Australia, Tasmania, and New Guinea, are small creatures somewhat resembling dormice in general appearance, and readily distinguished by their cylindrical mouse-like tails, which are covered with fur at the base, then scaly for the greater part of their length, but naked and prehensile at the tip. In the smallest species (*Dromicia concinna*) the length of the head and body may be

less than 2½ inches, while the tail is slightly longer. They are all nocturnal and arboreal in their habits; one of the species being stated to conceal itself during the day beneath the loose bark of large gum-trees. They feed upon honey and young shoots of grass, and probably also insects.

Pigmy Flying-Phalanger. One of the smallest and at the same time the most elegant of mammals is the exquisite little creature commonly known as the pigmy flying-phalanger (*Acrobates pygmæa*), in which the length of the head and body only slightly exceeds 2½ inches; that of the tail being somewhat more. This phalanger is readily distinguished from those yet noticed by the long hairs on the tail being arranged in two opposite fringes like the vanes of a feather. The general build of the animal is extremely light and delicate; the flying-membrane is very narrow, extending from the elbow to the flank, where it almost disappears, and thence to the knee; while the toes are furnished with expanded pads at their tips



PIGMY FLYING-PHALANGER (nat. size).

The fur is long, soft, and silky: its general colour on the upper-parts being brownish grey; while on the margins of the flying-membrane and beneath, together with the inner sides of the limbs, it is white. The teeth are sharp, and apparently adapted for an insectivorous diet. In spite of its diminutive proportions, the female has a well-developed pouch containing four nipples; but it is difficult to imagine the minuteness which must necessarily characterise the newly-born young.

The pigmy flying-phalanger is confined to Queensland, New South Wales, and Victoria; and is reported to be very abundant in the neighbourhood of Port Jackson. Its food consists of honey and insects; and its agility in leaping from branch to branch is described as little short of marvellous.

Pen-Tailed Phalanger. The little pen-tailed phalanger (*Distæchurus pennatus*), of New Guinea, has precisely the same relation to the preceding animal as is

presented by Leadbeater's phalanger to the members of the genus *Petaurus*, being in fact a pigmy flying-phalanger without the parachute. The foot-pads are however, wanting. The general appearance of the animal is very dormouse-like, the head being ornamented with stripes of white and dark brown, while the fur of the body is uniformly buff.

Koala. This curious and somewhat bear-like creature is an aberrant member of the family, constituting not only a distinct genus but likewise a separate subfamily by itself. To the natives it is known by the name of koala, while by the colonists it is generally termed the native bear; its scientific title being *Phascolarctus cinereus*. The koala has been compared in size to a large poodle dog, the length of the head and body being about 24 inches. It is a heavily-built animal, differing from all the other members of the family in the absence of any external tail, and also readily recognised by its large, squared, and thickly-fringed ears. The fur is extremely thick, woolly, and



THE KOALA (⅛ nat. size).

moderately soft; its general colour on the upper-parts being ashy grey, with a tinge of brown, but becoming yellowish white on the hind-quarters, while the under-parts are whitish. All the feet are provided with long claws, and the two innermost toes of the fore-feet are completely opposable to the remaining three. A peculiarity of the koala is the possession of pouches in the cheeks for storing food; while the dentition differs from that of the typical phalangers in the absence of the minute rudimentary teeth referred to above. The upper molar teeth have very short and broad crowns, somewhat resembling, in the structure of their tubercles, those of the crescent-toothed phalangers. In its internal organisation the koala approximates to the wombats.

Habits. The koala is confined to Eastern Australia, where it ranges from Queensland to Victoria. Like the other members of the family it is

chiefly arboreal, moving awkwardly when on the ground, and when pursued always endeavouring to gain a tree with all possible speed. Its movements are usually comparatively slow and sluggish, and, although mainly nocturnal, it may not unfrequently be seen abroad in the daytime. Koalas are generally found in pairs; and spend the day either high up on the tree-tops or in hollow logs. They are purely herbivorous, and subsist chiefly on the leaves of the blue gum-tree, although at night they descend to the ground in order to dig for roots. In the evenings these animals slowly creep along the boughs of the gum-trees, the females often having a solitary cub perched on their backs. When irritated or disturbed, the koala utters a loud cry, variously described as a hoarse grunt, and a shrill yell.

Giant Extinct Phalanger. The superficial deposits of Australia have yielded evidence of the former existence in that country of a phalanger (*Thylacoleo carnifex*) far exceeding any of the living forms in point of size, and remarkable for the exceedingly specialised character of its dentition. The functional teeth, as shown in the accompanying figure of the skull, were, indeed, reduced to a pair of large incisors, and a single elongated cutting premolar on each side of both the upper and lower jaws; the latter tooth evidently corresponding to the permanent premolar of the rat-kangaroos (see the figure on p. 237). Such other teeth as remain were small, and of no functional importance. The skull is unique among Marsupials in that the sockets of the eyes are completely surrounded by bone.



SKULL OF THE GIANT EXTINCT PHALANGER (⅛ nat. size).

This huge phalanger received its technical names on the supposition that it was of purely carnivorous habits; but from the resemblance of its dentition to that of the existing members of the family, it seems more probable that its diet was mainly of a vegetable nature.

The Wombats.

Family *Phascolomyidæ*.

The wombats of Australia and Tasmania, where they are represented by three existing species all referable to the one genus *Phascolomys*, constitute the last family of the herbivorous Marsupials. These animals are of considerable size, and characterised externally by their massive build, short and flattened heads, broad flat backs, and extremely short and thick legs; their hind-feet being plantigrade. Their ears are small or of moderate size, and more or less pointed; the eyes are small, and the tail is reduced to a mere stump. The fore-feet have five toes, of which the first and fifth are considerably shorter than the remaining three, all being furnished with powerful and somewhat curved nails. In the hind-feet the inner or "great" toe resembles that of the phalangers in being unprovided with a nail, although it cannot be opposed to the rest; the others have strong curved nails and

are of nearly equal length, but the second and third are relatively slender and partially united by skin, thus foreshadowing the "syndactylism" of the two foregoing families. The most distinctive feature of the wombats is, however, their dentition. The teeth, twenty-four in number, all grow uninterruptedly throughout life, and thus never develop roots. The incisors are reduced to a single pair in each jaw, these being exceedingly powerful chisel-shaped teeth, with enamel only on their front surfaces, thus resembling the incisors of Rodents. The cheek-teeth are five on each side, of which the first is a premolar, and separated by a long interval from the incisor. Each molar is much curved, and consists of two triangular prisms; but the premolar comprises but one such prism. It will thus be evident that, so far as their teeth are concerned, the wombats simulate the Rodents, to many of which they also approximate in habits. In general appearance these Marsupials are however, curiously like diminutive bears, as shown in the illustration on p. 266.



SKELETON OF WOMBAT.

Of the three species of the genus, the smallest is the Tasmanian wombat (*P. ursinus*), inhabiting Tasmania and the islands in Bass Strait. It is characterised by its small and somewhat rounded ears, the naked extremity of the muzzle, and the coarse and rough hair; the colour being uniform dark grizzled greyish brown. About one-fourth larger than this species is the common wombat (*P. mitchelli*), from New South Wales, Victoria, and South Australia, in which the length of the head and body is about 30 inches, while the colour may vary from yellow, through yellow mingled with black, to nearly pure black. The third species is the hairy-nosed wombat (*P. latifrons*), from South Australia, intermediate in size between the other two, from which it differs by its longer and more pointed ears, hairy muzzle, and soft silky hair.

Habits. All the three species seem to agree in their habits, and are exclusively herbivorous, living either in burrows excavated by themselves, or in clefts and crannies of rocks. Like most Marsupials, they are exclusively nocturnal; and their food consists of grass, other herbage, and roots. They walk with a peculiar shuffling gait; and utter either a hissing sound or a short grunt when irritated. In disposition they are shy and gentle; although their powerful incisor teeth are capable of inflicting severe bites. On the rare occasions that these animals are seen abroad in the daytime, they suffer themselves to be caught with ease, and often make no resistance after their capture.

The Bandicoots.

Family *Peramelidæ.*

All the members of the preceding families are characterised by the presence of not more than three pairs of upper incisor teeth, and also by those of the lower jaw

being reduced to a single functional pair of large size, which are invariably inclined forwards. On account of this single pair of functional lower incisor teeth, they are collectively termed Diprotodonts. The upper canine or tusk is small in all the group, and the corresponding lower tooth absent or represented by a rudiment. On the other hand, in the remaining families of the order the incisor teeth, as shown in the woodcut on p. 268, are of a more normal type; that is to say, they are numerous, and the innermost pair is not greatly developed at the expense of the others. The tusks are large and prominent; and whereas in the Diprotodonts the molar teeth have broad and often squared crowns, surmounted



TASMANIAN WOMBAT (ON THE LEFT) AND HAIRY-NOSED WOMBAT (ON THE RIGHT). ($\frac{1}{8}$ nat. size.)

by transverse ridges or blunt tubercles, those of the present group have sharp cusps, and are generally more or less triangular in form, thus indicating a partially or wholly carnivorous diet. On account of the number of their lower incisor teeth, the name of Polyprotodonts has been suggested for this second great group of the Marsupials, which occupy the place in the order held by the Carnivores and Insectivores among the Placental Mammals. Instead of being restricted to the Australasian region, the Polyprotodonts are represented in America by the opossums; while in former epochs they had apparently a world-wide distribution, and included some of the oldest mammals known.

The bandicoots are small or medium-sized animals of fossorial habits, living either on insects or a mixed diet, and are readily characterised by the structure of their hind-feet. They have long and sharply pointed noses; and the

pouch is complete, with its opening directed towards the hinder end of the body. In the fore-feet the three middle toes, or two of them, are of nearly equal size and furnished with well-developed and somewhat curved claws, while the first and fifth toes are rudimentary or absent. The hind-feet are constructed on the same type as in the kangaroos; the fourth toe being much larger than the others, while the second and third are small, slender, and united by skin, the first being rudimental or wanting. The terminal bones of the larger toes in both feet are peculiar among Marsupials in having their extremities cleft by a longitudinal slit, in the same manner as are those of the pangolins. As regards their dentition, the bandicoots are characterised by having either four or five pairs of incisor teeth in the upper jaw, and three in the lower; while their upper molars are more squared than in the other families, with their cusps arranged in the form of the letter W. The similarity between the hind-feet of the bandicoots and the kangaroos is a very remarkable feature;—more especially if, as is now generally considered to be the case, this structure has been independently acquired in the two groups.

True Bandicoots. The true bandicoots (*Perameles*), of which there are eleven species, are characterised by having the three middle toes of the fore-foot large and functional, and the first and fifth present, although small and nailless; while on the hind-foot there is also a rudiment of the first toe. The ears, although variable, are never of enormous length, and the tapering cylindrical tail is devoid of a crest of hairs near its extremity. In all, the build is stout and clumsy, and there is no great disproportion between the fore and hind-limbs. The various species of bandicoots inhabit Australia and Papua; one of the best known being Gunn's bandicoot (*P. gunni*), from Tasmania. The length of the head and body in this creature is about 16 inches, and that of the tail 4 inches. It belongs to a group characterised by the ears being long and pointed, reaching as far as the eyes when turned forwards; and also by the hinder-half of the sole of the foot being covered with hairs. The fur is soft, and of a general grizzled yellowish brown colour above, with four or more pale vertical bands, separated by dark brown intervals on the rump; the chin and under-parts being white or yellowish white. The smaller short-nosed bandicoot (*P. obesula*), which is common to Australia and Tasmania, represents a second group, in which the ears are very short and rounded at the tip, the soles of the hind-feet completely naked, and the fur intermingled with short spines. These two groups are closely connected by the Papuan representatives of the genus.

Bandicoots are the commonest of the Australian carnivorous Marsupials; and are cordially detested by the colonists on account of the damage they do to gardens and cultivated fields. Omnivorous in their diet, consuming, with equal gusto, roots, bulbs, berries, fallen fruits, or other vegetable substances, as well as insects and worms, they are chiefly nocturnal, and pass the day either in holes or hollows or logs; to which retreat they at once fly when pursued. In addition to their burrows, some of the species at least construct nests.

Rabbit-Bandicoot. The rabbit-bandicoot (*Peragale lagotis*), together with a closely allied species, constitutes a genus readily distinguished by the enormous length of the ears, by the terminal half of the tail having a crest of long hairs on its upper surface, and by the great relative length of the hind-limbs, in

which all trace of the inner toe is wanting. The molar teeth are, moreover, curved; and in the type species have longer roots and shorter crowns than in the true bandicoots. The rabbit-bandicoot is about the size of an ordinary rabbit, and is clothed with fine silky hair of considerable length. The general colour of the upper-parts is pale grey, passing into rufous on the flanks, and becoming white beneath; the feet, as well as the end of the tail, being white.

Pig-Footed Bandicoot. The pig-footed bandicoot (*Chœropus castanotis*) is a delicately-built and rather small animal, measuring from 10 to 11 inches in length, exclusive of the short tail. It has long ears; and a rather short but sharp muzzle, naked at the extreme tip; but its most characteristic features are to be found in its feet. In the fore-limbs, which are much shorter than the hinder-pair, the functional toes are reduced to the second and third, these being furnished with short, symmetrical, and slightly curved claws; while the first and fifth toes are absent, and the fourth represented merely by a small rudiment. In the long and slender hind-limbs the whole strength is concentrated in the long and stout fourth toe, the united second and third toes being very small, and the fourth altogether rudimentary. The fur is coarse and straight; its general colour on the head and body being a uniform grizzled grey, with a tinge of fawn; while the chin, chest, and under-parts are white, and the feet pale grey or white, with a yellowish tinge. This animal inhabits the greater part of Australia, with the exception of the extreme north, north-east, and east; its favourite haunts being open grassy plains, where it constructs nests like those of the ordinary bandicoots.

The Dasyure Tribe.

Family *Dasyuridæ*.

Dasyures are distinguished from the members of the preceding family by having the second and third toes of the hind-foot perfectly separate from one another, and as well developed as the fourth and fifth; the first toe, if present at all, being small and without a claw. The dentition differs from that of most of the bandicoots in that there are four in place of five incisor teeth on each side of the upper jaw; both groups having three pairs of these teeth in the lower jaw.



FRONT VIEW OF SKULL OF THE TASMANIAN DEVIL.
(From Sir W. H. Flower, *Quart. Journ. Geol. Soc.* vol. xxiv.)

In all the members of the family the fore and hind-limbs are of approximately equal length; and the fore-feet have five well-developed toes, all armed with claws. The tail, which may be either medium or long, is hairy, and without the power of prehension; and the pouch,

when present, opens downwards and forwards. In the more typical forms the incisor teeth are small, and the tusks large, as shown in the figure on p. 268; the number of cheek-teeth being either six or seven on each side of both jaws. At the present day the family is confined to Australia, Tasmania, and New Guinea, although in the Tertiary period it was represented in South America, where some of the extinct forms appear to have been very closely allied to the existing thylacine. While the larger species are purely carnivorous, catching and killing their own prey, the smaller representatives of the family are mainly insect-eaters. In structure these animals are the most generalised of all Marsupials, and come nearest to the extinct forms from the Secondary rocks.

Thylacine.

The largest of the carnivorous Marsupials is the animal commonly known in Australia as the Tasmanian wolf, but better designated the thylacine (*Thylacinus cynocephalus*). In appearance this creature is extraordinarily wolf-like; and the unscientific observer would probably at first



SKELETON OF THYLACINE.

sight regard it as a member of the canine family. Nevertheless, the female has a well-developed pouch; although the marsupial bones are wanting, being represented merely by cartilages, of which the position is indicated by the * in the figure of the skeleton. In size the thylacine is rather smaller than the European wolf; from which it is readily distinguished externally by the tapering and thinly haired tail, as well as by the dark transverse stripes on the hinder part of the back and loins, and the shortness and closeness of the fur. The ground-colour of the fur is greyish brown, while the transverse bands are black. In the hind-foot the first toe is wanting; and there are seven cheek-teeth on each side of the jaws.

Tasmania is now the only habitat of the thylacine; although remains of a species near akin to the living one are met with in the superficial deposits of the mainland. Like most Marsupials, the thylacine is mainly nocturnal. Its favourite haunts are caverns and clefts of rocks among the deep glens of the mountains in the more remote districts of Tasmania; the settlers having nearly exterminated the animal from the more populated regions on account of the damage it inflicts on their flocks.

Tasmanian Devil.

The animal rejoicing in the name of the Tasmanian devil (*Sarcophilus ursinus*) is the sole living representative of its genus. Like the thylacine, it has, however, an extinct cousin on the Australian mainland. The Tasmanian devil is an ugly and powerfully-built animal, with an excessively large head, terminating in a short and broad muzzle; its size being approximately that of the common badger. The ears are large and rounded on the outer side; and the tail is of moderate length, and thickly, although evenly haired. As in the thylacine, the hind-foot has no trace of the first toe; but, instead of being digitigrade, both fore and hind-feet are markedly plantigrade. The fur



THE THYLACINE, OR TASMANIAN WOLF ($\frac{1}{10}$ nat. size).

of the head and body is thick and close, with a large quantity of under-fur, which is nearly equal in length to the straight fur. In colour the fur is mainly black or blackish brown, but there is a white collar or patch on the throat, and a variable number of white spots on the neck, shoulders, and rump. The incisor teeth (as shown in the figure on p. 268) differ from those of the thylacine in that the outermost pair are not markedly larger than the others; while the cheek-teeth are six instead of seven in number, on each side, and are closely packed together, in place of being separated from one another by intervals. It is an even more exclusively nocturnal animal than the thylacine, being almost blinded if exposed to the rays of the sun, and passing the day coiled up in some dark and secluded lair, which may be either a natural cave or cleft among the rocks, or a burrow excavated by

the animal's powerful claws at the root of a tree. In its gait and movements it presents a considerable resemblance to a badger or small bear. Except those which are too large to be attacked, living creatures of all kinds—whether vertebrate or invertebrate — form the prey of the Tasmanian devil; even sheep being destroyed in large numbers by these comparatively small marauders.

Dasyures. On the mainland of Australia the carnivorous Marsupials are represented by the civet-like dasyures, or native cats (*Dasyurus*), the largest of which are about equal in size to an ordinary cat. They have the same number of teeth as in the Tasmanian devil, but the cheek-teeth are less massive and powerful. The general form of the body is also much longer and more slender, and the tail more elongated; while in all cases the body is profusely spotted with white, upon a grey or brown ground-colour. The muzzle



THE TASMANIAN DEVIL ($\frac{1}{10}$ nat. size).

is sharp, the ears long, narrow, and pointed; and the long tail evenly and thickly furred. In some of the species there is a rudiment of the first toe of the hind-foot. The dasyures, of which there are five species, are common to Australia, Tasmania, and New Guinea. The largest is the spotted-tailed dasyure (*D. maculatus*), from Eastern and South-Eastern Australia, distinguished from the others by the tail being spotted as well as the body; but the best known species is the common dasyure (*D. viverrinus*), inhabiting both Australia and Tasmania. The dasyures are arboreal animals, and in habits resemble the martens, of which they appear to take the place in Australasia. They feed on small mammals, birds and their eggs, and probably also lizards and insects, and are especially destructive to poultry.

Phascologales. Far more numerous than the dasyures are the smaller phascologales (*Phascologale*), the largest of which is not bigger than a good-sized rat. They are distinguishable from the dasyures by the absence of white spots

on the fur, and by the presence of an additional premolar in each jaw, thus bringing up the number of cheek-teeth to seven on each side. The crowns of these teeth are more minutely cusped, and the canines relatively smaller than in the dasyures. The muzzle is rather long and pointed, the ears moderately rounded and nearly naked, and the feet short and broad; the hind-foot always having a distinct, although nailless, first toe. The long tail is subject to considerable variation in the different species, being in some cases bushy, in others furnished with a crest of hair, and in others nearly naked. The pouch is rudimentary, being represented merely by a few loose folds of skin. Probably these animals produce a larger number of young at a birth than any other Australasian Marsupials, seeing that in some species the number of teats may be as many as ten. There are altogether thirteen distinct species of the genus, distributed over Australia and New Guinea, and also ranging into the Aru Islands. Of these thirteen, nine are distinguished by the absence of any stripe down the back, and are mainly confined to Australia. This stripe is present in the remaining



COMMON DASYURE (½ nat. size).

four, which are exclusively Papuan. Of the two species figured here, the yellow-footed pouched-mouse (*P. flavipes*) is a small form, liable to considerable variation in point of size and colour, and inhabiting a large portion of Australia, although unknown in Tasmania. It belongs to a section of the first group, characterised by the tail being evenly covered with short hair. In general appearance it is a mouse-like creature, with close and rather crisp fur, of which the prevailing colour is clear grey more or less suffused with yellow or rufous. The under-parts, together with the feet, in the typical East Australian variety, are yellow; this colour sometimes deepening to rufous and spreading over the whole body. The variety inhabiting Western and Northern Australia differs in that the whole of the under-parts and limbs are more or less nearly pure white instead of yellow.

The brush-tailed phascologale (*P. penicillata*) is a larger species, inhabiting the whole of Australia except the extreme north, although likewise unknown in Tasmania. It belongs to a section of the unstriped group, characterised by the extremity of the tail being evenly tufted on all sides. It is a more stoutly-built

animal than the last, with short and coarse fur. The general colour of the upper-parts is pale grizzled grey, while the chin is white, and the lower surface of the body pale grey or white. The head is characterised by the large size of the ears, and the presence of a more or less indistinct black streak down the nose. These pretty little animals are arboreal and insectivorous in their habits; and appear to fill the place in Australia occupied in the Oriental region by the placental tree-shrews, which they much resemble in general habits. All seek their insect-prey by climbing the boughs of trees; and at least some make nests in the hollows of the trunks and branches.

Common Pouched-Mouse. The tiny creature, known as the common pouched-mouse (*Sminthopsis murina*), constitutes, with three other nearly-allied species, a distinct genus, differing from the last by the extreme narrowness of the hind-foot, and also by the circumstance that the soles of the feet are covered with hair or granulated. This species measures 3¼ inches in length to the root of the tail; the



YELLOW-FOOTED POUCHED-MOUSE (nat. size).

length of the tail being a little less than 3 inches. The pouched-mice of this genus are confined to Australia and Tasmania; and since they are terrestrial and insectivorous, they may be compared to the shrews among placental mammals. In all the pouch is well-developed; and the number of teats varies from eight to ten.

Jerboa Pouched-Mouse. The last and apparently the rarest of the typical section of the family is the jerboa pouched-mouse (*Antechinomys laniger*), from South Queensland and New South Wales, which constitutes a genus by itself. This little creature, which has much the appearance of a sharp-nosed jerboa, with very large oval ears, and a long tail, becoming bushy at the end, is distinguished from the members of the preceding genus by the great elongation of the hind-limbs, and the total absence of the first toe from the hind-foot. Its form is very slender and graceful; and the soft and fine fur composed almost entirely of under-fur. The general colour is pale grizzled grey, with the chin and feet pure white, and the hairs of the under-parts grey at the base and white at the tips. The tail, of which the length considerably exceeds that of the head and body, is fawn-

coloured. This pouched-mouse inhabits open sandy districts, and is mainly if not exclusively terrestrial. It progresses by leaps like a jerboa, and is accompanied in its haunts by the placental jumping mice of the genus *Hapalotis*.

Banded Anteater. One of the most curious and interesting of all the Australian Marsupials, is the little banded anteater (*Myrmecobius fasciatus*); which derives its special interest from the circumstance that it comes closer to some of the extinct Marsupials of the Secondary rocks of Europe than does any other living type. This animal, which may be compared in size to a squirrel, differs from the other members of the family in that there are more than seven cheek-teeth on each side of both the upper and lower jaws, and also in the tongue being elongated



BRUSH-TAILED PHASCOLOGALE (½ nat. size).

and cylindrical, and thus capable of being protruded a long distance from the mouth. The banded anteater takes its name from the broad transverse bars of white on the dark ground-colour of the hinder-half of the back and loins; the general hue of the fur of the upper-parts being dark chestnut-red, with the under surface of the body white, and a dark line running from the ear through the eye towards the nose. The fur itself is of a somewhat coarse and bristly nature. In form the animal is characterised by its long but broad head, and narrow, elongated muzzle, moderate-sized and somewhat pointed ears, elongated body, short limbs, and long bushy tail. In the fore-feet the first and fifth claws are considerably shorter than the others; while in the hind-foot there is no external trace of the first toe. The banded anteater is one of the few Marsupials in which the female has no pouch; the young, when first born, being merely concealed by the long hair of the belly as

they cling to the teats (four in number). The teeth are all small, and are mostly separated from one another by distinct intervals; those of the cheek-series are



JERBOA POUCHED-MOUSE (⅔ nat. size).

either eight or nine in number on each side of both the upper and lower jaw, thus making a total of either fifty-two or fifty-six teeth—a greater number than in



THE BANDED ANTEATER (½ nat. size).

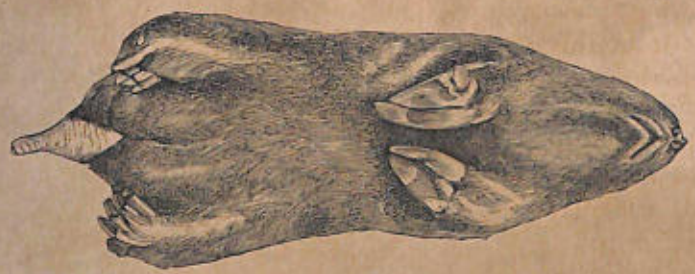
any other existing members of the order. In many of the above-mentioned points this creature differs widely from all the other *Dasyuridæ*, and there is considerable justification for the view that it ought to constitute a family by itself. The banded

anteater inhabits Western and Southern Australia, and lives mainly on the ground, although it will sometimes ascend trees. Its nutriment consists entirely of insects, and chiefly of ants and termites, which are collected by the long extensile tongue. Its favourite haunts are sandy regions, where there are numerous hollow tree-stems and ant-hills.

The Pouched-Mole.

Family *Notoryctidæ*.

In general bodily conformation the pouched-mole (*Notoryctes typhlops*) is a mole-like creature, measuring about 5 inches in total length, and covered with long, soft and silky hair of a light fawn colour, deepening in parts to golden. There are no external ears, and the eyes are represented merely by small black dots buried in the skin. The nose and upper lip are protected by a peculiar quadrangular leathery shield, the use of which to a burrowing animal is sufficiently obvious. The short limbs, which are covered with hair down to the claws, are very remarkable in structure. Both pairs are of nearly equal length, powerfully made, and furnished with five toes. In the fore-paws the third and fourth toes are enormously enlarged and furnished with huge triangular claws of great power; while in the hinder-pair the first toe is small and furnished with a small claw, and the others decrease in size from the second to the fifth. The short, cylindrical, and stumpy tail is hard and leathery, and marked by a series of distinct rings. The pouch opens backwards, and contains two very small teats. The teeth are small and weak, and appear to be forty in number. Of these three pairs in each jaw are incisors, and seven are cheek-teeth; the molars having triangular three-cusped crowns, and much resembling those of the golden mole. This mole appears to be a very rare and locally distributed animal, restricted to the deserts of Northern South Australia, lying to the north-east of Lake Eyre. Here it inhabits flats and hills of red sand, upon which grow porcupine-grass (*Triodia*) and acacias. Dr.



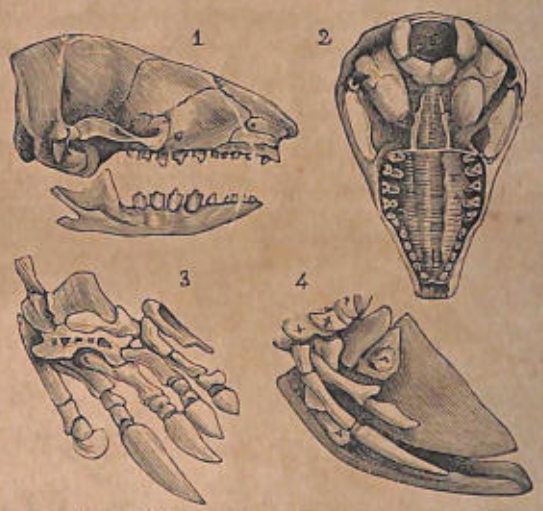
UNDER SURFACE OF THE POUCHED-MOLE (⅔ nat. size).—After Stirling.



FEET OF THE POUCHED-MOLE (about ⅔ nat. size).

1. Outer aspect of left fore-foot. 2. Profile view of same. 3. Inner aspect of same. 4. Upper surface of left hind-foot. 5. Palmar surface of same.—After Stirling.

Stirling, by whom the marsupial mole was first made known to science, states that most of the specimens he obtained were "captured by the aboriginals, who, with their phenomenal powers of tracking, follow up their traces until they are caught. For this reason they can only be found with certainty after rain, which sets the surface of the sand and enables it to retain tracks that would be immediately obliterated where it is dry and loose. Nor are they found except during warm weather, so that the short period of semitropical summer rains appears to be the favourable time for their capture." Perpetual burrowing seems to be the characteristic trait of this animal. On "emerging from the sand, it travels on the surface for a few feet, at a slowish pace, with a peculiar sinuous motion, the belly much flattened against the ground, while it rests on the outsides of its fore-paws, which are thus doubled in under it. It leaves behind it a peculiar sinuous triple track, the outer impressions, more or less interrupted, being caused by the feet, and the central continuous line by the tail, which seems to be pressed down in the rear. It enters the sand obliquely, and travels underground either for a few feet or for many yards, not apparently reaching a depth of more than two or three inches, for whilst underground its progress can often be detected by a slight cracking or moving of the surface over its position."



SKULL (1 and 2) AND SKELETON OF THE HIND (3) AND FORE (4) FEET OF THE POUCHED-MOLE (about ⅔ nat. size).—After Stirling.

THE OPOSSUMS.

Family *DIDELPHYIDÆ.*

The last family of the existing Marsupials is constituted by the well-known opossums, which are now confined to America, although during the early portion of the Tertiary period they also ranged over Europe. Closely allied to the Australian *Dasyuridæ*, the opossums are mainly distinguished by the hind-foot having a well-developed inner toe, which, although nailless, is capable of being opposed to the other digits. They are further distinguished by the number of their incisor teeth, of which there are five pairs in the upper and three in the lower jaw. The tail is generally of considerable length, partially naked and prehensile at the extremity; and the feet are likewise devoid of any hairy covering. Although complete in a few of the species, the pouch is generally either wanting altogether, or represented merely by a couple of longitudinal folds in the skin of the abdomen, which partially conceal the numerous teats. As a rule, opossums may be compared in general outward appearance to rats, although they have longer snouts terminating

in a perfectly naked muzzle; while in the larger species the body becomes proportionately stouter.

As regards habits, all the opossums, with the exception of the water-opossum, are arboreal, and omnivorous or insectivorous in their diet. They are nocturnal, and spend the day concealed either among the foliage of trees or in hollows in their trunks or boughs. The opossums take the place in America of the Insectivores of the Old World. They are naturally forest-loving animals; but a few are found on the pampas of Argentina, where they have adapted themselves to a terrestrial life. In those species in which the pouch is rudimental or wanting, the young after leaving the teats are carried upon the back of their female parent, where they maintain their position by curling their tails round that of their mother,



COMMON OPOSSUM (½ nat. size).

which is bent forwards for the purpose. Opossums are essentially characteristic of Central and South America, only one out of some twenty-four species ranging into North America, where it extends as far north as the United States.

True Opossums. The true opossums, of which there are about twenty-four living species, are characterised by the absence of webbing between the toes, and by their arboreal habits. The common or Virginian opossum (*Didelphys marsupialis*) is the sole representative of the first group, and likewise the only species found in the northern half of America. It is from three to five times the size of any other species, and characterised by its long, scaly, prehensile tail, and by the fur consisting of a mixture of long bristle-like hairs and a fine under-fur. It may be compared in size to a cat, the length of the head and body reaching 22 inches in large specimens, and that of the tail 15 inches. It is, however, subject to great variation both in size and colour, and on this account has received a number of distinct names, the common South American

form being generally known as the crab-eating opossum. The general colour of the fur may, indeed, vary through all the intermediate shades from black to white, while the hair on the face shows an almost equal amount of variation, the northern forms being almost wholly white in this region, while those from the south are darker, and often nearly black. In all cases the pouch is complete; but the number of teats may vary from five to thirteen.

The range of this widely-spread species includes the whole of temperate North America, and extends southwards through the tropical regions of the other



PHILANDER OPOSSUM ($\frac{1}{2}$ nat. size).

half of the continent. In many parts it is one of the commonest animals, and may be met with even in towns, where it lies concealed during the day in drains and other lurking-places. Its diet is a mixed one, comprising fruits, roots, birds, and other small animals, eggs, and carrion; and it is reported to be very destructive to poultry. With the aid of its prehensile tail, this opossum is one of the most expert of climbing mammals; and when caught, it has, in common with some of the other members of its genus, the habit of feigning death. Like so many marsupials, it is extremely tenacious of life. The young are born in the spring, and comprise from six to sixteen in a litter. They remain in the pouch till they

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are about the size of a mouse, after which they venture abroad, although returning to its shelter for the purpose of being suckled or sheltering for a considerable time. The female exhibits the most marked attachment to her offspring, and endeavours by every means in her power to prevent her pouch from being opened.

Rat-Tailed Opossum. The rat-tailed opossum (*D. nudicaudata*) is a well-known representative of the second group of the genus, which includes three medium-sized species, characterised by their short, close fur being of one kind only, and their long tails, which in two of the species are naked, although in the thick-tailed opossum (*D. crassicaudata*) the tail is hairy nearly to its tip. Although in the two species above-named the pouch is rudimental or absent, it is well-developed in the Quica opossum (*D. opossum*).

Philander Opossum. The philander (*D. philander*) and the woolly opossum (*D. lanigera*) are easily distinguished from the members of the preceding group by the presence of a distinct brown streak running down the middle of the face. The pouch is represented merely by two longitudinal folds of skin. The philander attains a length of from 9½ to 11½ inches to the root of the tail; the tail itself varying from 12½ to 15 inches. The fur is thick, soft, and woolly, and of a dull yellowish or rufous grey colour, with the face pale grey, save for the dark brown streak down the forehead, and similar dark areas round the eyes; the under-parts being some shade of yellow. This species is restricted to Guiana and Brazil, but is replaced in most other parts of tropical South America by the somewhat larger woolly opossum. In both species, the young, which may be a dozen in number, are carried on the back of the mother, and it is marvellous with what rapidity the females when thus loaded manage to climb trees.

Murine Opossum. The murine opossum (*D. murina*), ranging from Central Mexico to Brazil, may be taken as an example of the fourth group of the genus, in which all the species are small, with short, close hair, very long tails, and no dark streak down the middle of the face. The pouch is absent in all the group. In size the murine opossum may be compared to a common mouse; the general colour of its fur being bright red. From their small size it may be inferred that all the opossums of this group live exclusively upon insects.

Three-Striped Opossum. The last group of the genus includes its smallest representatives, among which the three-striped opossum (*D. americana*) of Brazil is conspicuous for its coloration. The whole ten species which constitute this group are shrew-like little creatures, easily recognised by their short and generally non-prehensile tails, which are less than half the length of the head and body. The three-striped species, which is by no means the smallest, measures from 4½ to 5¼ inches to the root of the tail; while the length of the tail is rather less than 2½ inches. Its general colour is reddish grey, with three black bands running down the back. Another species (*D. unistriata*) has a single dark line down the back; but in nearly all the others the colour is uniform. The smallest of all is the shrew-opossum (*D. sorex*), from Rio Grande do Sul, in which the length of the head and body is less than 3 inches.

Water-Opossum. The water-opossum or yapock (*Chironectes minima*) differs from all the other members of the family in having the hind-toes webbed, and the presence of a large tubercle on the outer side of each fore-foot, giving the

appearance of a sixth digit. This animal ranges from Guatemala to Brazil, and is distinguished by its peculiar coloration and aquatic habits. The fur is short and close, and the long tail naked and scaly for the greater part of its length. The head and body measure about 14 inches in length, and the tail about 15½ inches. The ground-colour of the fur is light grey, upon which there is a blackish brown stripe running down the middle of the back, and expanding into large blotches on the shoulders, the middle of the back, the loins, and rump. The face has also blackish markings, with an imperfect whitish crescent above the eyes; while there is a



WATER-OPOSSUM (⅛ nat. size).

certain amount of the dark tint on the outer surfaces of the limbs, the under-parts being pure white. The female possesses a complete pouch. In habits the yapock closely resembles an otter, to which group of animals it was indeed referred by the earlier naturalists. Its food consists of crustaceans, small fish, and other aquatic animals.

Extinct Marsupials.

From their low degree of organisation it would be expected that Marsupials are some of the oldest of mammals; and this expectation is borne out by the facts. So far as can be determined, no placental mammals are known to have

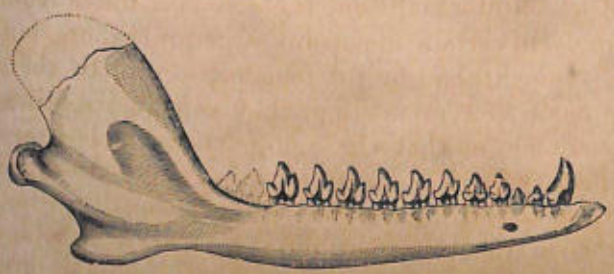
existed before the Tertiary period, that is to say, in the rocks lying below the London clay. The cretaceous rocks of North America, and the underlying Jurassic or Oolitic rocks both of that continent and of Europe have, however, yielded a number of remains of small mammals which may be pretty confidently assigned to the Polyprotodont section of the present order. In one form, known as *Triconodon*, the molar teeth, of which there were four in the fully adult state, although only three are shown in the lower jaw here figured, are characterised by carrying three compressed cones arranged in a line one before the other; while the premolars, three in number, were simpler. The groove (*g*) seen on the inner side of the lower jaw, corresponds to one found in the banded anteater and a few other living Marsupials, but unknown in any other mammals. In a second type, as represented by *Amphilestes* from the Stonesfield beds near Oxford, the cheek-teeth were much more numerous, and the molars less unlike the premolars. In the molar teeth the front and hind-cones were relatively smaller in proportion to the middle one than is the case in *Triconodon*; and in the number and form of these teeth this early mammal comes exceedingly close to the living Australian banded anteater. A third type is represented by jaws from the Purbeck rocks of Dorsetshire, known as *Amblotherium*, closely allied to which is the jaw from America represented in our third figure. Here the front and hind-cones have become twisted round to the inner side of the main cone, so that the crown of each molar forms a triangle, as in the living bandicoots and opossums. The number of the cheek-teeth is, however, much greater than in the latter, and thus indicates relationship with the banded anteater.



LOWER JAW OF TRICONODON (3 times nat. size).—After Marsh.



LOWER JAW OF A MARSUPIAL (*Amphilestes*) FROM THE STONESFIELD SLATE (twice nat. size).



LOWER JAW OF AN AMERICAN JURASSIC MAMMAL (twice nat. size).—After Marsh.



ECHIDNA WALKING.

CHAPTER XXXVII.

Egg-Laying Mammals, or Monotremes,—Order Monotremata.

The Australasian mammals, known as the duckbill and the echidnas, differ from the other members of the class not only in certain important structural points, but also by their young being hatched from eggs laid by the female parent. In their structural differences, and in their mode of reproduction, they resemble reptiles, although they agree with other mammals in that the young, when hatched, are suckled by milk secreted by the mother. Owing to these great differences, the Egg-laying Mammals, or Monotremes, as they are technically termed, constitute not only a distinct order (*Monotremata*) in the class, but form a separate subclass known as Prototherians (*Prototheria*). Consequently we find that Mammals are divided into three primary groups or subclasses, viz.:

1. Eutherians, or Placentals, containing the first nine orders.
2. Metatherians, or Implacentals, including the Pouched Mammals.
3. Prototherians, represented only by the Egg-laying Mammals.

These Egg-laying Mammals have no immediate relationship to Birds, but are closely allied to certain extinct orders of Reptiles and Amphibians; and the present representatives of the group are highly specialised creatures, and thus widely different from the original ancestral types of the Mammalian class, which we may fairly presume to have once existed as members of the Prototheria. Such ancestral types were doubtless furnished with a full series of teeth of a

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simple type of structure, and it is possible that certain imperfectly known mammals from the earliest Secondary rocks may turn out to be such missing links.

In regard to the distinctive features of the Egg-laying Mammals as a subclass, it may be mentioned that they differ from all other members of the class in having but a single excretory aperture to the body; whence their name of Monotremes is derived. Then, again, in their skeleton the shoulder-blade (scapula), instead of forming the sole support for the arm, is connected with the breast-bone (sternum) by another plate-like bone termed the metacoracoid, in advance of which is a third element known as the coracoid; the metacoracoid being always present in the lower Vertebrates. Another resemblance to Reptiles is found in the presence of a T-shaped bone overlying the breast-bone, and collar-bones (clavicles), and known



SKELETON OF DUCKBILL.

as the interclavicle; such interclavicle being similar to that of lizards and certain other reptiles, and unknown among higher mammals. Another feature of these animals is connected with the milk-glands, which instead of opening by nipples or teats, communicate with the exterior by a number of small pores situated in a cup-like depression in the skin of the abdomen. Although there are many other peculiarities in the structure of these animals, if we add to the above that their brains are of an exceedingly low and simple type, and that their young are produced from eggs, we shall not have much difficulty in understanding why they are referred by naturalists to a distinct subclass. It may be added that their skeletons possess "marsupial" bones similar to those of the Pouched Mammals.

The Duckbill.

Family *Ornithorhynchidæ.*

The duckbill, or duck-billed platypus (*Ornithorhynchus anatinus*), derives its name from the duck-like bill forming the extremity of the head. In length the adult male duckbill measures from 18 to 20 inches from the tip of the beak to the extremity of the rather short tail. The muzzle is expanded and flattened, and has both the upper and lower jaws invested with a blackish naked beak not unlike that of a duck. This beak is bordered by a naked sensitive skin, forming a lappet-like fold at the base of the snout; the nostrils being situated near its anterior extremity. The depressed and oval-shaped body is covered with short, close, and somewhat mole-like fur, comprising both longer hairs and a woolly under-fur; its usual colour being deep brown, becoming paler underneath. There are no external conchs to the ears; and the eyes are small, and in the living state inconspicuous. The tail

is broad and somewhat flattened, with a coat of coarse hairs, which on the under surface become more or less worn off in old individuals. The short limbs have their feet—more especially the front pair—expanded and webbed for the purpose of swimming. Each foot has five complete toes furnished with strong nails; but while in the fore-feet the web extends considerably beyond the extremities of the nails, in the hind-pair it reaches only to their bases. The extension of the web of the fore-feet might appear to be a hindrance in burrowing; but this difficulty is avoided by the web being then folded back on the palm of the paw. The nails of the fore-foot are somewhat flattened and expanded, while those of the hind-foot are longer, narrower, and much curved. To the heel of the male is affixed a long,



THE DUCKBILL ($\frac{1}{4}$ nat. size).

horny spur, curving upwards and backwards, and nearly an inch in length. A canal traversing this spur, and opening near its summit, is connected with a gland on the leg, which appears to secrete a poisonous fluid.

The tongue is small and non-extensile; while the cheeks are provided with pouches of considerable size, doubtless used for storing food. If it be a fully adult specimen that we examine, it will be found that in lieu of teeth each jaw carries two pairs of horny plates, of which the more anterior are sharp and narrow, while those behind are broad and flattened. Between these plates the palate is thrown into a number of transverse wrinkles, like those in a duck. In young specimens, however, two or three pairs of cheek-teeth may be observed in the upper, and two pairs in the lower jaw; most of these teeth being broadly quadrangular in form, with two cusps on one side, separated by a hollow from a longitudinal crenulated ridge on the other. As these teeth are gradually worn away by the sand taken into the mouth with the food, the horny plates grow up beneath and around them,

till they are eventually shed. That the ancestors of the duckbill were provided with a full series of persistent teeth is thus evident.

Distribution. and Habits. The duckbill is restricted to Southern and Eastern Australia and Tasmania, where it is fairly common in places suited to its habits. Thoroughly aquatic in their habits, and exclusively frequenting fresh waters, duckbills are remarkably shy creatures, and rarely seen, except at evening, when they come up to the top of the water, and look like so many black bottles floating on the surface,—sinking down immediately if alarmed. By quietly watching the stream in the evening they may be easily shot, and they will readily take a bait on a hook. Although gregarious when in the water, these animals live in pairs in the burrows constructed in the banks; their favourite haunts being where the streams expand into wide, still pools. In the banks of such sequestered spots are constructed their burrows; each of which usually has one entrance opening beneath the water, and another above the water-level, hidden among the herbage growing on the bank. The burrow runs obliquely upwards from the water to a great distance—sometimes as much as fifty feet—into the bank; and ends in a chamber, lined with grass and other substances, where the young are produced. Two eggs are laid at a time, enclosed in a strong, flexible, white shell, measuring about three-quarters of an inch in length, and two-thirds of that in diameter. They resemble the eggs of birds in the large size of their yolk, of which only a small portion goes to the formation of the embryo, while the remainder serves for its food. When first hatched, the young are blind and naked, with the beak very short, and its margins smooth and fleshy, thus forming a nearly circular mouth, well fitted to receive the milk ejected from the glands of the mother. The duckbill feeds on various small aquatic animals, such as insects, crustaceans, and worms, which it obtains by probing with its beak in the mud and sand near the banks; the food being first stored in the capacious cheek-pouches, and afterwards devoured at leisure. The large front paws are the chief agents in swimming and diving. On land these creatures move somewhat awkwardly, in a shuffling manner; and when reposing in their nests curl themselves up in a ball-like fashion. The aborigines capture the duckbill, by digging holes with sticks into the burrow from the ground above at distances from one another, until they light upon the terminal chamber.

The Echidnas.

Family *Echidnidæ*.

The echidnas, or spiny anteaters, of which there are two species, representing as many genera, are widely different in appearance and structure from the duckbill, and have a more extensive distribution. Instead of mole-like fur, the echidnas have the upper surface of the head and body covered with a mixture of stiff hairs and short thick spines. The head is rather small and rounded, and has a long, slender, beak-like snout, covered with skin, at the extremity of which are situated the small nostrils. There are no external conchs to the ears; but the eyes are of fair size. The opening of the mouth is very small; and the extensile tongue

has the elongated cylindrical form characterising anteaters of all kinds. The skull is devoid of all traces of teeth, and remarkable for the slenderness of its lower jaw, and its generally bird-like form. Although there is nothing corresponding to the horny plates of the mouth of the duckbill, both the palate and the tongue are thickly beset with small spines. The body of the echidnas is remarkably broad and depressed, with a sharp line of division between the spine-covered area of the back and the hairy under-parts. The tail is a mere stump; and the short and sturdy limbs are armed with enormously powerful claws, varying in number from three to five on each foot. Although the front-feet are applied to the ground in the usual way, the hind-feet, in walking, have the claws turned outwards and backwards. The males resemble those of the duckbill in having a hollow spur at the back of the hind-foot, which is probably employed as a weapon in the contests between rival males during the breeding-season. The brain of the echidnas differs from that of the duckbill in that the surface is extensively convoluted.

The common echidna (*Echidna aculeata*), is a variable species, found in Australia, Tasmania, and New Guinea; and characterised by having five toes



SKELETON OF ECHIDNA.

on each foot, all provided with claws; those on the fore-feet being broad, while the others are narrow and more curved. In length the beak is about equal to that of the remainder of the head; and it is either straight or slightly turned upwards. The smallest variety inhabits Port Moresby, in New Guinea, and attains a length of about 14 inches; its distinctive feature being the shortness of the spines on the back. The variety from the Australian mainland is larger, and the spines are of great length. Larger than either is the Tasmanian variety, in which the length may be 19 inches; the very short spines on the back being partially or completely hidden by the fur, the dark brown hue of which is frequently relieved by a white spot on the chest; while the beak is unusually short.

The three-toed Echidna (*Proëchidna bruijnii*), of North-Western New Guinea, is larger than any of these. Usually it has but three claws to each foot, but there is considerable variation in this respect, one specimen having five claws on the front, and four on the hind-feet. The beak is bent downwards, and attains a length equal to about double that of the rest of the head. The short spines are generally white, and the colour of the fur is dark brown or black, although the head may be almost white.

Echidnas are fossorial and mainly nocturnal animals frequenting rocky

districts, and subsisting almost exclusively on ants. They are generally found in the mountains, and the three-toed species has been taken at an elevation of between three and four thousand feet. Although it is definitely ascertained that they lay eggs, much less is known of their breeding-habits than is the case with the duckbill; according, however, to native reports, the young, which are probably two in number, are born during the Australian winter, generally in the month of May. Remains of a large extinct echidna have been obtained from the superficial deposits of New South Wales.



UNDER PART OF THE SKULL OF A SOUTH AFRICAN SECONDARY MAMMAL (⅔ nat. size).

Allied Extinct Mammals.

Certain forms from the Secondary and early Tertiary rocks of Europe, Africa, and North America are believed to belong to the Prototherian subclass, of which they probably indicate a distinct order. Their molar teeth have a distant resemblance to the teeth of the duckbill, while the bones of the shoulder seem to have comprised the two elements characterising the Egg-laying Mammals. The peculiarity in the teeth of these mammals is that the molars are traversed by one or two longitudinal grooves, on either side of which are ridges carrying a number of small tubercles; and from this feature the name of Multituberculata has been proposed for the group. The number of ridges in the upper molars is always one more than in those of the lower jaw. In some species, as in *Tritylodon*, represented in our first figure, the premolar teeth are similar to the molars; but in others, as in our second figure, the molars are small, while the premolars are large and have sharp cutting edges. When unworn, such cutting premolar teeth generally have a series of oblique grooves on the sides, and as the incisor teeth (*a*) are large and often reduced to one pair, the jaw resembles that of the rat-kangaroos. The molar teeth, however, are different, and if these Secondary Mammals are really Prototherians, the character of their teeth indicates that they cannot be the ancestral types of the higher groups of the class.



LOWER JAW OF PLAGIAULAX (nat. size and enlarged).—After Marsh.



BIRDS.

CHAPTER I.

General Characteristics,—Class **Aves.**

A traveller may in many parts of the world journey from one week's end to another without coming across a single Mammal or Reptile, but few indeed are the regions where bird-life, in some form, will not present itself more or less abundantly to his gaze; and in no country is this exuberance of bird-life, as contrasted with the apparent scarcity of Mammals and Reptiles, more remarkable than in the British Islands. This abundance is largely due to the great majority of Birds being diurnal in their habits, whereas most Mammals are nocturnal, but it is chiefly owing to the Birds being more numerous in most parts of the world, both as regards individuals and species. On this account alone Birds have always aroused a widespread interest even among those who pay no particular attention to Natural History; and in addition to it we have the beauty of their form, the gorgeous hues with which their plumage is so frequently adorned, and the power of melodious song with which so many members of the class are endowed. Then, again, the many interesting points connected with their habits, and more especially their conjugal affection and the care they bestow on their helpless young, have combined to aid in producing the universal enthusiasm for what have been most

appropriately designated "our feathered friends." As the result of this widespread popularity, the literature devoted to Birds is far more extensive than that relating to any other group of animals of equal size. And it may, perhaps, be questioned whether, in spite of their many undoubted claims to special interest, Birds have not attracted rather more than their fair share of attention; for, after all, the whole of the members of the class are wonderfully alike in general structure, even its most divergent representatives presenting no approach to the differences distinguishing nearly allied mammalian orders. It is to a great extent owing to this remarkable structural uniformity that such different views still exist as to the classification of Birds.

Distinctive Characters of Birds. Birds form a class in the Vertebrates ranking on the same level as the Mammalia, and technically known as Aves; and from the aforesaid structural uniformity of all its members, there is no difficulty in defining a Bird, nor is there any possibility of mistaking any other animal for a Bird. All living Birds, and so far as we know all fossil ones likewise, are sharply distinguished from every other creature by the possession of feathers; these corresponding in essential structure to hairs, and being similarly developed from pits sunk in the superficial layer of the skin or epidermis. This is the grand and essential characteristic of Birds, most of their other peculiarities being shared by some of the other groups of Vertebrates, either living or extinct.



LEFT SIDE OF THE PELVIS OF THE KIWI.

il, haunch-bone or ilium; *p*, *p'*, pubis; *is*, ischium; *a*, cup for head of thigh-bone.—After Marsh.

Birds agree with Mammals in having a four-chambered heart and hot blood, and also in that the blood is carried to the body by only a single great artery or aorta; but while in Mammals this aorta passes over the left branch of the windpipe or bronchus, in Birds it crosses the right. In producing their young from eggs laid by the female parent, Birds resemble not only the Egg-laying Mammals, but likewise most of the lower Vertebrates. All living members of the class possess two pairs of limbs; of which the hinder pair are always adapted either for walking or swimming, while the first pair are generally specially modified for flight, although in the flightless species they are small and more or less rudimentary. Except to a small degree in the penguins, they never subserve the purpose of walking, at least in the adult condition. The power of true flight, which is such an essential characteristic of the majority of Birds, is found elsewhere among Vertebrates only in the bats among Mammals, and the extinct pterodactyles among Reptiles. An especial peculiarity of Birds is the manner in which their whole structure is permeated by atmospheric air taken in through the windpipe. Thus, whereas in Mammals the lungs are enclosed in complete sacs (the pleuron), and

are freely suspended in the cavity of the chest, in the present class they are moulded to the form of the back of that cavity, while some of the great air-tubes pass completely through them, and thus carry the air to all parts of the body. In most Birds even the bones, which are hollow, are thus permeated by air; and in the dried state they show a small aperture (pneumatic foramen) by which the air-tube enters. It is in consequence of this arrangement that it is impossible to kill a "winged" bird by compressing its windpipe, the process of respiration being carried on by means of the air entering the broken end of the bone. In addition to the hollow bones, Birds also have a number of air-sacs disposed beneath the skin. Curiously enough, there appears to be no sort of relation between the power of flight of a bird and the degree of development of pneumaticity, as the aeration of the body and bones is called. The hornbills, for instance, which are poor and heavy fliers, have the whole of the bones, including the vertebræ, so hollowed that they are reduced to little more than shells, while in their not very distant cousin the rapid flying swift, the aeration is reduced to a minimum. Among swimming birds a similar difference may be observed, the gannet having a remarkably pneumatic skeleton and large air-sacs, while in the allied cormorants there are no air-sacs, and the bones are but slightly or not at all pneumatic. According to the old theory, the heated air in the sacs and hollow bones made the bird lighter than the medium in which it flew, and thus rendered flight easy; but, as Mr. Headley well observes, the sight of an eagle flying off with a lamb ought to convince anyone that the saving of a fraction of an ounce cannot make the slightest difference to its flight. Moreover, the swallow has all the bones solid. That the air-sacs aid to some extent in general respiration, and thus help in maintaining the high temperature of the blood in birds (reaching in some cases 112° F.) is probable, but this cannot be their sole function, and it is most likely that during flight, when a bird's breathing must be rapid, they are the chief agents in maintaining an equable temperature of the system. The function of the pneumaticity of the bones is not at present decided, and it would therefore be only entering on controversial matters to discuss it here. That one of the objects of the coat of feathers, which forms a most efficient insulator, is to assist in the maintenance of a uniform high temperature, cannot be doubted.



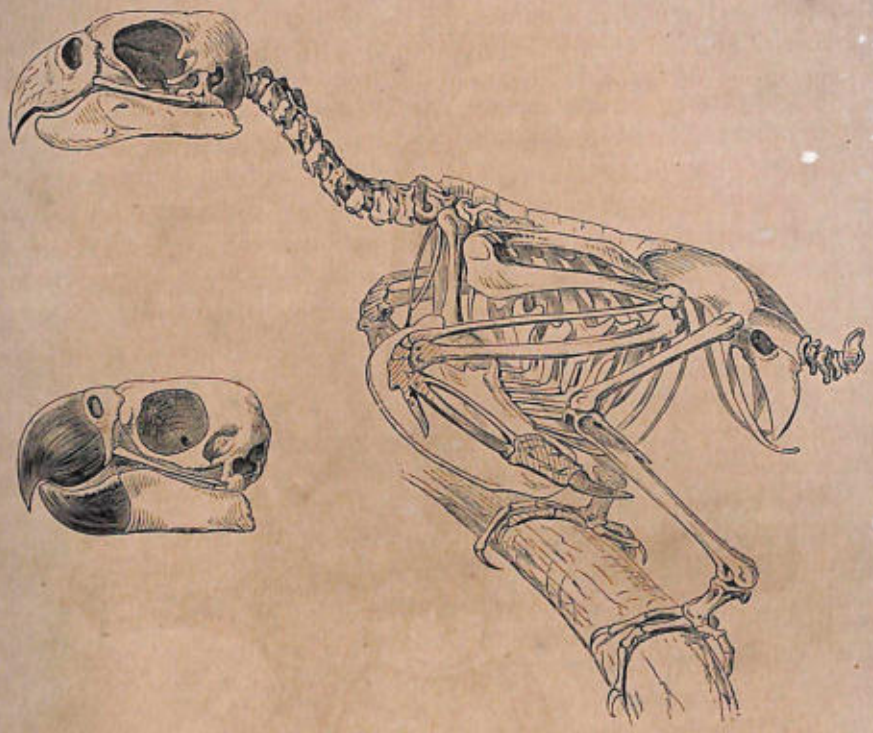
SKELETON OF VULTURE.

1, head; 2, neck; 3, back; 4, tail; 5, ribs; 6, breast-bone; 7, furcula; 8, metacoracoid; 9, thumb; 10, humerus; 11, ulna; 12, metacarpus; 13, phalanges; 14, pelvis; 15, femur; 16, tibia; 17, metatarsus or cannon-bone; 18, toes.

An important structural difference between Mammals and Birds is to be found in the absence in the latter of the partition or diaphragm, which in the former separates the cavity of the chest containing the heart and lungs from that of the abdomen.

Skeleton.

As the skeleton of Birds affords many important characters, whereby the class is distinguished from Mammals, it is advisable to enter at once upon its consideration. In the first place, the skull of a bird, as shown in the figures given later on in the chapter, differs from that of a mammal



SKELETON OF PARROT AND SKULL OF COCKATOO.

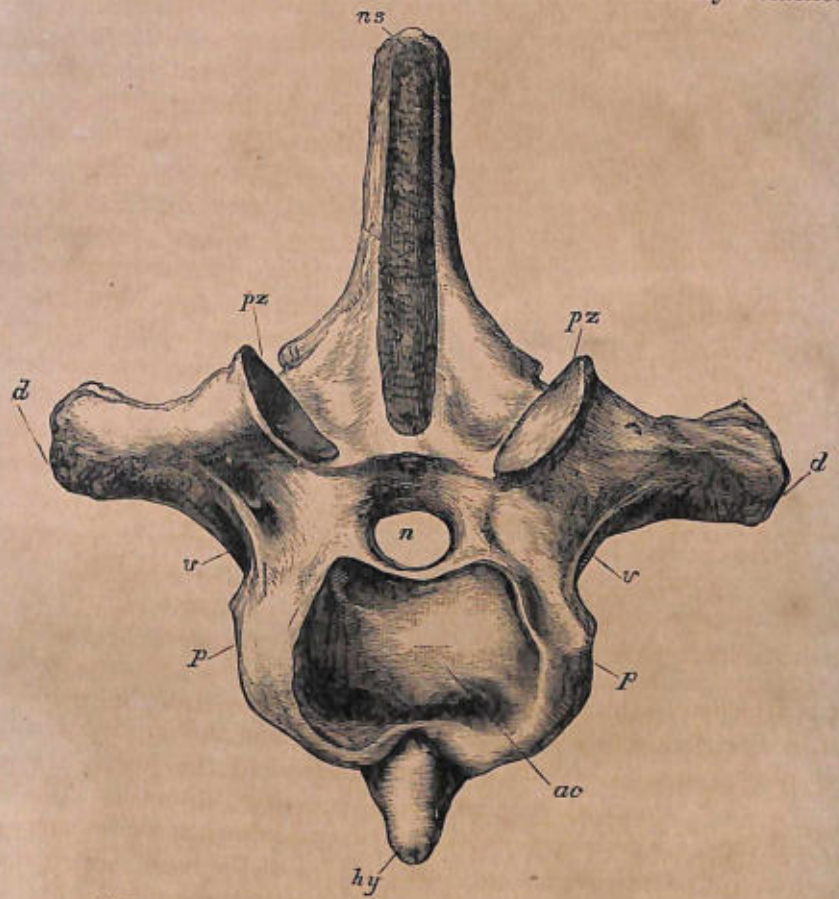
in that it is attached to the first joint of the backbone by a single knob or condyle, instead of by two such condyles. Secondly, each half of the lower jaw is composed of several pieces, instead of but one; and instead of the lower jaw articulating directly with what is known as the squamosal region of the brain-case, it does so by the intervention of a separate bone, termed, from its form, the quadrate, the position of which is indicated in the accompanying figure. It may be mentioned here that in all existing Birds both jaws are encased in horn, and are devoid of teeth; while the two halves of the lower jaw are completely soldered together by bone at their junction, or symphysis. Certain extinct Birds had, however, a full series of teeth, and the two halves of the lower jaw separate.



SIDE VIEW OF SKULL OF TEAL, WITH THE LOWER JAW DISPLACED.

The bone immediately to the left of the one marked *Pt* is the quadrate. (From Huxley, *Proc. Zool. Soc.*, 1867.)

As regards the backbone, existing Birds differ from Mammals in that the bodies of the vertebræ, at least in the region of the neck, are articulated to one another by saddle-shaped surfaces, instead of by a cup-and-ball joint or two nearly flat surfaces; and there is no constancy in the number of joints in the neck. A further peculiarity is that a number of the vertebræ of the back, together with some of those of the tail, are solidly united with the proper sacrum, while the whole long series of welded vertebræ are themselves as firmly attached to the

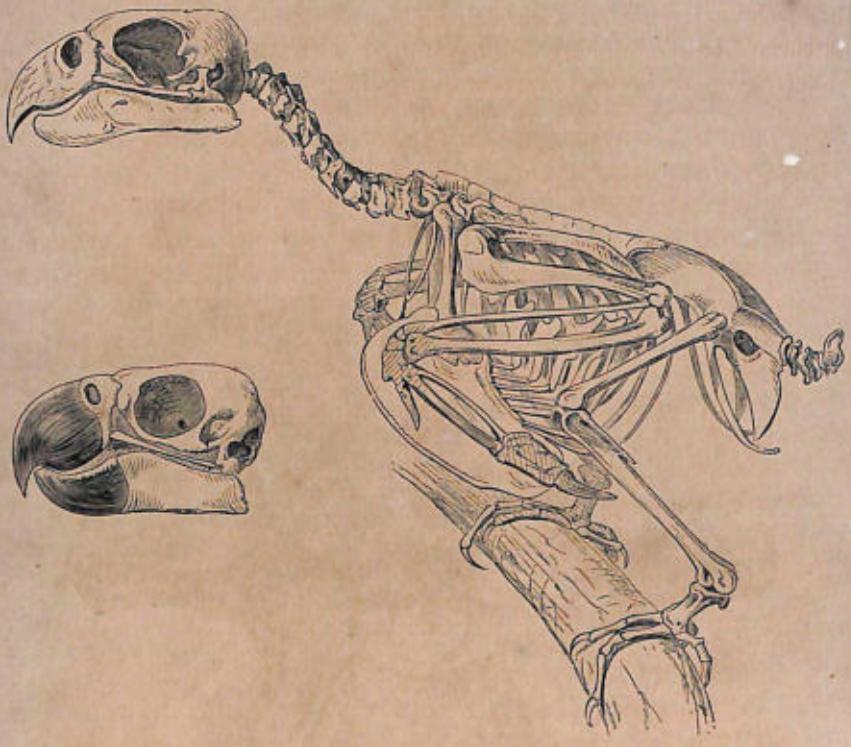


ANTERIOR ASPECT OF THE DORSAL VERTEBRA OF A MOA (*Pachyornis.*)

ns, upper or neural spine; *n*, neural canal; *pz*, prezygapophysis; *d*, transverse process; *v*, pedicle of arch; *p*, facet for rib; *ac*, anterior surface of body or centrum; *hy*, lower or hæmal spine.—After Owen.

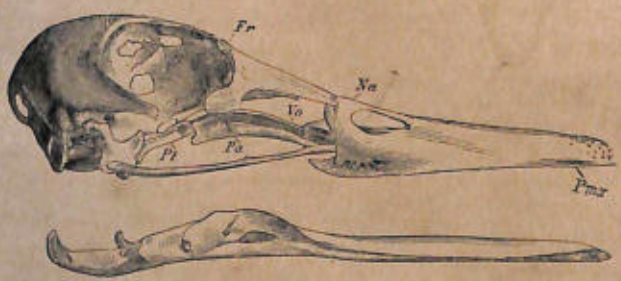
haunch-bones of the pelvis. In all living Birds the bones of the tail are very few in number, and terminate in a triangular bone (as seen in our figure of the skeleton of a parrot), termed the ploughshare-bone. It is to this region of the body that the tail-feathers of a bird, commonly called the tail, are attached; and it will thus be apparent that the so-called tail of a bird does not correspond with the tail of a mammal. In the earliest known bird the tail was, however, long, and composed of a number of vertebræ, each carrying a pair of feathers. The pelvis of a bird is remarkable for the great elongation of the haunch-bones, and also for the circumstance that the portion known as the pubis (*p*, *p'*) is

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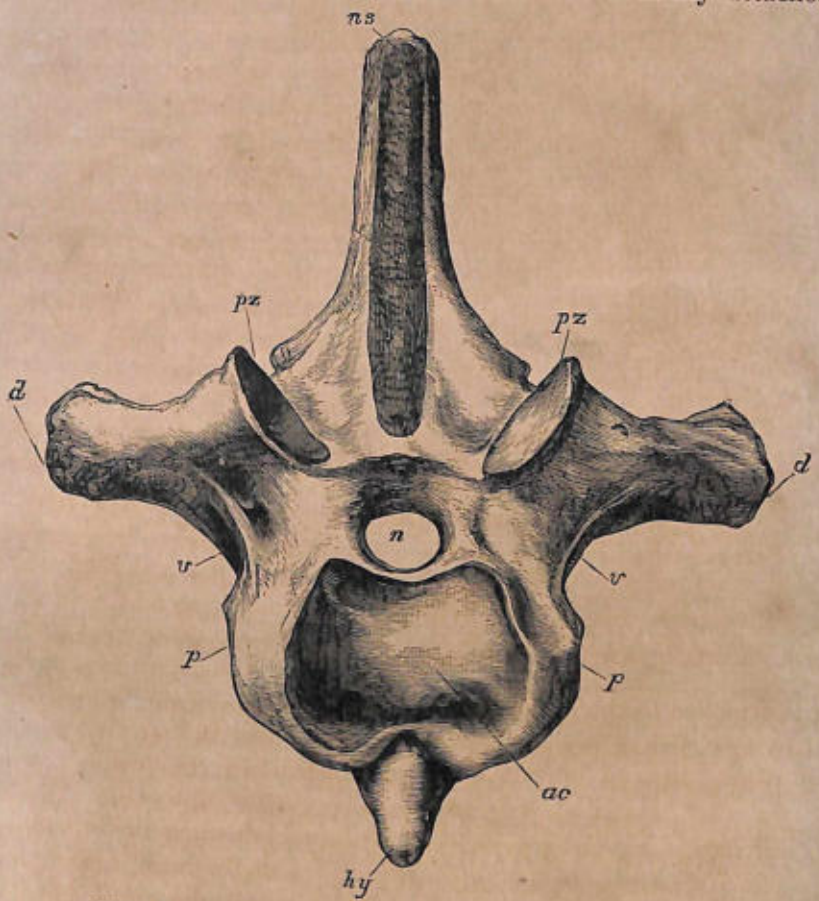
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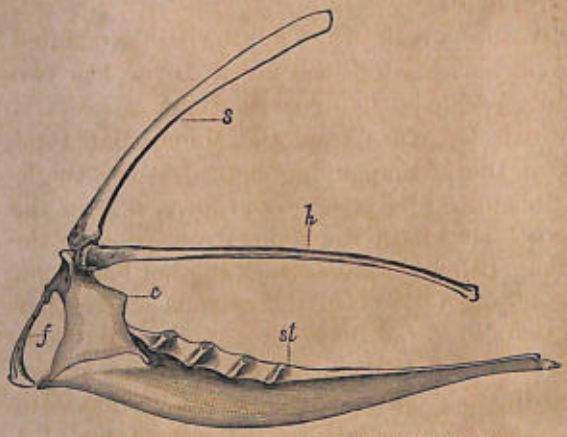


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directed backward parallel with the element termed the ischium; the three elements being united together as in Mammals but differing from them, with two exceptions, in that neither the ischium nor the pubis unites with its fellow of the opposite side in the middle line. Moreover, the cup in the pelvis for the head of the thigh-bone is always open at the base. The firm union of the haunch-bones with such a large portion of the backbone is necessary to afford a solid basis of support for the rest of the skeleton in flight.



LEFT SIDE OF SHOULDER AND BREAST-BONES OF A FLIGHTLESS BIRD.

s, blade-bone or scapula; *c*, metacoracoid; *h*, arm-bone or humerus; *f*, furcula; *st*, breast-bone or sternum.—After Marsh.

Equally essential is a solid union between the bones of the shoulder and the breast-bone. Accordingly, we find that, as in the Egg-laying Mammals the blade-bone or scapula (*s*) is connected with the breast-bone (*st*), by a metacoracoid (*c*); the scapula and metacoracoid thus jointly forming the cup for the articulation of the head of the arm-bone or humerus (*h*). Although in flightless Birds the metacoracoid is short and broad, in other species it is more or less elongated; and in either case its lower expanded end is received in a groove on the summit of the breast-bone. Usually the collar-bones, or clavicles, are well-developed, and united together to form a V or U-shaped bone, now known as the "merry-thought," or furcula (*f*); this furcula generally articulating with a process on the metacoracoid (*a*), and also with the anterior end of the breast-bone. The breast-bone in flying Birds is provided with a strong keel up the middle of its inferior surface, as shown in the figure of the skeleton of a parrot on p. 292, in order to afford support for the powerful muscles moving the wing; but in flightless Birds, as in the figure on this page, it is smooth and rounded. To the sides of the upper part of the breast-bone are attached the lower segments of the ribs; the ribs themselves being few in number, and distinguished from those of Mammals by the presence of oblique (uncinate) processes projecting from their hinder borders.



FRONT SURFACE OF THE LEFT METACORACOID OF A FLYING BIRD.

a, process for articulation of furcula; *b*, *c*, *d*, surface for junction with breast-bone.

With regard to the limbs, the bones of a bird's wing correspond generally to those of the arm or fore-leg of a mammal; the arm-bone or humerus having distinct condyles (*a*, *b*) for the articulation of the bones of the fore-arm (radius and ulna); and being sometimes furnished with a projecting process above the outermost of these two condyles. The two bones of the fore-arm always remain separate from

one another. In the wrist the numerous bones found in Mammals are, however, reduced to two; and the metacarpus and hand are flattened and specially modified. Thus there are never more than three digits, which are usually without claws, although among recent birds two may be thus armed. The thumb, or first digit, is represented merely by one or two joints (as shown in the skeleton on p. 292), and carries the so-called bastard-wing; while the other two digits represent the index and middle fingers of the human hand. Their respective metacarpals, as seen in the figure cited, are united at their two ends so as to form a single bone; while the index finger has two flattened joints, and the third finger (not present in the figure) but one.



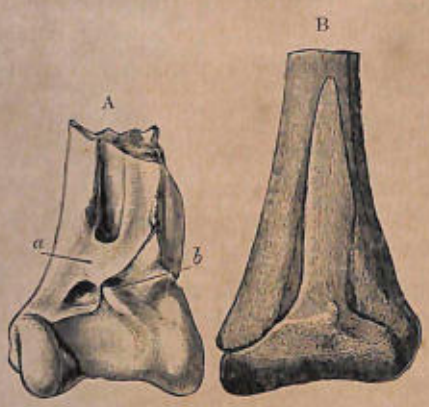
FRONT VIEW OF THE RIGHT HUMERUS OF A GULL.

In the hind-limb there is a still wider departure from the Mammalian type. The uppermost bone in a bird's leg (A of the accompanying figure) is the thigh-bone, or femur; below this comes the tibia, or larger bone of the lower leg, on the outer side of which is a small splint (not shown in the figure) representing the fibula. Below the tibia comes another long bone, terminating (except in the ostrich, where they are reduced to two) in three pulley-like surfaces, known as trochleæ, to which are articulated the toe-bones. Obviously, then, this third long bone corresponds to the metatarsus of a mammal, consisting in fact of the three middle metatarsals of the typical five-toed limb welded together, in the same manner as two such metatarsals are united in the hind-limb of a ruminant mammal. It may, therefore, be called either the metatarsus or the cannon-bone. The reader will, however, now ask what has become of the ankle or tarsus in the bird's leg. To this it may be replied that its upper bones have united to the lower end of the tibia; while the lower row has joined the upper end of the cannon-bone. The figure on p. 296 exhibits the lower end of the tibia of an adult crane and of a young ostrich; and it will be seen that in the latter the upper ankle-bone is still distinct, while in the former it has become completely united with the tibia. A precisely similar state of things takes place in the formation of the cannon-bone. It will, therefore, be apparent that the tibia of a bird corresponds to the tibia, *plus* the upper half of the ankle, of a mammal; while the cannon-bone represents the metatarsus, *plus* the lower half of the ankle. Hence, while the ankle-joint in a mammal occurs between the tibia and the upper row of ankle-bones, in a bird it is placed between the upper and lower rows of the ankle. The bony bridge seen at *a* in the tibia of the crane is very commonly present in birds; it acts as a pulley for the tendons of the muscles of the front of the leg



A, BONES OF THE RIGHT LEG OF A MOA; B, CANNON-BONE OF SAME ON A LARGER SCALE.

which pass beneath. Such pulleys enable the fleshy portions of the muscles to be placed high up in the limb, and thus cause the centre of gravity of the body to be near the wings, an arrangement essential for flight. In addition to the three toes articulating with the lower end of the cannon-bone, most birds have another toe, corresponding to the first or great toe of the human foot, of which the metacarpal is loosely attached to a facet on the inner edge of the hinder surface of the cannon-bone—as shown in the figure of the cannon-bone of a buzzard in our fourth volume. No bird has any trace of the fifth toe. The number of joints in each toe, in place of not exceeding three as in ordinary mammals, increases regularly from the first to the fourth toe.



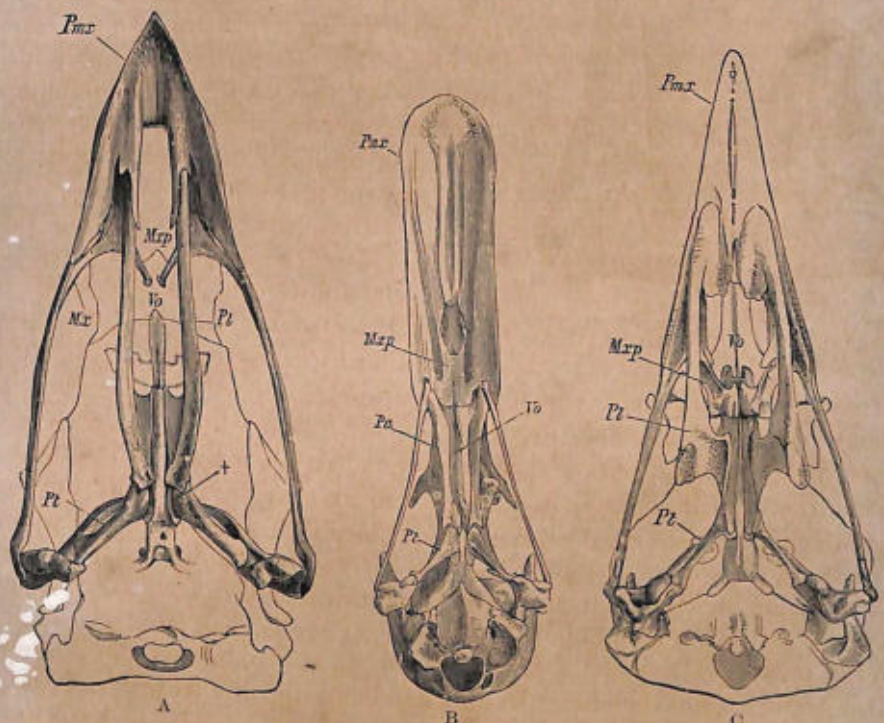
LOWER END OF THE LEFT TIBIA OF A CRANE (A), AND A YOUNG OSTRICH (B).

Skull. As the structure of the base of the skull is of some importance in classification, a few words are necessary on this point. In the first place, the skull of a bird is characterised by the great size of the sockets for the eyes, which are separated from one another merely by a thin bony partition. The aperture for the nostrils (immediately below *Na* in the figure on p. 292) may be either short and rounded, when the skull is said to be *holorhinal* (as in that figure); or they may form elongated slits, as in a pigeon, when the condition is termed *schizorhinal*. In all Birds most of the component bones of the skull are completely united together, without any trace of the original lines of division, in the adult state; and in ornithology it is usual to apply the terms upper and lower mandible to the two parts of the beak.

With regard to the bones of the palate, the introduction of a number of technical terms is unavoidable. In the middle of the hinder part of the lower surface of a bird's skull can be seen a pointed rod of bone, known as the *sphenoidal rostrum*, which may carry, as in (A) of the figure, a pair of *basipterygoid facets* (†). In advance of this is a single or double bone, termed the *vomer* (*Vo*). On the two sides of this central axis are two pairs of slender bones, of which the hinder are termed *pterygoids* (*Pt*), and articulate with the basipterygoid processes when present; while the front pair are named *palatines* (*Pl*). From the sides of the upper jaw or *maxillæ* (*Mx*), are given off two *maxillo-palatine processes* (*Mxp*), projecting in the middle line towards the vomer. Now when the vomer, as in the fowl and capercaillie (A) is pointed in front, while the maxillo-palatines remain separate both from it and from one another, the skull is said to be *schizognathous* (cleft palate). When, on the other hand, as in the duck (B), the maxillo-palatines unite in the middle line, so as to form a bridge in front of the vomer, the construction is termed *desmognathous* (bridged palate). In a third modification, as exemplified in the raven (B) and all other living passerine birds, the maxillo-palatines, although extending beneath the vomer, do not unite either with that bone or with one another, while the vomer itself is expanded and abruptly truncated in front; this arrangement being termed *ægithognathous* (passerine-

palate). Various minor modifications of these three types exist, but a little practice will enable the student to determine to which of the three any given skull conforms. A fourth modification, met with only among the ostrich-like birds and the South American tinamus, need not be referred to till a later chapter.

Before leaving the subject of the skull, it may be mentioned that the outer coat or "white" of the eye of a bird contains a movable ring of overlapping bones surrounding the pupil and iris, which by their contraction or expansion are con-



UNDER VIEW OF SKULL OF CAPERCAILLIE (A), DUCK (B), AND RAVEN (C).

Mxp, maxillo-palatine; *Vo*, vomer; *Pa*, palatine; *Pt*, pterygoid; †, basipterygoid facet. (From *Proc. Zool. Soc.*, 1867.—After Huxley.)

sidered to alter the degree of convexity of the aqueous humour and cornea, and thus to render the eye focally adapted to the constantly varying distance of objects during flight.

External Characters. When clothed with its feathers, the bodily conformation of an ordinary bird is that best adapted for cleaving the air with the least possible resistance; the head being more or less sharpened, the body gradually swelling to a point some distance in advance of the middle, and then as rapidly decreasing in girth, while the feathers are all directed from the head towards the tail. In those birds in which the neck is not unduly elongated the whole contour is, indeed, spindle-shaped, and may be compared to two cones placed base to base at the thickest part of the body. It is essential to the exigencies of flight that the centre of gravity should be on the lower aspect of the body, as nearly as possible immediately below the points of suspension by the wings; and, in order to ensure

this, there is the concentration of muscles and other organs in this region, to which some allusion has been already made. Not only are the fleshy portions of the muscles of the legs mainly confined to the upper portions of these limbs, but the muscles which elevate the wings are actually placed on the under instead of on the upper surface of the body. In the breast of a flying bird the great superficial muscle, known as the pectoralis major, is for the purpose of depressing the wing; beneath this is, however, a second muscle—the pectoralis minor—of which the function is to raise the wing-bone, or humerus. This is effected by the muscle terminating in a tendon, which passes through a pulley over the head of the scapula

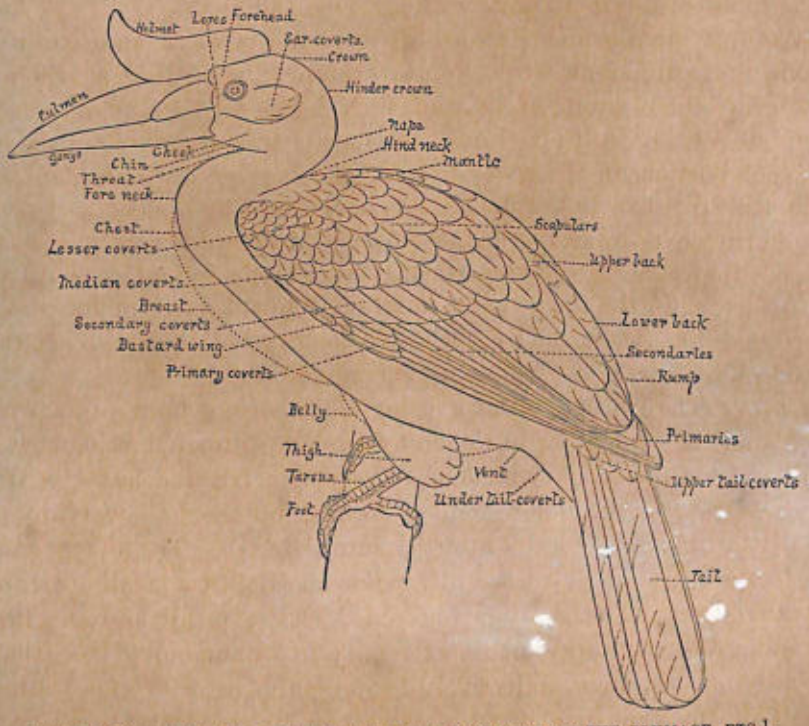


DIAGRAM OF A BIRD, TO ILLUSTRATE THE ARRANGEMENT OF THE PLUMAGE, ETC.[1]

and metacoracoid, and then being attached on the upper surface of the humerus; that bone being accordingly elevated when the muscle contracts. The same tendency to the concentration of structures is exhibited by the organ of voice (syrinx) of a bird being placed within the chest, where the windpipe divides into the two bronchi, instead of, as in Mammals, immediately beneath the lower jaw.

An important external feature in Birds is the frequent presence of a gland termed the oil-gland, on the upper surface of the rump, the function of which is to secrete oil for the lubrication of the feathers. This gland, which is most developed in aquatic birds, may be absent, and when present may be either naked or crowned with a tuft of feathers.

[1] For this cut the Editor is indebted to Mr. Rowland Ward, in whose *Sportsman's Handbook* it originally appeared. Acknowledgments are likewise due to the same gentleman for the copyright of the head of the Musk-ox on p. 210 of Vol. II., which is taken from a photograph of a specimen shot by Lord Lonsdale and mounted by Mr. Ward.

Ornithologists have devised a number of terms to indicate the different parts of a body of a bird, several of which are located in the accompanying diagram; the others it will be unnecessary to mention here. It may be observed, however, that the ears of Birds are unprovided with external conchs, merely opening flat on the sides of the head, usually a little behind and below the eyes. The eyes, which are in most cases placed laterally and near the middle of the head, are provided with a third eyelid, or nictitating membrane, which can be drawn obliquely like a shutter over the eyeball, while the proper eyelids remain open; as may be observed in a captive owl or eagle, when the glistening white membrane will be seen from time to time to sweep across the eye with extreme rapidity.

The beaks of birds, which, as we have said, are always encased in horn or leathery skin, have different terms applied to them, according to their relative length and form; the meaning of most of such terms, as *fissirostral*, *dentirostral*, *conirostral*, etc., being self-apparent. A horny investment is also generally present on such portions of the lower part of the legs as are devoid of feathers; although in some cases, as in the ducks, this is replaced by a more or less leathery skin. The horny covering of the metatarsus may consist of small pieces, with the edges in apposition, as in the plovers, when it is said to be *reticulate*; but frequently the front surface, as in the fowls, has a number of broad overlapping plates, when it is termed *scutate*. Occasionally each side is invested by a single greave-like plate, meeting its fellow in a prominent ridge at the back.

Plumage.

The feathers of birds being all-important need a somewhat fuller notice. A feather in its most complete state of development consists of a main stem, and a secondary stem, or *after-shaft*; but the latter is frequently wanting. The base of the main stem is formed by the hollow horny quill, the lower end of which is pointed and inserted into the skin. The upper part of the quill passes into the shaft, or *rachis*, at a point marked by a small aperture termed the upper *umbilicus*. The shaft is four-sided, elastic, pithy, and less horny than the quill; and gradually tapers at its extremity to a fine point. On either side of the shaft are the two *webs*, collectively forming the *vane* of the feather. Each web or half of the vane, one of which is generally considerably wider than the other, is composed of a series of flattened plates closely applied to one another, and diverging from the shaft at an open angle, each plate terminating in a point. These plates form the *barbs*, and they are held together by *barbules*, given off in the same manner as are the barbs from the stem; while the barbules may again give off *hooklets*. The after-shaft is, when fully developed, a miniature of the main stem, from which it is given off at the junction of the quill with the shaft. Such is the structure of a typical feather; but the soft feathers known as *down* have the stem short and weak, or even wanting, while the barbs are soft and not held together by fully-formed barbules and hooklets. Sometimes the ends of such feathers break up into powder, and they may then be spoken of as *powder-down feathers*. In another type of feather the vane is rudimentary, and the whole structure then becomes more or less hair-like; to such the term *thread-feathers* is applicable. Finally, the feathers covering the body and concealing the underlying down are conveniently referred to as the *contour-feathers*.

Instead of being evenly distributed over the body of a bird, the feathers grow

from certain well-defined tracts, between which are bare spaces. Although such tracts have received distinct names, and are of some importance in classification, it will suffice to mention their mere existence; and we pass on to the consideration of the names applied to the feathers of the tail and wings.

As shown in the diagram on p. 298, the tail-feathers, which are very generally twelve in number, are termed *rectrices*; and are usually firm and fully developed. Above and below the rectrices are the upper and under *tail-coverts*; although generally small and unimportant, in the peacock the upper tail-coverts attain an extraordinary development, and constitute what is commonly designated the tail. Premising that the feathers clothing the shoulders are termed *scapulars*, and those between them *interscapulars*, we pass on to the consideration of the feathers of the wings. First of all, we have the little group of feathers forming the *bastard-wing*, or *alula*, which are carried by the first digit, or thumb, and lie on the front border of the back of the wing. Next, we have the *flight-feathers*, *remiges*, or *quills*, which arise from the bones of the arm and pinion (or hand, exclusive of the thumb); all are strong, firm feathers, giving rise to the main contour of the wing. Such of the remiges as take their origin from the pinion are termed *primaries*; while those attached to the fore-arm (ulna) and upper arm (humerus) are entitled *secondaries*, though the remiges arising from the humerus used to be distinguished as *tertiaries*, and the term *secondaries* confined to those attached to the ulna. The primaries are the firmest and stiffest of the wing-feathers, and are very generally either nine or ten in number. As the rectrices of the tail have tail-coverts, so the remiges have *wing-coverts*, both above and below. Of the upper wing-coverts, we have first the *primary coverts* overlying the primaries; while the secondaries are overlain by three series, respectively known as the *greater*, *median*, and *lesser upper secondary wing-coverts*. Of these the greater coverts are the largest and the most important in classification. The *under wing-coverts*, which are less important in classification, are likewise divided into a primary and secondary series.

Change of Plumage. When first hatched, Birds are covered with some kind of down, very scanty in those which are reared in nests, but thick in all those able to run about at the time of birth. The true feathers are, however, soon developed, those of the wings and tail being usually the first to make their appearance, and the rapidity with which feathers grow is one of the most remarkable features of Birds. In order to preserve the plumage in good condition, it is essential that it should be renewed at least once a year. This renewal of the feathers is termed moulting, and frequently takes place twice during the year; while in the ptarmigan there are three moults. The chief moult usually takes place soon after the breeding-season; but in those birds which, like ducks, have a special breeding-plumage, a second moult takes place previous to that period. In the ptarmigan the third moult is for the assumption of the white winter dress. Usually the wing-feathers are shed in pairs one after another; but among the ducks, which are enabled to conceal themselves among water plants, and can thus protect themselves without flight, the shedding of all the wing-feathers is frequently almost simultaneous.

Eggs.

As already mentioned, birds produce their young by means of eggs, covered with a hard calcareous shell, often remarkable for the beauty of its coloration. Into the structure of an egg it will be quite unnecessary to enter in this work; but the following remarks, chiefly taken from the descriptive account of a series of some of the most remarkable forms in the central hall of the British Museum, will be found of general interest. Although the number of eggs laid and incubated together is generally pretty constant in each kind of bird, yet there is great specific variation in this respect. The Manx shearwater, for instance, lays but a single egg, while clutches of the long-tailed tit and red-legged partridge may contain from nine to twelve eggs. In form, eggs vary from an almost spherical shape, as in owls, to different modifications of the elliptical or oval. The latter shape, in which one end is smaller and more pointed than the other, although far from being universal, is decidedly the most common; this conical shape allowing a larger number of eggs to be accommodated in a circular nest than would otherwise be possible; and it may be noticed that, when only a pair of eggs is laid, this form is but seldom assumed. Such eggs as narrow very rapidly, and thus take a pear-shaped form, mainly pertain to the wading-birds and their terrestrial allies the plovers, of the order *Limicolæ;* four of these being laid in a nest. Their size being large in proportion to the bulk of the bird by whom they are laid, their position in the nest, with their pointed ends meeting together in the centre, causes them to occupy the smallest possible amount of space. Sea-birds, like the guillemot and razorbill, which lay one or two eggs on barren ledges of rock, likewise have them pointed, as being much less liable to roll than would be the case if they were spherical.

Although the size of the eggs generally varies proportionately to that of the parent bird, yet this is by no means invariably the case; and it appears that in birds of which the young are hatched in a helpless condition, the eggs are relatively smaller than in those in which the young come into the world fully fledged. Moreover, it is the birds that have helpless offspring that usually make the most carefully constructed nests; while those that have fully fledged young lay their eggs in very rude nests or on the bare ground. As examples of birds of equal size, laying differently sized eggs, may be mentioned the curlew and the raven; while the bird which has the relatively smallest egg is the cuckoo, and that with the largest the kiwi.

The texture of the outer surface of the shell is liable to much variation, tinamus and kingfishers laying smooth and porcellaneous eggs, while those of the ibises and ducks are dull and chalky, those of the flamingos coated with a calcareous outer film, and those of the emu rough and pitted. As regards coloration, no relation can be traced between eggs and the birds by which they are laid; and it is probable that originally Birds resembled Reptiles in laying white eggs, this want of colour being retained, or perhaps reacquired, in the eggs of the majority of birds which lay in holes. The larger number of eggs are, however, variously coloured by the deposition of pigment on or near the outer surface of the shell. The colour (as in the tinamus) may be either uniform over the whole surface, or it may take the form of irregular washes, blotches, lines, or more or less nearly circular spots, upon either a white or uniformly-coloured ground.

Very little is, however, at present understood with regard to the signification of egg-coloration. Frequently the different species of a group lay very similarly coloured eggs, as is exemplified by the warblers and buntings; but this is by no means invariably the case, as is well shown by the different members of the thrush family. In many cases the coloration of the eggs is evidently adapted to the hue of their natural surroundings, as is well exemplified by sandpipers, dunlins, plovers, and their allies, and likewise by pheasants and partridges.

Migration. Since no bird hibernates, while a large number breed in regions where they could not possibly exist during the cold winter months, it is essential that they should migrate to warmer regions in which to pass that season of the year. Such migrations may be very partial, as is the case with many British species, when the individuals passing the summer in the more northern parts of the country come further south during the winter; while those from the area into which the immigrants arrive likewise move southwards. From such partial migrations there is a gradual transition to complete migrations, when the birds of one country travel to a far distant land for the winter. As the great masses of land enjoying a cold climate are mainly confined to the Northern Hemisphere, it is obvious that bird migrations must take place from south to north, and the following general laws of migration are now accepted. With the exception of purely tropical species, every bird breeds in the coldest or most northern part of its range; such nesting-grounds being generally reached by a horizontal migration, although in a few instances birds may ascend mountains until they meet with the required degree of temperature. This northerly migration is always for the purpose of breeding, while the southward return is for food and warmth. Those species which go furthest north often also range furthest to the south; while every species has its particular period of migration. Finally, no species ever breeds during its sojourn in the southern portion of its migratory area.

It would be quite out of place to enter into any discussion as to the origin of this migratory instinct; but it may be mentioned that as the young frequently make the autumn migration unattended by the old, it is quite evident that the journey is made independently of any knowledge of the route. Moreover, as most migrations take place in the night, it is clear that this alone will preclude any guidance of the host by landmarks. Then, again, from the circumstance that during astronomical observations flights of birds have been seen crossing the moon's disc at an immense elevation above the earth, there is good reason to believe that at least many migrations take place at heights whence the configuration of the continents and oceans would be invisible even during the day. Nevertheless, it appears that there are certain definite lines along which vast numbers of birds, subject to conditions of weather, habitually migrate; one of these trunk-routes passing through the island of Heligoland and along the western coast of Europe.

Distribution. Although, from their power of flight and migratory habits, it might seem that Birds would have no definite distributional areas, yet this is by no means the case; and the different zoological regions into which the world is now mapped out were originally defined from the various groups of Birds

by which they are inhabited. For instance, while the Palæarctic region, that is to say, the greater part of Europe and Asia north of the line of the Himalaya, is characterised by the sole possession of the capercaillie, and its abundance of grouse, buntings, etc., North America is the sole home of the turkey, while humming-birds are mainly characteristic of South and Central America, as are birds of paradise, lyre-birds, and cockatoos of the Australasian region. Many birds, especially some of the humming-birds, have indeed a very local distribution; and, as might have been expected, the various groups of flightless Birds are now respectively confined to particular continents and islands. It would be impossible to pursue the subject further in the space available, but the reader will be enabled to gather many of the leading facts of avian distribution in the course of our description of the various groups.

As regards their geological distribution, it may be mentioned that most of the birds from the Tertiary formations are more or less closely allied to existing types. When, however, we reach the antecedent Cretaceous (chalk) epoch, we find that at least several of the birds were furnished with teeth; while in the still older Jurassic or Oolitic epoch the one definitely known bird (*Archæopteryx*) was not only furnished with teeth, but had a long tapering tail, and exhibited several other features indicative of reptilian affinity. While Birds present no sort of relationship to Mammals, they show manifest indications of being nearly allied to certain extinct groups of Reptiles; but the nature of that relationship can be best indicated in our consideration of those groups.

Classification. On no subject is there greater diversity of views among zoologists than with regard to the classification of Birds; scarcely any two ornithologists being in accord on this point. To a great extent this is owing to that structural uniformity among the members of the class to which reference has been already made, which renders it almost impossible to determine what features should be regarded as of primary importance. With such conflicting views it is inevitable that schemes of classification are to be counted almost by the dozen, and scarcely a year passes without one or more new ones being proposed. As it is unlikely that any one of these latter classifications will be permanently accepted, it has been thought advisable, in a popular work of the present nature, to revert to a modification of a scheme proposed some years ago by Dr. Sclater. Including certain extinct groups, the class, according to this scheme, may be divided into the following twenty-five groups, of which the first twenty-two may be reckoned orders—such orders, be it understood, being for the most part far less distinct from one another than are those of Mammals.

Orders of Birds.

1. Passeres—Perching Birds.
2. Picariæ—Woodpeckers, Cuckoos, Hornbills, etc.
3. Psittaci—Parrots.
4. Striges—Owls.
5. Pandiones—Ospreys.
6. Accipitres—Eagles, Falcons, Vultures, etc.

7. Steganopodes—Pelicans, Cormorants, and Gannets.
8. Herodiones—Herons and Storks.
9. Odontoglossi—Flamingos.
10. Anseres—Ducks, Geese, and Swans.
11. Palamedeæ—Screamers.
12. Columbæ—Pigeons, Dodo, and Sand-Grouse.
13. Gallinæ—Fowls and Game-Birds.
14. Fulicariæ—Rails and Coots.
15. Alectorides—Cranes and Bustards.
16. Limicolæ—Plovers, Curlews, Snipe, etc.
17. Gaviæ—Gulls and Terns.
18. Tubinares—Petrels and Albatrosses.
19. Pygopodes—Divers, Auks, and Grebes.
20. Impennes—Penguins.
21. Odontornithes—Toothed Birds (extinct).
22. Crypturi—Tinamus.
23. Stereornithes—Patagonian Flightless Birds (extinct).
24. Ratitæ—Ostriches, Emus, Cassowaris, etc.
25. Saururæ—Long-Tailed Birds (extinct).

Of these groups the first twenty-two, which are reckoned as orders, are brigaded together to form the subclass of Carinate Birds (Carinatæ), the great majority of which possess the power of flight, and have a strong keel (carina) to the breast-bone. The twenty-fourth group, or Ratitæ, constitutes, on the other hand, a second subclass, characterised by the absence of a keel to the breast-bone, and the loss of the power of flight; while the extinct long-tailed birds (group 25) form a third main division differing from all the others by the retention of the long reptilian tail.

The number of existing species of birds being in all probability considerably over ten thousand, it will be obvious that in the space at our command the various groups must be treated much more briefly than were the Mammals; and in many instances we shall be able to allude only to the families, without referring to the genera, and in some cases not even the whole of the former are mentioned.

It will be noticed that in the course of this Introduction practically nothing has been said as to the anatomy of the soft parts of birds; for this we must refer the reader to other works.

CHAPTER II.

The Perching Birds,—Order Passeres.

Crows to Honey-Creepers.

Families *Corvidæ* to *Cœrebidæ*.

The order of Passeres, which includes by far the great majority of existing birds, and especially those popularly termed song-birds, may be regarded as occupying a position analogous to that held by lizards among the Reptiles, and by the bony fishes in the Fishes, all its members being more or less specialised and highly organised. On this account the group is now, by general consent, regarded as the highest in the class. All these birds are characterised by having the palate constructed on what is termed the ægithognathous modification, the structure of which is described and illustrated on p. 301. They are further distinguished by producing their young in a helpless and nearly naked condition, having merely a few patches of down scattered here and there over the body. In the skeleton the slender metatarsus has its three nearly equalised condyles placed almost in the same transverse line; while the arm-bone, or humerus, has a well-marked bifurcate process at the outer sides of its lower end; and, as a minor character, it may be mentioned that the breast-bone has but a single notch. The first toe is always present, and is mobile and directed backwards, in addition to being worked by a muscle independently of the other digits. A covering of feathers invests the legs as far down as the ankle-joint. There are usually twelve feathers in the tail; while the primary quills of the wings vary in number from nine to ten, the latter being the usual complement among the typical members of the order.

With three exceptions, the perching birds of the Old World belong to a section characterised by having the intrinsic muscles of the syrinx, or organ of voice, attached to the cords of the open rings of the bronchial tube, and technically termed the *Acromyodi*. The Indian members of the order, provided with ten primary quills in the wings, may be divided, according to an arrangement suggested by Mr. Oates, into five groups. In the first of these the nestling resembles that of the adult female; this is likewise true of the second group, in which the coloration of the young bird is more brilliant than that of its parent, being in the Indian forms generally suffused with yellow. On the other hand, in the third group, the nestling is transversely barred; while in the fourth it is striated; and in the fifth group the nestling-plumage is either mottled or squamated.

Although certain species of the perching birds, such as the snow-bunting and the sand-marten, have a circumpolar distribution, numerous genera of this order

are restricted to the New World; while in spite of the fact that many species, as well as families, range across the whole of the north temperate parts of the Old World, from the British Isles to Japan, comparatively few families can be termed strictly cosmopolitan. Among those families, which are variously represented in almost every region of the globe, may be ranked the finch tribe, the swallows, and the true crows. For lustre of plumage and striking combinations of colour, the perching birds of the Indo-Malayan region excel all others; but South America possesses a larger and more varied assortment of these birds. Among the number, tanagers and chatterers form specially interesting groups. While the mocking-birds, represented by closely allied species in both the northern and southern divisions of the New World, have the best claim to be considered the finest songsters in the entire order, in Europe it is probable that the blue thrush possesses the most beautiful notes of all the passerines.

In such a large and difficult group as the perching birds it is but natural to expect diverse views among ornithologists in regard to classification. To a great extent the scheme of Dr. Sharpe is here followed, which differs very considerably from that recently proposed by Mr. Oates in the *Birds of British India*. Without attempting to weigh the value of the two, the former has been adopted, as being that more generally known. It will be obvious that in such a vast assemblage all that can be attempted in the limits of our space is to notice some of the more generally interesting types.

The Crow Tribe.

Family *Corvidæ*.

Frequently conspicuous by a black or pied plumage, often variegated with grey, and occasionally with brown, although some species, like the blue jays of South America, are much more gaudily coloured, the members of the crow family form a group which, while having few characters in common, are yet easy of recognition. Possessing a stout and generally large beak, without a distinct notch in the upper mandible, and generally straight, the crows have the chin-angle, or union of the two branches of the lower jaw, almost always produced in front of the line of the nostrils; while the tongue is non-extensile. The toes are of the normal passerine type, but although the first toe is strong, it is inferior in length to the third. The nostrils are clear of the line of the forehead, and are protected by a number of stiff bristles reaching to the middle of the beak, which are, however, shed in the adult of the European rook. The wing always has ten primary quills, and the tail twelve feathers. Mr. Oates, who includes the tits in the present family, points out that the crows may be distinguished by having the first primary quill longer than half the length of the second; while the plumage is more or less firm and glossy, and the length of the bill considerably greater than its depth. Both groups agree in that the plumage of the two sexes is alike, and undergoes but one moult (in the autumn); while the plumage of the young is paler.

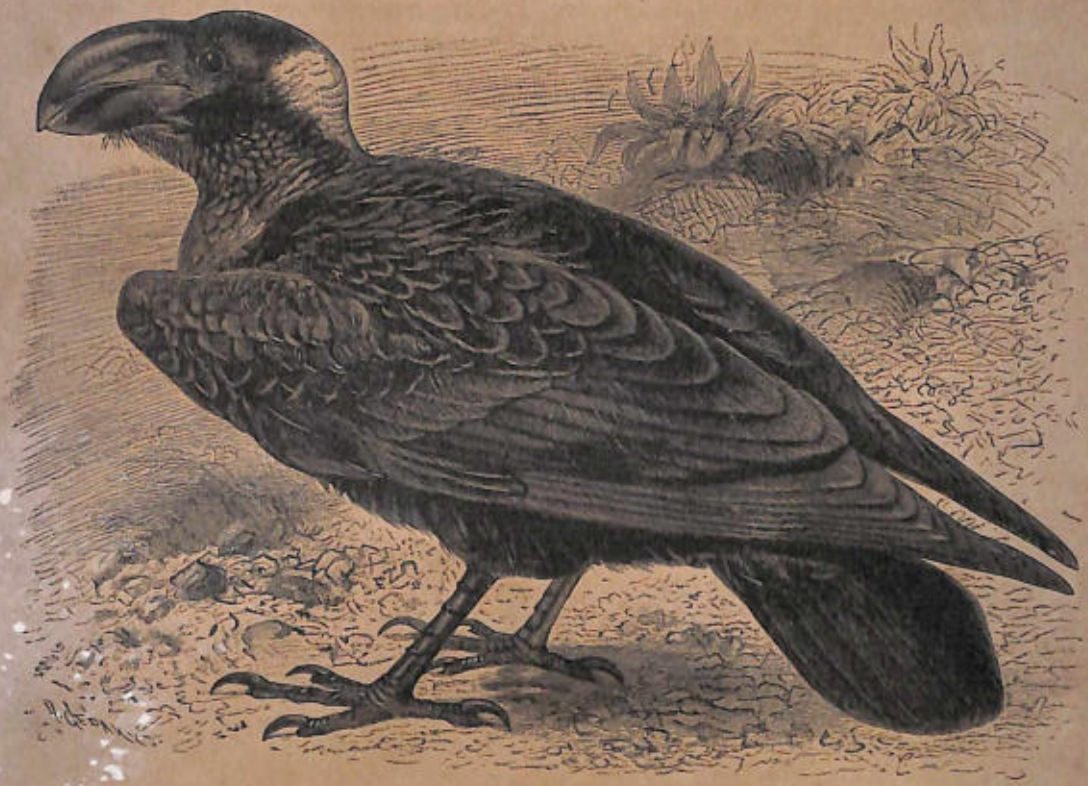
Some representatives of this specialised family are found in all the great continents; and even islands have in some cases their peculiar species. The piping



GROUP OF CROWS.

1, Jackdaw; 2, Rook; 3, Grey Crow; 4, Magpie, [illegible]

crows are only found in Australia; while magpies, nutcrackers, and choughs, are characteristic of the northern and central parts of the Old World. South America possesses some jays of brilliant plumage; those of the genus *Xanthura* having beautiful blue feathers, associated with black or deeper blue markings.



THICK-BILLED RAVEN.

Ravens and Crows. The genus *Corvus* includes all the true ravens and crows, distinguished by a stout compressed bill, straight at the base, arched towards the point, and sharp at the edges. The wings are long and graduated, and the tail is more or less graduated. The feet are powerful, the metatarsus exceeding in length the middle toe. The plumage is identical in both sexes; and black, more or less glossed with green or purple, decidedly predominates. Birds of this genus are found throughout the whole of Europe and Asia north of the line of the Himalaya, ranging into North-Western India, Australia, North America, and Mexico.

Raven. The type of this well-known genus is the large raven (*Corvus corax*), familiar to the natives of the northern parts of both hemispheres. In Japan its place is occupied by the Oriental raven, which is also found in India, Ceylon, South China, and the islands of the Malay Archipelago. The common raven of temperate Europe may be regarded as the parent form, and thrives in a wide diversity of regions, ranging from Greenland to Spain and from Portugal to Palestine, contriving constantly to adapt its habits to its immediate

environment. The raven is an early breeder, and the birds of the English fells annually repair their nests while snowdrifts are lying in deep folds on the mountain sides. It sometimes happens that a raven's nest becomes swamped by rain and driving sleet to such a degree that the eggs are chilled and rendered useless. In the event of such a contingency arising, the breeding ravens retire to some other favourite haunt, in which the female lays a fresh complement of eggs. The latter are four or five in number, rarely six; and are usually of a bluish green colour, blotched and spotted with dark olive-brown, although a reddish variety is occasionally obtained. The raven performs valuable services as a scavenger, and the damage it does the game-preserver is infinitesimally small; but it must be confessed that



WHITE-BELLIED CROW (⅛ nat. size).

shepherds have only too good reason to complain of the injuries inflicted upon ewes when dropping their lambs, for the raven readily attacks any defenceless animal such as a weak lamb or a feeble fawn.

African Crows. In Africa the genus is represented by the black African rook (*C. capensis*); the white-necked raven (*C. albicollis*), which is brown and black with a conspicuous black collar; the thick-billed raven (*C. crassirostris*); and the white-bellied crow (*C. scapulatus*). This last is a handsome bird, easily recognised by its black and white or parti-coloured plumage. It obtains much of its food about the high roads, examining the droppings of the animals that pass by, and picking the carcases of such as perish on their journeys. It makes its nest in trees or in the recesses of rocks, and

lays about six eggs, light blue in colour, profusely spotted with brown. It sometimes nests in gardens, approaching the haunts of men; at other times it is shy and retiring, especially when breeding.

Hooded Crow. Although hybridisation is comparatively rare among the true crows, naturalists have long been aware that the hooded crow (*C. cornix*) occasionally interbreeds with the carrion crow (*C. corone*) notably in such parts of Scotland as both species frequent during the summer. It was, however, reserved for Mr. Seebohm to discover that these two species interbreed to an extraordinary extent, the hybrid offspring of the original stocks apparently proving fertile for several generations, in the valley of the Yenesei in East Siberia. This is the more remarkable because both forms possess a well-defined distribution, and only occasionally overlap one another in the breeding-season. Many naturalists (among them Professor Newton) consider that the carrion crow is only a black form or variety of the hooded crow, which has lost the dun-coloured portions of the plumage peculiar to the hooded crow of both sexes and all ages; and it must be confessed that the flight and cries of these two forms are to all intents and purposes identical. While, however, the carrion crow lives chiefly in wooded valleys, nesting in isolated pairs, and harrying the nests of other birds, the hooded crow frequents the wildest coasts of Western Europe, ranging from the northern islands that fringe the continent to the forest-regions of Central Russia, rearing its young with equal success upon the ground, in the top of a tree, or on the face of a frowning precipice. The nest of the hooded crow is often a cumbrous collection of heather-roots, sticks, and seaweed, lined with softer substances well felted together. The eggs vary from four to six in a clutch, and are greenish in ground-coloured, blotched with dark olive-brown.

Rook. The ordinary "crow" of the British public has long been known to naturalists as the rook (*C. frugilegus*), and as such is almost the best known and most familiar of European birds. The sooty plumage differs from that of its Eastern representative, the Siberian rook (*C. pastinator*), chiefly in having a bluish purple gloss in lieu of the reddish purple of the Asiatic species. The latter to a large extent retains the feathers around the bill, which are generally moulted by the western bird when arriving at maturity. Like many other crows, the rook is an early breeder, nesting sometimes in shrubs or even on the roofs of houses, but chiefly in tall trees, often in the midst of crowded streets. The young are mainly reared upon noxious insects in their various stages, on field-voles, and waste substances.



ROOK.

In the autumn the rooks band together to plunder cornfields. They also do much mischief to young turnips, often tearing up thousands of newly-planted seedlings; and in severe weather they attack the roots of the turnips, or devour such small birds as have become too enfeebled by want of food to elude their enemies. During the greater part of the year they are gregarious, and many of their established "rookeries" contain myriads of birds every night. Their sagacity enables them to evade the various forms of destruction which reduce the numbers of other birds, and, as they are extremely long-lived, the rapid increase in their numbers has become somewhat alarming. Though less easily reconciled to captivity than other members of the family, they are nevertheless lively and amusing pets.

Jackdaw. The daw or jackdaw (*C. monedula*) is readily distinguished from other crows by its small size, less powerful bill, and slaty-grey collar, the remainder of the plumage being entire black in the western form. The typical European daw is replaced in Northern Asia and Japan by Pallas's daw (*C. dauricus*), which wears a broad collar of ashy white and has a white belly. The daw is distributed locally throughout temperate Europe, and is very abundant in parts of Algeria. A highly gregarious species even in the breeding-season, it forms colonies in low cliffs, nesting numerously in the holes and recesses formed by weathering. Elsewhere single pairs appropriate disused rooks' nests, adapting them to their own purposes. Not the least remarkable of the many idiosyncrasies of this familiar bird, is the readiness with which it contents itself with every variety of nesting site, rearing its young as happily in a disused rabbit-hole as in the belfry of a church. The nest is often a cumbrous pile of sticks, carefully lined with hair, wool, or other soft material. The eggs vary in number from four to six, and are bluish green spotted with grey and brown. Mr. Tait says that the jackdaws frequenting the islands on the coast of Galicia breed in holes under the stones, and follow the droves of pigs, in order to secure the insects which the animals turn up when grubbing in the soil with their snouts. While the pig ploughs up the ground, they may often be seen perching on its back, waiting their opportunity. During seasons of drought jackdaws are sometimes compelled by hunger to commit serious depredations upon the pheasant-coops, in consequence of the earthworms upon which these birds largely subsist having retired from the surface to secure moisture at a greater depth. This species does not appear to make the migratory journeys frequently accomplished by rooks and hooded crows, the daw being in fact of a somewhat sedentary character, as evinced by the attachment which it displays for favourite nesting sites. A black variety of the European jackdaw, in which the usual grey collar has become entirely suppressed, has been regarded by some naturalists as a valid species. Although these are rare, white jackdaws are sufficiently plentiful. Examples of a uniform silver-grey occur from time to time, but are less frequently met with than white or pied birds.

The Nutcrackers. The genus *Nucifraga* contains only four species, three of which are designated nutcrackers from their partiality for nuts and other fruits. The American representative of the genus is Clarke's crow (*N. columbiana*), a plain grey-coloured bird with glossy black wings, most of the secondaries broadly tipped with white, and the tail white, with the exception of the black central

feathers. This unspotted bird ranges through the coniferous woods of Western America, nesting in high pines in mountainous and northerly localities.

The nutcrackers of the Old World are birds of well-marked form and colour, not only sharing the possession of a long, straight, pointed bill with their American relative, and a black-and-white tail which is always conspicuous in flight, long wings, nostrils covered with bristly feathers, but exhibiting, in a special degree,



NUTCRACKER AND SIBERIAN JAY (⅓ nat. size).

a general uniformity of coloration among themselves, all three species being constantly of a general chocolate-brown, more or less spotted with white. Two of these species belong to the higher parts of the Himalaya, where they are resident throughout the year in forests of pine and cedar. The best known species is the European nutcracker (*N. caryocatactes*), which inhabits the northern and central portions of Europe and Northern Asia, ranging into Northern China and Japan. A conspicuous species during many months of the year, sometimes approaching the neighbourhood of human dwellings in search of food, in the

breeding-season the nutcracker becomes shy and cautious, so that its whereabouts is no longer easy to ascertain. The difficulty of discovering the vicinity of its nest is enhanced by the nutcracker being one of the very earliest birds to nest, and consequently the forests in which it breeds, usually vast extents of pine trees, often at an elevation of several thousand feet above sea level, are covered with deep snow at the time when the eggs have to be sought. These are usually laid in the month of March, and are pale bluish white, in ground-colour, thickly spotted with olive-brown. The young are easily reared by hand if supplied with a sufficient variety of food, and exhibit a marked predilection for insects. Mr. Howard Saunders gives the following description of the habits of the nutcracker, as observed in the Prattigäu:—"Between September 14th and 18th this species was quite common among the hazel bushes, and the top of a low wall, within five minutes' walk above the village where I was staying, was a favourite anvil on which to hammer the nuts, their shells lying thick on it. Every few minutes a bird might be seen flitting along the hillsides—its widely-spread tail-feathers displaying the white spots on their tips—with a somewhat dipping flight, less laboured than that of the jay. Often alighting on a sloping patch of sward, the nutcracker would draw itself up till its neck seemed unnaturally elongated, then give a few skips, and, taking a short flight, make a furious attack on a bush, tearing off a whole cluster of nuts. This was sometimes rejected, after a comically critical examination, and another cluster would be torn off, after which the bird would fly up to some tolerably wide branch of a fir, and hammer the nuts energetically to free them from their shucks, pausing to look up as if for admiration. Then the bird would hop rapidly up the branches—as if on the rungs of a ladder—to the top of the tree, dash away across a ravine, settle on a bush, and be lost to view for a time, returning with its crop quite distended with nuts." One of the notes is a peculiar *gurre, gurre;* but there is another, like a sprung rattle. Hancock records the fact that a nutcracker which lived in his possession for six years had a sweet, low, delicate, warbling song; this was uttered only when everything was perfectly quiet.

Magpies. Characterised by their stout and compressed beaks, which are sharp at the edges and arched towards the tip, short and rounded wings, strong feet, and long, graduated tails, the magpies have typically a black-and-white plumage, although many of their Oriental representatives are gorgeously coloured. The common magpie (*Pica rustica*) is found throughout the more northern portions of the Old World, from Britain to Northern China, and likewise occurs in the western districts of the United States. On the other hand, the Moorish magpie (*P. mauritanica*) is peculiar to North-Western Africa, although certain Spanish specimens tend to bridge over the distinctions of colour distinguishing the typical representatives of the two forms. Familiar enough in many parts of the British Islands, magpies in the north of Europe may be seen hunting for insects on the roofs of cottages; but elsewhere they lead a wandering life, feeding on carrion, small birds, and such other animal food as they can obtain. Breeding in a variety of situations—frequently in a tall poplar, but at other times in a low bush or hedge—they construct a domed nest of dry branches, securely protected by projecting thorns. Even in China, where they nest in February, their choice of a situation of a site for building is quite as varied as in Europe, Swinhoe stating



MAGPIES.

that he has seen nests on the poles in front of a mandarin's house, and in the crown of a cocoa-nut palm. The eggs, from five to seven in number, are bluish white, with greenish brown or brownish spots. A nonmigrant, as a rule, and frequenting open rather than forest districts, the magpie affords excellent sport before the hawk, Sebright stating that "it is far superior to every other kind of hawking. The object of the chase is fully a match for its pursuers—a requisite absolutely necessary to give an interest to any sport of this kind, and it has the advantage of giving full employment to the company, which is not the case in partridge-hawking. A down or common where low trees or thorn bushes are dispersed at distances of from thirty to fifty yards apart, is the place best calculated for this diversion. When a magpie is seen at a distance, a hawk is immediately to be cast off. The magpie will take refuge in a bush the moment he sees a falcon, and will remain there until the falconer arrives, with the hawk waiting on in the air. The magpie is to be driven from his retreat, and the hawk if at a good pitch will stoop at him as he passes to another bush, from whence he has to be driven in the same way, another hawk having been previously cast off, so that one or the other may always be so situated as to attack him with advantage. Four or five assistants besides the falconer are required for this sport. The magpie will always endeavour to make his way to some strong cover; care therefore must be taken to counteract him and to drive him to that part of the ground where the bushes are farthest from each other."

Azure-Winged Magpies.

The azure-winged magpie (*Cyanopica cooki*), on account of certain differences, is regarded as representing a genus apart from the typical pies; and is one of the handsomest of European birds. In colour, the head and upper-part of the neck are coal-black, the back and mantle brownish grey, the throat greyish white, the under-parts light fawn grey, and the wings and tail light greenish blue. This bird is selected for notice on account of the remarkable geographical distribution of the genus to which it belongs. Thus the typical azure-winged magpie is confined to certain districts of Spain and Portugal, where it is far from common, and very local, breeding in small colonies, and

generally resorting to districts where evergreen oaks are abundant. Unknown elsewhere in Europe, this bird is replaced in China by an almost identical form, distinguished by its superior size, and generally greyer tone of coloration, the same form also occurring in Japan. Such an instance of discontinuous



AZURE-WINGED MAGPIE (½ nat. size).

distribution is scarcely paralleled among the Passerines. In disposition the azure-winged pie is described as being an active and intelligent bird, building a nest very like that of the common jay.

Blue Magpies. The magpies included in the genus *Urocissa* are distinguished by having the nostrils covered with soft plumes instead of stiff bristles, and situated near the base of the bill. They further differ from the pies in having the bill either red or yellow, but never black; and they are all characterised by the predominance of azure-blue in their plumage. Unlike the true magpies, they build open nests. One species is found in Formosa, China, and Burma, and two others inhabit the Himalaya and Nipal. The Chinese blue magpie (*U. sinensis*) inhabits the hills of Eastern China, sometimes extending its range into the more wooded portions of the plains. Styan states that it is a noisy bird, and possesses a great variety of notes. It wanders about the wooded hillsides in large parties, composed exclusively of members of its own kind. The upper-parts are lavender-brown, slightly shaded with bluish purple,

the wings dull azure, brighter on the quills, the primaries being spotted with white; the tail is azure-blue, broadly tipped with white; the head and entire throat are black, all the feathers of the fore-part of the crown being tipped



RED-BILLED BLUE MAGPIE (⅔ nat. size).

with lavender-grey, and the under surface of the body being light grey. The red-billed species (*U. occipitalis*), which is the one represented in our figure, extends throughout the Himalaya, from the north-west to Nipal, where it is chiefly confined to the outer ranges. It lives in small parties containing from two or three to half a dozen birds, and breeds from March to July. The open nest is built at a variable elevation above the ground, and is formed of twigs and branches, lined with fine roots. The number of eggs ranges from three to five; their colour being similar to that characterising those of the common magpie. When feeding, these birds are generally on the ground. The head, neck, and breast of the red-billed magpie are black; a large patch on the nape is white; back, scapulars, and

rump are purplish blue; the wings are brown; the first primaries are edged with blue; the tail is blue broadly tipped with white; the lower plumage white tinged with purple.

Indian Tree-Pies.

The genus *Dendrocitta* contains a group of Indian species, generally resembling the pies of the Old World, but distinguished by short curved bills and the constant possession of a chestnut coloration varied with black. One species inhabits the island of Formosa; another is peculiar to the Andaman Islands; and a third is found in the Himalaya and Assam. The most generally distributed is the common Indian magpie (*Dendrocitta rufa*), which is very common in well-wooded districts, especially in the plains; and in travelling further north is to be seen in pairs and small parties in every grove and garden, and about every village. It builds a large nest of sticks usually in some lofty tree, and lays three or four eggs of a light greenish-fawn colour, usually indistinctly blotched with brown. It preys upon insects, small birds, and even bats; but at times feeds principally upon fruits. The adult has the upper-parts orange-brown, shading off into a brighter orange-buff on the lower back and rump; the wings are black, the tail-feathers grey, with black tips, the lores and throat blackish, and the rest of the under-parts orange-buff.



INDIAN TREE-PIE (¼ nat. size).

The Jays.

Under the general title of jays may be included a group of several genera of closely allied members of the present family, in all of which the wings are relatively short, the tail being always more than three-fourths the length of the wing. In the typical genus the short and compressed beak is shorter than the head; the nostrils are placed at the

base of the beak, and are hidden by stiff, forwardly-directed feathers; while the feathers of the crown of the head are long and erectile. The majority of the species have white upper tail-coverts, and the wings barred with light blue; the general colour of the body-plumage being fawn-red. Chiefly frequenting woods, where their presence is revealed by their harsh, discordant cries, jays are omnivorous, living on almost every description of animal and vegetable substance, but changing their diet according to the season.



COMMON JAY (½ nat size).

True Jays. The true jays of the genus *Garrulus* are principally inhabitants of the northern and temperate regions of the Old World, although one species is found in Burma, a second is peculiar to Algeria, and a third is confined to Japan. The common European jay (*G. glandarius*) ranges throughout Europe from Northern Russia and Scandinavia to Spain and Italy; but is replaced in Asia Minor by the black-headed jay (*G. krynicki*); while in Eastern Russia its place is taken by Brandt's jay (*G. brandti*), and in Syria by *G. syriacus*. Shunning open country, the jay frequents large woods, where it often nests at only a moderate elevation above the ground, laying usually six eggs, of a greyish white

colour speckled with brown. Although a shy bird, never dwelling in the open country and seldom seen on the ground, the jay is thoroughly arboreal in its habits; and, as its name implies, is especially fond of acorns and other forest fruits. Nevertheless, when dwelling in woods bordering gardens, it is frequently tempted forth during the fruit-season to plunder the latter. Not content, however, with the vegetable diet, the jay rifles and destroys the nests of the smaller birds, consuming both eggs and callow young alike; while it also destroys a considerable number of pheasants' eggs and chickens. In consequence of these thieving propensities, the jay is most cordially detested by the gamekeeper, who seizes every opportunity for shooting it; and in many districts of England, owing to such persecution, these handsome birds have become scarce.

The jay flies with an undulating and somewhat heavy motion, accompanied by much flapping of the wings; and generally takes only short flights from tree to tree, although when on migration it can fly for long distances. Unlike the preceding members of the family, when on the ground, the jay progresses by hopping instead of by walking. In its movements, when perching, it is lively and apparently self-conscious, the head being continually turned from side to side, the crest alternately raised and depressed, and the wings and tail in motion.

Siberian Jay. A characteristic bird of the most northern parts of the Old World is the Siberian jay (*Perisoreus infaustus*), distinguished by the possession of a soft fluffy plumage, well adapted to protect its owner from the rigour of an Arctic winter. The adult bird has the crown and nape sooty-brown, gradually fading in tinge as it joins the colour of the back; the upper-parts being dull lead-grey, washed with reddish brown, and the rump and tail bright foxy red, excepting the two central tail feathers. The chin, throat, and breast are grey, while the under-parts and flanks are bright rufous. The Siberian jay breeds early in the year, building its nest close to the stem of a pine or fir tree, and forming it principally of grey lichens closely interwoven with dry fir twigs, a few of its own feathers and those of the ptarmigan being inserted here and there, as also stalks of dry grass. The eggs vary in number from three to five, and in colour are dirty white, blotched with purplish grey and brown. Professor Newton writes: "More sprightly and cunning birds than these jays cannot well be, whether caged or not. In their own woods one hears their deep ringing *kook, kook, kook*, followed by a series of noises which sound like a conversation carried on by two or three people in an unknown tongue. One puts up a family-party off the ground where they have been feasting on the berries, and away they go through the trees with their wavering unsteady flight, every here and there a gleam of sunshine catching their tails, and turning them into gigantic redstarts. Or when one halts for any purpose, there comes a Siberian jay, at first stealthily; but soon, if he sees no sign of danger to him, he displays himself openly, perching almost within arm's length, ruffling his long, loose plumage, and calling to his neighbours."

Long-Crested Jay. A common bird in Western America, represented in Mexico by the bluer Mexican jay, is the long-crested jay (*Cyanocitta macrolopha*), which inhabits large pine forests. The upper-parts of this bird are sooty brown, passing on the rump and upper tail-coverts into beautiful, light, cobalt blue, which also occupies the lower parts. In habits it is cautious and cunning, displaying

in a marked degree the acuteness common to most members of the crow family. It nests in trees and bushes, and lays from five to six eggs, which are pale bluish green, profusely spotted with light and dark brown. The Mexican species is represented in our figure.

Urraca Jay. The urraca jay (*Cyanocorax chrysops*) is a well-known Brazilian species, found also in Paraguay and Uruguay. In colour it is black



MEXICAN LONG-CRESTED JAY (⅔ nat. size).

above, glossed with purple, the feathers of the crown forming a crest; the nape is greyish blue, deepening into purple on the hind neck; above the eye there is a blue spot; while the under surface is creamy yellow. According to Azara's account, this jay, of which we give a figure, is an abundant bird in Paraguay, where it is as familiar as is the magpie in England, not even hesitating to enter the houses of the inhabitants. Not ranging into the colder regions of Argentina, this bird seems to suffer from the cold during winter in Uruguay; and at that season it is by no means uncommon to see a party of from ten to twenty of these

jays crowding together in the most sheltered part of a tree, to obtain protection from the wind. If the tree or bush be small, and the best space limited, it may happen that some of the birds will perch on the back of their fellows, and thus form a regular pyramid. Like most gregarious pies and jays, when the flock is on the move, one bird flies off first, followed soon by another, and then by a third, till the whole party is on the wing. As a rule, the nest is built in a tall and thorny tree, and though it is strongly constructed, so coarsely made is it,



URRACA JAY ($\frac{2}{3}$ nat. size).

that the eggs can always be seen from below, and sometimes actually fall through the chinks. With a blue ground-colour, and a chalky incrustation, the eggs are generally six or seven in number, although upwards of fourteen have been taken from a single nest.

The Grey Struthidea. Distinguished by the arched form of the short bill, which Gould regarded as specially adapted to enable the bird to feed upon the seeds extracted from the cones of a tree found only in the district which it

inhabits, the grey struthidea (*Struthidea cinerea*) is confined to the rocky hill-ridges of Southern and Eastern Australia. The eggs are four in number, and are white in colour, blotched with reddish brown and grey; the nest is of mud, thickly lined with fine grass. The struthidea feeds principally upon insects, chiefly beetles. The two sexes are so nearly identical in size and colour that they can only be distinguished by dissection. This species differs from many other



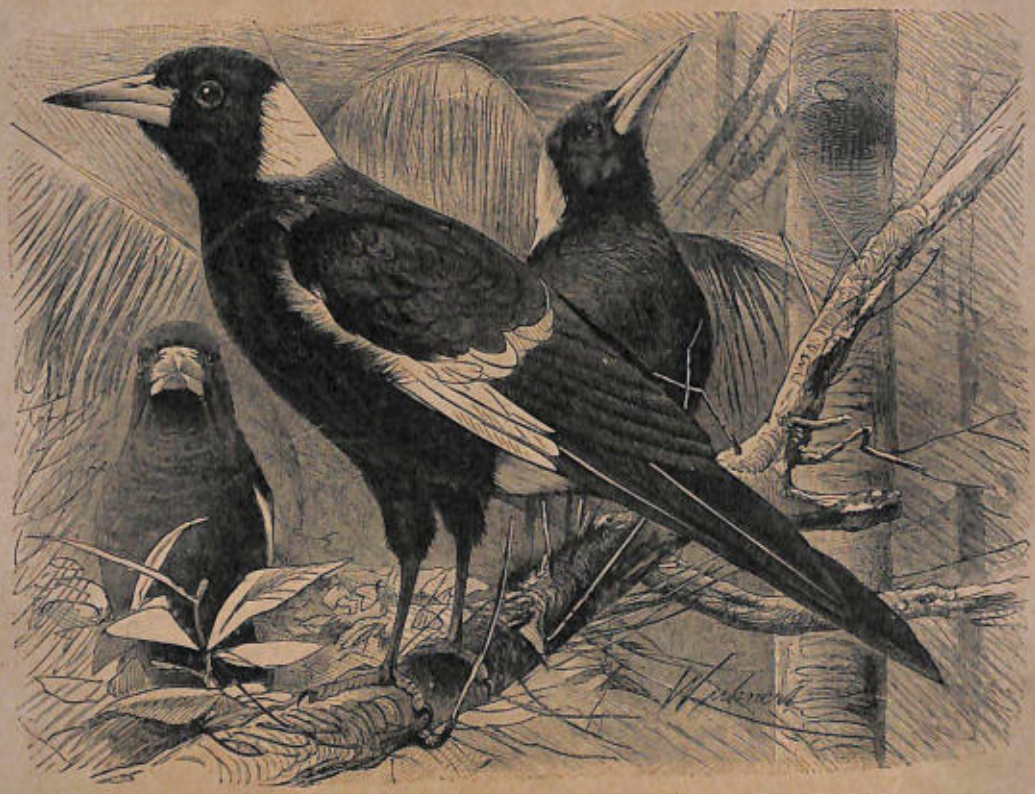
GREY STRUTHIDEA (⅓ nat. size).

Australian birds by reason of the sober colour of its dress, which is inconspicuous and little likely to attract attention. The general colour both above and below is grey, each feather being tipped with lighter grey; while the wings are brown, and the tail is glossy black, with a greenish lustre on the outer webs of its feathers.

Piping Crows. This small genus, *Gymnorhina*, includes only three species, popularly known as Australian magpies by reason of their black and white plumage, which is common to both sexes, and never varies.

The best known member of this genus is the black-backed piping crow (*G. tibicen*), which is universally distributed over New South Wales; the white-backed piping crow (*G. leuconota*) being restricted to the southern and western parts of the Australian continent, and very abundant in Southern Australia. A third species (*G. organica*), known to the colonists as the organ-bird is peculiar to Tasmania, and will pour forth from the branch of some dead tree a succession of the strangest notes that can be imagined, much resembling the sound of a hand-organ out of tune; it is very easily tamed, and can be taught to whistle various tunes as well as to articulate words.

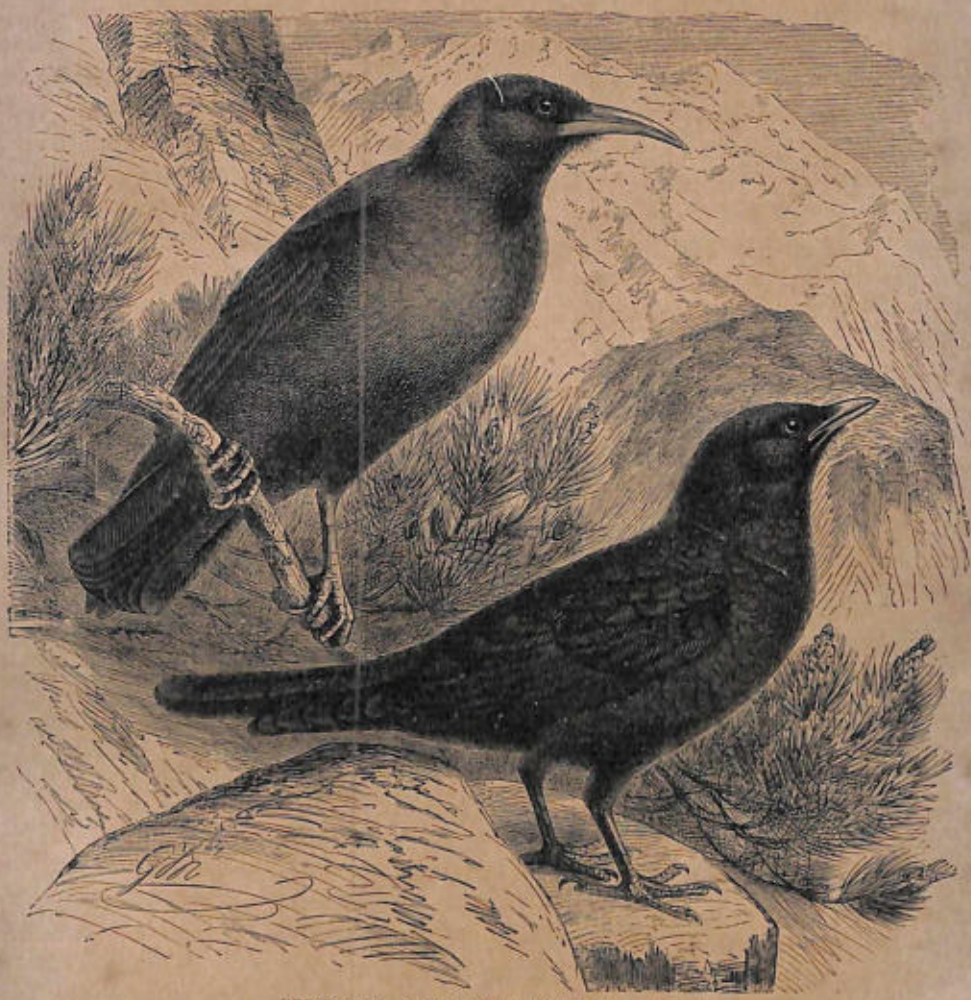
The black-backed species, which is the one given in our illustration, is



BLACK-BACKED PIPING CROW ($\frac{5}{16}$ nat. size).

bold and showy, enlivening and ornamenting the lawns and gardens of the colonists by its presence, and with the slightest protection from molestation becoming so tame and familiar that it approaches close to their dwellings and perches around them and the stock-yards in small families of from six to ten in number. Gould states that it prefers cleared lands, or open plains skirted by belts of timber; hence the interior of the country is more favourable to it than the neighbourhood of the coast. Its lively and intelligent habits and fine vocal powers render it a favourite cage-bird both at home and abroad. The crown, back, and under-parts are black; and the nape, wing-coverts, and upper and under tail-coverts white. Insectivorous in their habits, the piping crows live chiefly on grasshoppers, of which they consume an enormous quantity. The breeding-season commences in August and lasts till January, during which period each pair of birds nests twice.

The round and open nest is formed of twigs and leaves, with a softer lining; the three or four eggs are of a bluish white ground-colour, which may often have a reddish tinge, upon which are large blotches of brownish red or light chestnut-brown. It is noteworthy that although these birds seem always to thrive in captivity, yet their vocal powers in that state vary considerably, some specimens pouring forth the full song, while others sing only in a subdued undertone.



RED-BILLED, AND ALPINE CHOUGH (⅛ nat. size).

The Choughs. The two species of the genus *Graculus*, while resembling the true crows in form and coloration, differ in possessing long and pointed wings, as well as in the comparatively slender beak. Unlike other crows, they have a smooth metatarsus, and the feet and beak brightly coloured. Of the two species, the common or red-billed chough (*G. eremita*)[1] ranges from Eastern Europe to China and Eastern Siberia, being no less at home in the deserts of Ladak than on the cliffs

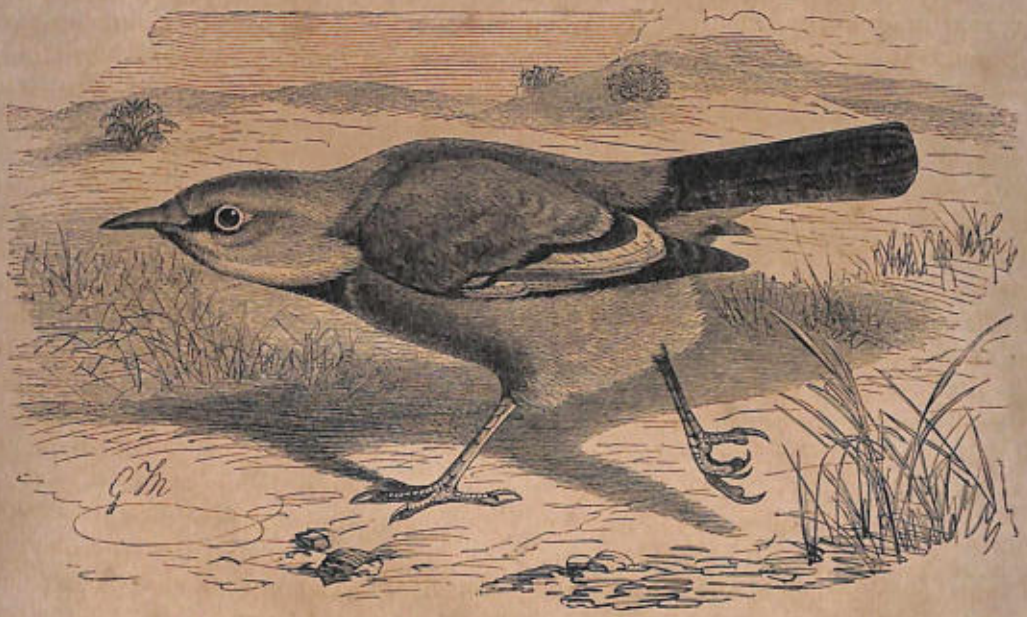
[1] When the generic name *Graculus* is adopted for these birds, the common species is generally termed *G. graculus*, but this is a combination the Editor cannot admit, and the alternative Linnean name is therefore taken.

of the English coast. Formerly this species was a comparatively common bird on the western coasts of Great Britain and Ireland, nor was it entirely a coast-loving one, since individual pairs nested in the recesses of limestone precipices inland, such as Whitbarrow Scaur in Westmoreland. The chough has, however, latterly decreased in numbers in most of its strongholds, partly owing to human interference; although there is some reason to suppose that its extermination may be partially accounted for by the special predilection of the peregrine falcon for its flesh. The chough nests in the spring of the year, breeding principally among the precipices of dizzy cliffs and headlands, deemed impregnable by all but professional cragsmen; but occasionally it rears its young among the broken pinnacles of some ruined cathedral. The eggs are white in ground-colour, streaked with brown and grey. The Isle of Man was formerly a great stronghold of the species, and when Jardine visited that island in 1827, he found the "red-legged crows" most abundant. Even in Britain the chough occasionally wanders from its maritime haunts; and in Ladak it dwells in the very heart of Asia. Not the least interesting feature in the life-history of this bird is the constancy with which individual pairs endeavour to rear their young for many successive years in the same nesting-places. Choughs obtain much of their food on the grassy borders of the cliffs which they frequent, as also in the adjacent fields, feeding either gregariously or in single pairs.

Alpine Chough. Amongst the Alps and other mountain-ranges of Central Europe the red-billed chough is in many cases replaced by the Alpine chough (*G. alpinus*) which has a yellow instead of a red beak, and is somewhat smaller in dimensions. Mr. Fowler says that the Alpine chough is the characteristic corvine of the Alps, as it also is of the Apennines; and its lively chatter, breaking suddenly on vast and silent solitudes, recalls to memory the familiar jackdaw. The Alpine chough nests amongst the crags of its native precipices; the eggs being four or five in number, and in colour white, varied with dirty yellow mottlings. This chough is a recognised article of commerce, and as such is frequently imported to Europe as a cage-bird.

Chough-Thrushes. We now come to a small but interesting group of birds, of somewhat doubtful affinity, though probably not distantly related to the choughs, from which they are at once distinguished by the relative shortness of their wings, which fall short of the tip of the tail by more than the length of the metatarsus. They are further distinguished by the possession of a peculiar style of coloration, and also by their inferior size. Comparatively little is known of the habits of the chough-thrushes, these birds being found only in certain parts of Central Asia, and having rarely come under the notice of field-naturalists. The whole of the four species known to science inhabit desert regions and sterile plains. Of these the first discovered was Pander's chough-thrush (*Podoces panderi*), and although many years have elapsed since its existence became known, it is still very rare in collections. Nor is this surprising, since its home is the lower Oxus, and the inaccessible deserts of Turkestan. It is not a gregarious species, nor does it associate with other kinds of birds, living for the most part in couples, which presumably pair for life, and constantly associate together, subsisting upon the insects and other food to be found in the vicinity of their favourite sandhills. Unlike its congener, the plain-coloured chough-thrush, the present

species is a handsome bird, and attractive in appearance; the upper-parts of the adult being clear grey; the wings white, with black at the base and at the tip; while the tail is glossy purplish black; the throat whitish; a large black patch adorns the fore-neck; and the lower-parts are vinaceous, fading into white.



PANDER'S CHOUGH-THRUSH (⅔ nat. size).

The Huia Bird. The genus *Heteralocha* includes a single species, variously referred to the hoopoes and crows; while Garrod considered its relations to be most intimate with the starlings, a view also adopted by Sir Walter Buller and Dr. Sharpe. The bill of the male is rather short and straight, and acutely pointed, with the sides compressed, and the nostrils at its base; while in the female it is long, curved, and slender; the difference being so great that the two sexes were at first regarded as distinct species. The wings are long and rounded. The huia bird (*H. gouldi*), which is peculiar to New Zealand, has an extremely restricted habitat, being confined to certain mountain-ranges, with their divergent spurs, and the intervening wooded valleys. The natives, who prize the bird very highly for its tail-feathers, which are used as a badge of mourning, state that, unlike other species which have of late years diminished and become more confined in their range, the huia has from time immemorial been limited in its distribution to its present haunts. Sir W. Buller, who comments on the readiness with which the huia becomes reconciled to the loss of its liberty, so long ago as 1864 received a pair of these birds from a native in exchange for a valuable stone. They were fully adult, and had been caught in the following simple manner. Attracting the birds by an imitation of their cry to the place where he lay concealed, the native, with the aid of a long rod, slipped a running knot over the head of the female and secured her. The male, emboldened by the loss of his mate, suffered himself to be easily caught in the same manner. When liberated in a large room, writes their owner, "it was amusing to notice

their treatment of the hu-hu. This grub, the larva of a large nocturnal beetle, which constitutes their principal food, infests all decayed timber, attaining at maturity the size of a man's little finger. Like all grubs of its kind, it is furnished with a horned head and horny mandibles. On offering one of these to the huia, he would seize it in the middle, and, at once transferring it to his perch, and placing one foot firmly upon it, he would tear off the hard parts, and then, throwing the grub upwards to secure it lengthwise in his bill, would swallow it whole. For the



MALE AND FEMALE HUIAS (⅛ nat. size).

first few days these birds were comparatively quiet, remaining stationary on their perch as soon as their hunger was appeased, but they afterwards became more lively and active, indulging in play with each other, and seldom remaining more than a few moments in one position. I sent to the woods for a small branched tree, and placed it in the centre of the room, the floor of which was spread with sand and gravel. It was most interesting to watch these graceful birds hopping from branch to branch, occasionally spreading their tail into a broad fan, displaying themselves in a variety of natural attitudes, and then meeting to caress each other with their

ivory bills, uttering at the same time a low affectionate twitter . . . But what interested me most of all was the manner in which the birds assisted each other in their search for food, because it appeared to explain the use, in the economy of nature, of the differently-formed bills in the two sexes. To divert the birds, I introduced a log of decayed wood infested with the hu-hu grub. They at once attacked it, carefully probing the softer parts with their bills, and then vigorously assailing them, scooping out the decayed wood till the larva or pupa was visible, when it was carefully drawn from its cell, treated in the way above described, and then swallowed. The very different development of the mandibles in the two sexes enabled them to perform separate offices. The male always attacked the more decayed portions of the wood, chiselling out his prey after the manner of some woodpeckers, while the female probed with her long pliant bill the other cells, where the hardness of the surrounding parts resisted the chisel of her mate. Sometimes I observed the male remove the decayed portion without being able to reach the grub, when the female would at once come to his aid and accomplished with her long slender bill what he had failed to do. I noticed, however, that the female always appropriated to her own use the morsels thus obtained." Buller subsequently studied the habits of the huia in the bush. The huia never leaves the shade of the forest; and moves along the ground, or from tree to tree, with remarkable celerity, by a series of bounds or jumps. In its flight it never rises like other birds above the tree-tops, except in the depths of the woods, when it happens to fly from one high tree to another. The old birds as a rule respond to the call-note in a low tremulous whistle or whimper, and almost immediately afterwards answer the summons in person, coming down noiselessly, and almost with the rapidity of an arrow."

The huia builds its nest in hollow trees, lining it with coarse grasses and bits of coarse herbaceous plants, twined into a basin-like form. A specimen of the egg brought to Buller was of a very delicate stone-grey, inclining to greyish white, without any markings except at the larger end where there are some scattered rounded spots of dark purple-grey and brown; but another specimen is described as pure white, without any trace of markings. The whole of the plumage is black, with a green metallic gloss, the tail being banded with white. Both sexes are adorned with large rounded wattles, which are of a rich orange colour in the living bird. The bill is ivory-white, darkening into blackish grey at the base. The young differ from the adults in having the entire plumage of a duller black, and the terminal bar washed with rufous. It may be added that in the superficial deposits of the North Island remains of the huia have been found in association with those of the extinct moas.

* Birds of Paradise.

Family *Paradiseidæ.*

In spite of their gorgeous plumage, which seems to run riot in the way of exuberance and eccentricity, the birds of paradise, according to the system we are

* Note. See p. 374.

following, are regarded as near allies of the crows, from which they may be distinguished by the abnormal structure of the toes. Thus, the outermost or fourth toe is inferior in length to the third, which is longer than the second; while the first is very large, and equal to or longer than the third. According to Dr. Sharpe's arrangement, the birds of paradise may be divided into two groups, in the first of which the beak is short and more or less stout, with its culmen shorter than the metatarsus; while in the second it is long and slender, the culmen being longer than the metatarsus.

These birds, which are represented by nearly fifty species, are almost wholly confined to New Guinea and the adjacent Papuan Islands (especially the Aru group), although one genus is found in the Malaccas, while three genera extend to North Australia. Although the females are at best generally plain and ordinary-looking birds, often of a uniform chocolate-colour, the adult males of all the species are characterised by an extraordinary development of plumage, quite unparalleled in any other group. "In several species," writes Mr. Wallace, "large tufts of delicate bright-coloured feathers spring from each side of the body beneath the wings, forming trains, or fans, or shields; and the middle feathers of the tail are often elongated into wires, twisted into fantastic shapes, or adorned with the most brilliant metallic tints. In another set of species these accessory plumes spring from the head, the back, or the shoulders; while the intensity of colour and of metallic lustre displayed by their plumage is not to be equalled by any other birds, except, perhaps, the humming-birds, and is not surpassed even by these."

Although but very little is known in regard to the habits of these lovely birds, it appears that as regards food they are generally omnivorous, feeding on fruits and insects, and showing a marked preference for figs, grasshoppers, locusts, leaf-insects, and caterpillars. Even, however, when supplied with food of this nature in captivity they almost immediately pine and die. While the long-tailed species are purely arboreal, some of the short-tailed kinds, like the six-plumed bird of paradise, are frequently seen on the ground; and in all cases the cock-birds are fond of assembling for mutual display. Till recently their eggs have been almost unknown, but such as have been obtained recall those of some of the rails in appearance. They are two in number, and laid in a nest built high up in the tree-tops. The eggs of the Empress Augusta paradise-bird have a pale pinkish buff ground-colour, upon which are streaks and spots of reddish brown and grey. Several of the species have a very small distributional area, but in no case is the range more restricted than in the red bird of paradise, which is entirely confined to the small island of Waigiou, at the north-western extremity of New Guinea, in which spot it replaces the members of the genus to which it belongs found in the other islands.

Twelve-Wired Bird of Paradise.

Commencing with the second of the two groups referred to above, or the one in which the beak is relatively long and slender, we may take as a first example the beautiful twelve-wired bird of paradise (*Seleucides nigricans*), which is the sole representative of this genus. Having a short, squared tail, much inferior in length to the body, this genus is distinguished by the absence of a jugular shield of metallic plumes on the throat and fore-neck; and still more so by the feathers of the flanks, which are

yellowish like those of the breast, being produced and their shafts elongated into six pairs of bare wire-like bristles, which are bent forwards in a bold curve. As regards the plumage, the head is covered with short velvety feathers of a purplish bronze colour; the breast appears at first nearly black, but in different lights shows various metallic tints, especially green and purple, the



TWELVE-WIRED BIRD OF PARADISE (⅓ nat. size).

outer edges of the feathers being margined with emerald-green. The whole of the back and shoulders is rich bronzy green, while the closed wings and tail are of the most brilliant violet-purple; and the whole plumage has a delicate silky gloss. Posteriorly to the fore-breast, the whole of the under-parts are of a rich buffy yellow, the same tint characterising the plumes of flank-feathers, which extend about an inch and a half beyond the tail. The total length of the bird is about a foot, of which two inches are taken up by the compressed beak. The

female, although less sombre than in some of the group, has none of the bright plumes of her partner, being bright chestnut-red above, with the crown of the head and back of the neck brown, while the under-parts are buffy brown, irregularly barred with blackish brown.

Inhabiting the island of Salwatti and the north-western parts of New Guinea, the twelve-wired bird of paradise, according to Mr. Wallace, "frequents flowering trees, especially sago-palms and pandani, sucking the flowers, round and beneath which its unusually large and powerful feet enable it to cling. Its motions are very rapid. It seldom rests more than a few moments on one tree, after which it flies off, and with great swiftness, to another. It has a loud, shrill cry, to be heard a long way off, consisting of *cah, cah*, repeated five or six times in a descending scale, and at the last note it generally flies away. The males are quite solitary in their habits, although, perhaps, they assemble at certain times like the true paradise-birds." Both Mr. Wallace and Dr. Guillemard have been fortunate enough to see this splendid bird in the living state. To capture them, the natives search the forest until they discover a roosting-place, where the hunter conceals himself beneath the tree, and having marked the particular bough on which the bird is accustomed to perch, ascends the stem at night, and secures his prize by the simple expedient of stealthily putting a cloth over it.

Allied Genera.

There are three other genera included in the long-beaked group, or *Epimachinæ*, namely, *Ptilorhis*, *Epimachus*, and *Drepanornis*. The first of these three are inhabitants of Northern Australia and New Guinea, and are commonly known as rifle-birds. While agreeing with the twelve-wired paradise-bird in the relative proportions of the tail, they differ in having a jugular shield of metallic plumes occupying the throat and fore-neck, as well as by the absence of the "wires." The scale-breasted bird of paradise (*P. magnifica*) is the Papuan representative of this genus, and is characterised by the shield of stiff metallic green feathers on the breast, and a small tuft of somewhat hairy plumes on the sides of the same; the back and wings being velvety black, faintly glossed with purple. The long-tailed bird of paradise (*Epimachus speciosus*), together with an allied Papuan species, represent the second of the three genera, sufficiently distinguished by the great elongation of the graduated tail, which is much longer than the body. Resembling the twelve-wired species in its dark velvety plumage, glossed with purple and bronze, this bird has the tail, which exceeds two feet in length, tinted above with a splendid opalescent blue; but its chief ornament is the group of broad feathers arising in a fan-like manner from the sides of the breast, which are dilated at their extremities, and banded with vivid blue and green; the beak being long and curved, and the feet black. In total length this bird measures between 3 and 4 feet. It is an inhabitant of the mountains of New Guinea, sometimes found near the coast.

The fourth genus is represented by the Albertis bird of paradise (*Drepanornis albertisi*), which differs from all the others in having a long, slender, sickle-shaped beak, downy plumage, a moderately long graduated tail, and the flank-feathers developed into a brown fan-like shield. "Above the beak," writes its discoverer, Signor Albertis, "are two tufts or horns, formed of small feathers deeply marked with green and copper-coloured reflections. The long feathers which grow from

the sides of the breast are, when closed, grey, shot with a violet tint; but when spread they form almost a semicircle round the body, and in certain lights shine



GORGET BIRD OF PARADISE (⅔ nat. size).

like gold, in others like fire. Long feathers of a greyish violet colour grow from the sides, their edges being of a metallic violet lustre. The upper-parts of the wing and tail-feathers are of a darkish yellow, as are those of the back, but sometimes of a still darker hue. The feathers of the throat are black, shading off into olive colour; those of the breast of a greyish purple, with an olive band; the abdomen is white. The beak is black, the eyes chestnut, and the feet dark lead-colour. When the bird raises the long feathers on his sides and breast, they form two semicircles, and he presents as extraordinary and beautiful a sight as one could behold." The female of this Papuan species is chestnut above, and yellower beneath.

The Gorget Bird of Paradise. This species (*Astrapia nigra*), from the mountains of Central New Guinea, is the sole representative of its genus, and brings us to the short-beaked or typical group of the family. Having a long and graduated tail, of which the central plumes are not elongated into wire-like shafts, it is especially distinguished by the thick feathering of the lores and angle of the mouth, by the presence of an erect frill surrounding the head, and another frill of a golden coppery tint round the throat. In the adult male the general colour of the upper-parts is velvety black, with a purplish gloss; the two long central tail-feathers are glossed with purple; the frill round the head is golden-green; while the feathers of the throat are steely black, with the above-mentioned gorget of brilliant copper; a ruff of black plumes springs from the shield on the neck; the flanks are dusky black, and the under-parts velvety grass-green.

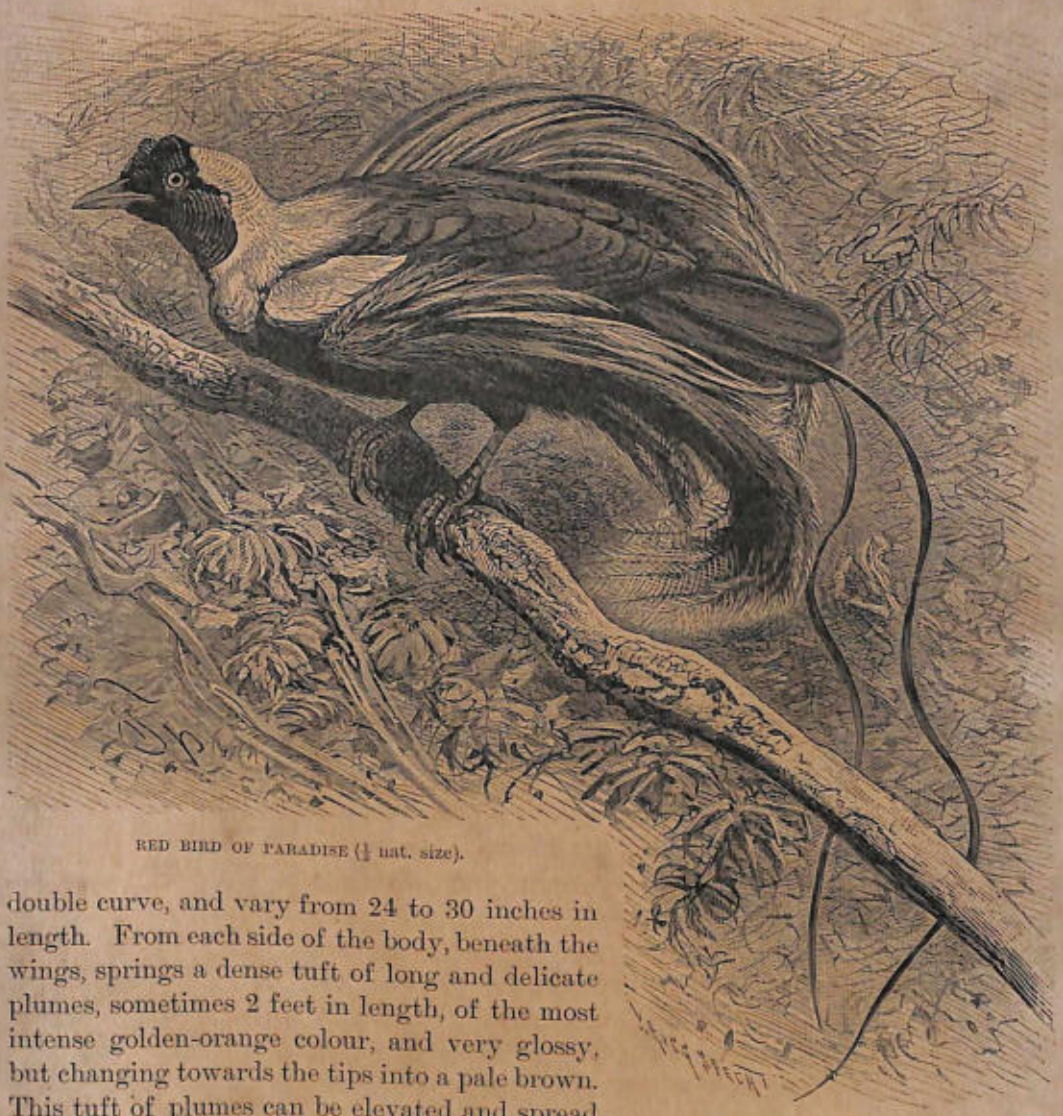
Wattled Bird of Paradise. An allied genus is represented by the wattled paradise-bird (*Paradigalla carunculata*) of New Guinea, distinguished by the lores having an erect orange-yellow wattle, while another of azure blue hangs from each angle of the mouth; the tail being shorter than the body, and the head and throat devoid of frills.

Typical Birds of Paradise. The great bird of paradise (*Paradisea apoda*), which was the first known representative of the entire family, derives its specific name from having been described by Linnæus from a skin prepared in the Papuan fashion, with the wings and feet cut off. The genus, which is represented by several species from Papua and the Aru and other islands, is characterised by the production of the central pair of tail-feathers into extremely long, horny, wire-like shafts, the absence of a shield on the back, and the elongation of the flank-plumes into two huge bunches of feathers reaching far beyond the tail. The great bird of paradise, of the Aru Islands, is the largest representative of the genus, measuring from 15 to 18 inches in total length, and is described by Mr. Wallace, as follows:—"The body, wings, and tail are of a rich coffee-brown, which deepens on the breast to a blackish violet or purple-brown. The whole of the top of the head and neck is of an exceedingly delicate straw-yellow, the feathers being short and close set, so as to resemble plush or velvet; the lower part of the throat up to the eye is clothed with scaly feathers of an



GREAT BIRD OF PARADISE.

emerald-green colour, and with a rich metallic gloss, and velvety plumes of a still deeper green extend in a broad band across the forehead and chin as far as the eye, which is bright yellow. The beak is pale lead-blue; and the feet, which are rather large, and very strongly and well-formed, are of a pale ashy pink. The two middle feathers of the tail have no webs, except a very small one at the base and at the extreme tip, forming wire-like cirrhi, which spread out in an elegant



RED BIRD OF PARADISE (½ nat. size).

double curve, and vary from 24 to 30 inches in length. From each side of the body, beneath the wings, springs a dense tuft of long and delicate plumes, sometimes 2 feet in length, of the most intense golden-orange colour, and very glossy, but changing towards the tips into a pale brown. This tuft of plumes can be elevated and spread out at pleasure, so as almost to conceal the body of the bird." In the female the whole of the ornamental plumes are wanting, and the colour is a uniform coffee-brown. The lesser bird of paradise (*P. minor*), from New Guinea, and several of the adjacent islands, although considerably smaller, is very similar in general characteristics.

Red Bird of Paradise.

On the other hand, the red bird of paradise (*P. sanguinea*), from the islands of Waigiou, Ghemien, and Batanta, is a very distinct

form. Measuring from 13 to 14 inches in length, it has the flank-plumes shorter, and of a rich crimson hue, while in structure they are rigid, their tips being horny, and nearly white. The forehead, sides of the head, and the whole throat are a brilliant metallic green, with the plumes of a velvety texture; the sides of the neck and entire mantle are bright golden-yellow, deepening into orange on the sides of the mantle and the middle of the back; the rump is straw-yellow, the two central feathers consisting of two long shafts, 21 inches in length, of a metallic horny structure; the wing-coverts are golden yellow; the primaries ruddy chestnut; and breast deep purplish chestnut. The female and young have the sides of the head and forehead purplish brown; the hind-part of the head, neck, and mantle straw-yellow, deepening into orange; the remainder of the upper surface, including the wings and tail, being chestnut-brown, as are the lower-parts.

Habits. Thoroughly arboreal in their habits, the birds of this genus live both upon insects and fruits; and occasionally they may be seen running along the lower boughs of trees almost like woodpeckers, with the long, black filaments of the tail hanging gracefully down on each side. In motion throughout the day, they are active and vigorous; and while small flocks of females and immature males are constantly met with, the adult cocks are less commonly seen, although their presence near by is revealed by their loud and harsh cries. At certain seasons of the year the adult males flock together in a selected tree for the purpose of display, forming what the natives term dancing-parties. "On one of these trees," says Mr. Wallace, "a dozen or twenty full-plumaged male birds assemble together, raise up their wings, stretch out their necks, and elevate their exquisite plumes, keeping them in a continual vibration. Between whiles they fly across from branch to branch in a state of great excitement, so that the whole tree is filled with waving plumes in every variety of attitude and motion." When thus assembled, the birds are shot with blunt-headed arrows by the natives, who climb silently into the "play-tree," and seat themselves in some convenient fork. From continual persecution to supply the European market with skins, the great bird of paradise, according to Dr. Guillemard, has of late years greatly diminished in numbers.

King Paradise Bird. The beautiful little king bird of paradise (*Cicinpurus regius*), from New Guinea and the adjacent islands, forms the type of a distinct genus, distinguished by the flank-plumes not extending beyond the tail, by the presence of a large tuft of fan-like plumes on each side of the breast, and by the two central tail-feathers being long and racket-like. Measuring only about 6½ inches in length, this lovely species has the head, throat, upper-parts, wings, and tail red, the fan-like plumes on the sides purplish, tipped with green, a green gorget below the red of the throat, and the rest of the under-parts white.

Wilson's Bird of Paradise. The remarkable species (*Diphyllodes wilsoni*) we illustrate may be included in a Papuan genus, typically represented by the magnificent paradise-bird (*D. magnifica*), and distinguished from the preceding by the presence of a shield of feathers on the back, and the absence of elongated flank-plumes; while from an allied genus (*Rhipidornis*) it differs in having no fan-shaped shield of feathers springing from each side of the breast. Whereas, however, in the magnificent paradise-bird the head is thickly feathered, in the species under consideration, with the exception of a few narrow tracts of feathers, it is bare; on

which account some writers refer Wilson's bird of paradise to a distinct genus. Describing this remarkable species, Dr. Guillemard writes that "behind the head a ruff of canary-coloured feathers stands erect above the scarlet back and wings. The breast is covered by a shield of glossy green plumes, which towards the throat are marked with metallic green and violet spots of extraordinary beauty. The two central feathers of the tail, prolonged for 5 or 6 inches beyond the others, cross

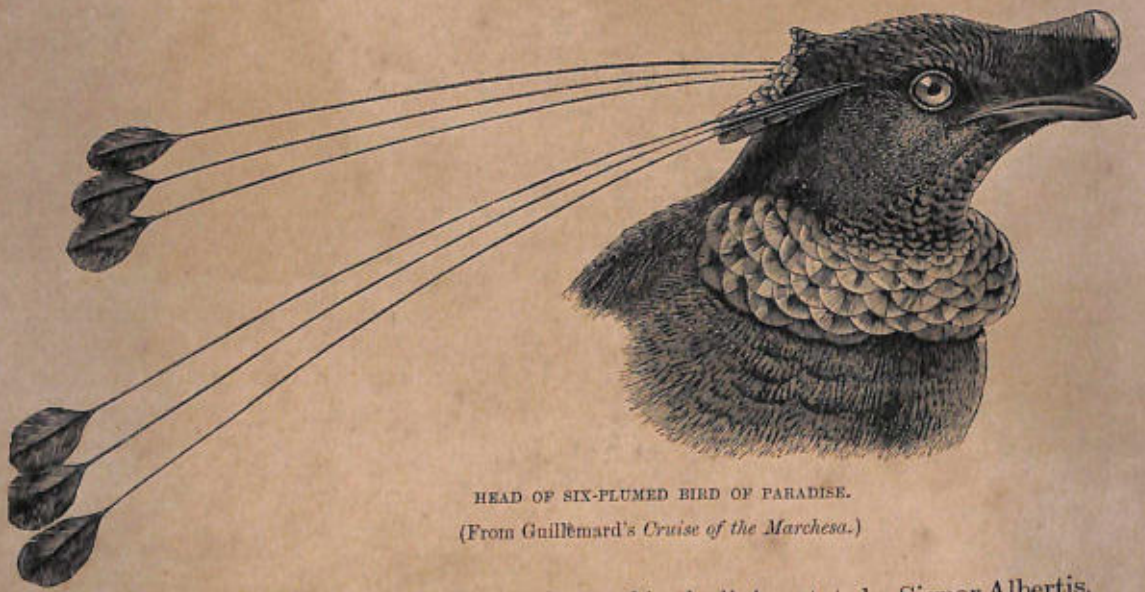


WILSON'S BIRD OF PARADISE. (From Guillemard's *Cruise of the Marchesa.*)

one another, and are curved into a complete circle of bright steely purple. But the chief peculiarity of the bird is the head, which is bald from the vertex backwards, the bare skin being of the brightest imaginable blue. The bizarre effect thus produced is still further heightened by two fine lines of feathers, which running lengthways and from side to side form a dark cross upon the brilliant azure background." This bird is of small size, and is confined to Waigiou and Batanta Islands, where it appears to be very locally distributed, frequenting forests of no great height, at an elevation of some eight hundred feet above the sea.

Six-Plumed Bird of Paradise.

Another strange and beautiful representative of a group in which all are lovely beyond description is the six-plumed bird of paradise (*Parotia sexpennis*) of New Guinea, which is the only known member of its genus. In common with the remaining members of the family, this bird has a short tail, without any elongation of the central pair of feathers, while it is specially characterised by three pairs of very long racket-feathers springing from the sides of the head. With the exception of a vivid steely-green bar across the crown of the head, and a tuft of silvery feathers at the base of the beak, together with a green and bronze gorget on the breast, the plumage is almost entirely black; the tuft of silvery feathers on the beak being capable of erection or depression at will. For many years this splendid species was known only by skins badly prepared by the



HEAD OF SIX-PLUMED BIRD OF PARADISE.

(From Guillemard's *Cruise of the Marchesa.*)

natives; but eventually it was observed in the living state by Signor Albertis, who writes as follows of his first sight of it in its native haunts:—"After standing still for some moments in the middle of the little glade, the beautiful bird peered about to see if all was safe, and then he began to move the long feathers of his head, six in number, from which his name is derived, and to raise and lower a small tuft of white feathers above his beak, which shone in the rays of the sun like burnished silver; he also raised and lowered the crest of stiff feathers, almost like scales, and glittering like bits of bright metal with which his neck was adorned. He spread and contracted the long feathers on his sides in a way that made him appear now larger and again smaller than his real size, and, jumping first on one side and then on the other, he placed himself proudly in an attitude of combat, as though he imagined himself fighting with some invisible foe. All this time he was uttering a curious note, as though calling on some one to admire his beauty, or perhaps challenging an enemy." From this account it would appear that the species is much less arboreal in its habits than the other members of the family.

The Standard-Wing.

Even more remarkable than the last is the standard-wing (*Semioptera wallacei*), from the islands of Batchian and Gilolo, which like-

wise forms a genus by itself, and is characterised by the absence of long thread-like plumes on the head, and the presence of two long projecting feathers from each wing, which are capable of being erected at the pleasure of their owner. Its discoverer, Mr. Wallace, describes this bird as being generally of a delicate olive-brown colour, deepening to a kind of bronzy olive in the middle of the back, and changing to a delicate ashy violet with metallic reflections on the crown of the head; the feathers covering the nostrils and extending half-way down the beak being loose and upwardly curved. On the breast the scale-like feathers are margined with a rich metallic bluish green; while the same colour embraces the throat and sides of the neck, together with the long pointed plumes arising from the sides of the breast. The two long projecting white feathers springing from near the bend of the wings are fully 6 inches in length, and are spread out, whenever the bird is excited, at right angles to the wings. The beak is horny olive, the iris deep olive, and the foot bright orange. In total length the bird measures 11 inches. The standard-wing, which resembles the rest of its tribe in being in constant motion, frequents the lower boughs of the forest trees, "flying from branch to branch, clinging to the twigs, and even to the smooth and vertical trunks almost as easily as a woodpecker. It continually utters a harsh, croaking note, somewhat intermediate between that of a *Paradisea apoda* and *Cicinnurus regius*. The males at short intervals open and flutter their wings, erect the long shoulder-feathers, and spread out the elegant green breast-shields." It is noteworthy that the examples of this species from Gilolo differ somewhat in coloration and the conformation of the plumes from those inhabiting Batchian, so that an expert is at once able to say from which of the two islands any given specimen was obtained.

Superb Bird of Paradise.

The acme of strange plumal adornment (which in all these cases is in all probability developed to attract the admiration and attention of the female, since it can have no other conceivable object) seems to be attained by the superb bird of paradise (*Lophorhina superba*), which is chiefly characterised by the presence of an enormous erectile forked shield of velvety black feathers, arising from the nape of the neck, and when in repose lying flatly on the back. So strange and apparently incongruous is this shield that it might suggest to the beholder that the tail of some other bird had been stuck on to the skin, were it not that its feathers are of a different type. The ground-colour of the plumage is of the deepest black, but with bronze reflections on the neck, while the feathers of the head are metallic green and blue. Spreading over the breast is a shield composed of narrow and rather stiff feathers, which extends in a pointed form along each side, and is emarginate in the middle. In colour this is bluish green, with a satiny sheen; the back-shield, on the other hand, is velvety black, with reflections of bronze and purple, its outermost feathers exceeding the primaries of the wing in length. So far as Dr. Guillemard could gather from native reports, it would seem that the enormous crest, as it appears displayed during the courtship of the female, is not only raised, but spread widely out in a fan-like manner, while the chest-shield is similarly expanded. Hence the head of the bird forms the centre of an irregular circle of feathers of velvety black and emerald, completely concealing the rest of the body when viewed from the front.

The remaining genera of the family, such as *Phonygama* of New Guinea and

North Australia, *Manucodia* of North Australia and the adjacent Papuan Islands, and *Lycocorax* of the Moluccan and Papuan Islands, must here be passed without further mention.

* The Bower-Birds.

Family *Ptilonorhynchidæ*.

By no means easy of definition, the bower-birds, most of which are, however, characterised by building the structures from which they take their name, have given rise to some difference of opinion among ornithologists as to their affinities, and they have been included in the preceding family, although they are now placed by Dr. Sharpe in his catalogue of the birds in the Museum of the Royal College of Surgeons between the birds of paradise and the starlings. While the so-called regent-bird approximates to the former group in the nature of the feathers on the head, and the gorgeous coloration of its plumage, the true bower-birds are more thrush-like in appearance. The group is mainly peculiar to Australia, although one Australian genus extends to the Papuan Islands, and another genus (*Amblyornis*), with a single species, inhabits New Guinea only.

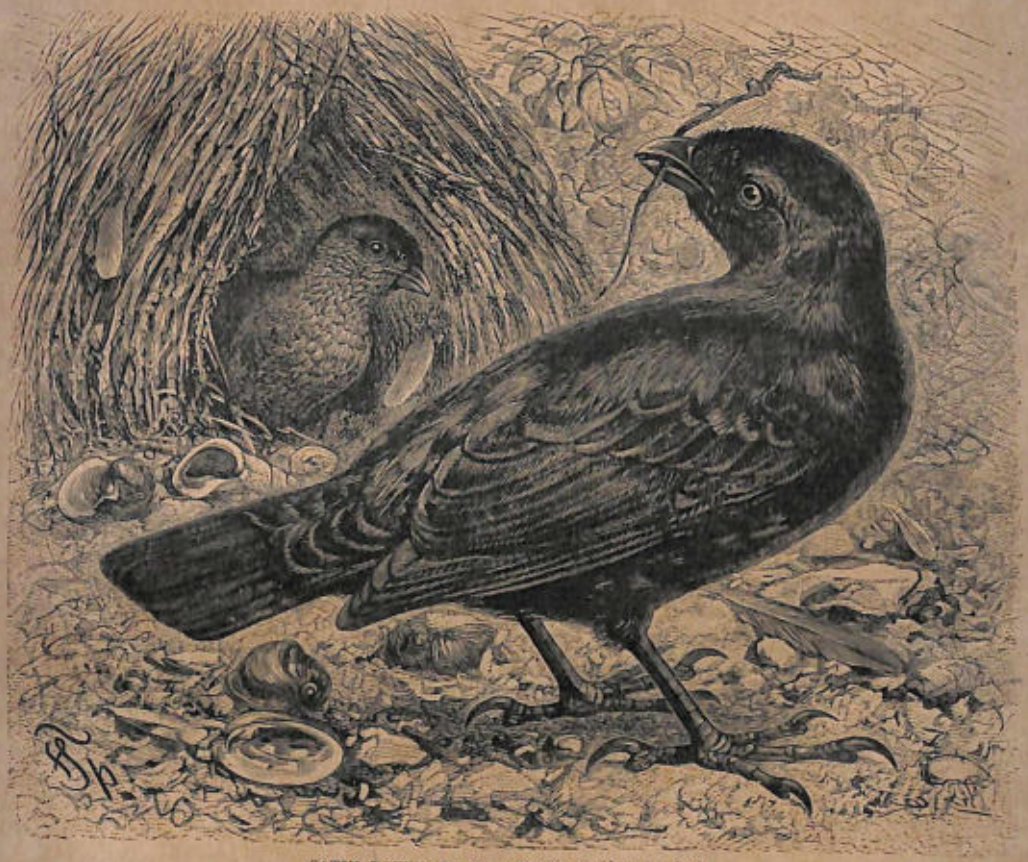
They all have the base of the beak fully feathered, and the foot of the normal Passerine type. In the position of the flexure of the lower mandible, immediately below the aperture of the nostrils, the skull resembles that of the birds of paradise; but, in a slight backward projection of the hinder extremity of the mandible, they approximate to the starlings, in which it is more developed, while the flexure is further back.

Satin Bower-Bird.

The satin bower-bird (*Ptilonorhynchus holosericeus*) is the type of a genus characterised by the short, convex, and laterally compressed beak, in which the nostrils are basal and concealed by the silky feathers of the forehead; the wings being pointed, the tail somewhat rounded, and the feet stout and furnished with moderately long claws. These bower-birds belong to the eastern and northern districts of Australia.

The localities frequented by the satin bower-birds are the luxuriant and thickly foliaged brushes stretching along the coast of New South Wales. Their popular name owes its origin to their extraordinary habit of constructing what the colonists commonly call "runs," which are used by the birds as a playing-house, and are constructed in avenue form, built of pieces of stick or grass and adorned with stones, bright-coloured shells, and even bleached bones, as well as the blue tail-feathers of certain parrakeets. The natives are so well acquainted with the propensity of these birds for carrying off any attractive object, that they always search the runs for any small article that may have been dropped in the bush; and in one Gould found a small neatly-worked stone tomahawk, together with some slips of blue cotton rags, which the birds had doubtless picked up at a deserted encampment of the natives. This is a stationary species, but roams from one part of the district to another in search of food. It appears to have particular times in the day for feeding, and when thus engaged may be approached within a few feet, although at other times the old males are shy and watchful. In autumn these bower-birds associate in

small flocks, and may often be seen on the ground near the sides of the rivers. The adult male is entirely of a deep, shining blue-black, closely resembling satin, with the exception of the wings and tail, which are of a deep velvety black. The female has all the upper-parts greyish green; the under surface being similar, but lighter and washed with yellow; and each feather of the under surface having a crescentic mark of dark brown near the extremity. Young males closely resemble the females. There are other species of the genus.



SATIN BOWER-BIRDS AND NEST (⅓ nat. size).

Spotted Bower-Birds. The five species of this genus differ from the preceding group by having the nostrils exposed, instead of completely hidden by silky plumes; while from an allied form they are distinguished by the nostrils being oval in shape and overhung by a membrane behind, as well as by the longer and more slender beak. In colour the upper-parts of the common spotted bower-bird (*Chlamydodera maculata*) are deep brown, as are also the wings and tail; each feather of the back and rump, as well as the scapularies, being tipped with a large buff patch; the under-parts are greyish white. The male is ornamented with a broad crest of rose pink, which is wanting in his partner.

Much similarity exists between the habits of the satin bower-bird and those of the spotted bower-bird. The latter species is, however, extremely shy,

and would often escape notice were it not for the harsh grating note with which it receives the intrusion of a stranger into its haunts. When disturbed it takes to the topmost branches of the loftiest trees, and frequently flies off to another neighbourhood. Gould states that he found several of the bowers or runs of this bird during his journey into the interior of New South Wales, both on the plains studded with small trees and in the brushes clothing the lower hills;



SPOTTED BOWER-BIRDS AT HOME (½ nat. size).

these were considerably longer and more avenue-like than those of the satin bower-bird, being in many instances 3 feet in length. "They are outwardly built of twigs, and beautifully lined with tall grasses, so disposed that their heads nearly meet; the decorations are very profuse, and consist of bivalve shells, crania of small mammalia and other bones, bleached by exposure to the rays of the sun or from the camp-fires of the natives. Evident indications of high instinct are manifest throughout the whole of the bower and decorations formed by this

species, particularly in the manner in which the stones are placed within the bower, apparently to keep the grasses with which it is lined fixed firmly in their places. These stones diverge from the mouth of the run on each side so as to form little paths, while the immense collections of decorative materials is placed in a heap before the entrance of the avenue, the arrangement being the same at both ends. In some of the larger bowers, which had evidently been resorted to for many years, I have seen half a bushel of bones, shells, etc., at each of the entrances. I frequently found these structures at a considerable distance from the rivers, from the borders of which they could alone have procured the shell sand small round pebbly stones; their collection and transportation must therefore be a task of great labour. I fully ascertained that these runs, like those of the satin bower-bird, formed the rendezvous of many individuals."

Gardener Bower-Bird. The Papuan representative of the next genus (*Amblyornis inornatus*) has the beak less elevated than in the other genera, and the nostrils completely concealed. It is remarkable for building a kind of hut-like structure, fronted with what may be termed a garden, which displays a striking appreciation of beauty in its mode of arrangement. The hut, which is always placed at the foot of a large tree, is some two feet in height, and is formed of the stems of orchids, radiating and sloping from a central support, and roofed with a mass of moss, while round it runs a gallery. One side of the hut is left open, and in front of this is the garden, which is decorated with the bright-coloured berries and flowers, these being removed as soon as they wither. It may be mentioned here that the "bowers" of the whole group have nothing whatever to do with nesting, and appear to be erected solely for the amusement of the birds.

There are several other genera pertaining to the family, among which may be mentioned *Ælurædus*, as represented by the Australian cat-bird (*Æ. viridis*). Instead of building a bower, this species merely clears a space of ground, which may be some 8 feet in diameter, where the birds sport.



COMMON STARLING.

The Starlings.

Family *Sturnidæ*.

Following the arrangement of Dr. Sharpe, the next family on our list is that of the starlings, although Mr. Oates, in his *Birds of British India*, assigns it a very different position. All these birds agree in possessing a wing with five primary quills, and twelve tail-feathers; the beak being generally, although not invariably, slender and curved. The nostrils are clear of the line of the forehead; but the length of the metatarsus is variable. The characters in which the skull differs from that of the birds of paradise are noticed under that family.

Starlings are found throughout the Eastern Hemisphere, with the exception of New Zealand.

True Starlings. In the typical genus (*Sturnus*) the beak is as long as the head, and blunt at the tip and depressed, its edges being quite smooth; the wings are long and pointed, and the tail is short and squared. The members of the genus principally inhabit the temperate regions of Europe and Asia, as well as Northern Africa.

Common Starling. Breeding commonly in most parts of temperate Europe, although more rarely in the north than in the central districts of the Continent, the common starling (*Sturnus vulgaris*) is one of the most adaptive of birds, in consequence of which its range is steadily increasing. In the British Islands it has increased of late years to an extraordinary extent. So long as the starling contented itself with nesting sporadically in the pigeon-houses of farms and in hollow trees, as, for example, in the London parks, the public naturally desired to afford protection to so charming a bird; and there can be no doubt that it merits much interest, since it works assiduously to destroy the larvæ of such injurious insects as the crane-fly.

At the same time it is only right that we should take into account the heavy loss which fruit-growers frequently sustain from the inroads of hordes of hungry starlings; the extraordinary numbers of these birds which visit orchards of ripe fruit almost defying description. Quite recently the starling has developed an alarming fondness for ripe pears and apples; nor does he altogether disdain wild fruit; even the berries of the mountain-ash are much to his taste, and he constantly strips them with extreme pertinacity. When feeding on grass lands, in company with thrushes, the starling is apt to play the part of a bully, robbing his gentler neighbours of their fairly-earned subsistence.

In addition to being a vocalist of no mean order, the starling is a first-class mimic, and delights in reproducing familiar sounds with the greatest fidelity to truth. We have heard individual starlings reproduce the call-note of the skylark, goldfinch, wagtail, and other small birds; sometimes we have been startled on a winter's day to recognise the cry of the common sandpiper or the grating call-note of a fern-owl in the middle of a crowded city, and have discovered the author of our astonishment in the person of a starling, that is pouring forth his rhapsodies from some neighbouring chimney-top. Perfection is not easily acquired; but the starling practises his performances until he acquires a high measure of proficiency.

The starling does not, however, confine his attention to the reproducing the notes of other birds; any sound that strikes his fancy being rehearsed time after time, until the sharpest expert might be deceived. Not long ago, one of these birds astonished its human neighbours by reproducing the hammering of a stonemason, who had been engaged in dressing stone. The starling nests in April, and the young usually fly about the end of May; many pairs rearing two broods of young in a season. Some birds nest in the recesses of sea-caves in company with rock-doves and black guillemots; others rear their broods in the interior of old stone walls; while others again inhabit and enlarge the burrows of sand-martins in some perpendicular cliff: by far the greater number nest, however, about human habitations. In some

districts the fledged young gather together in dense flocks as early as July; and with the advance of autumn young and old congregate at their favourite roosts in prodigious numbers, feeding during the day in widely different localities, but flocking together at their favourite rendezvous before nightfall. Myriads of starlings migrate along the British coasts in spring and autumn; hence their presence at one or other of our lighthouses is frequently the subject of remark. Many individuals

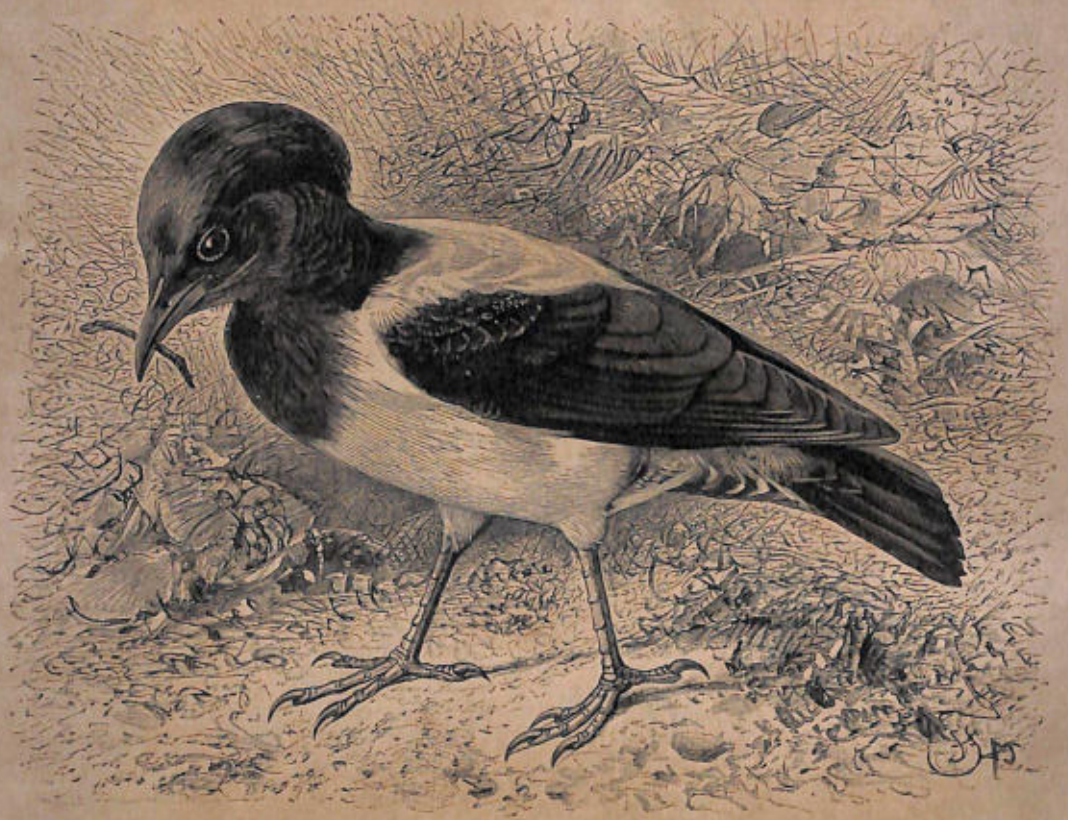


COMMON AND BLACK STARLING (¼ nat. size).

bred in northern Britain winter in the midland counties, frequenting half-flooded meadows and other attractive haunts.

The male in summer has the plumage black brilliantly shot with purple-green and steel-blue; the feathers of the nape and upper-parts generally being tipped with buff in the form of triangular spots. Professor Newton points out that after the autumnal moult the starling is profusely spotted with buff, especially on the lower-parts, but in the spring many of these spots become obsolete. The plumage of the young is a dull brownish grey.

Black Starling. In Southern Europe the spotted starling of the British Isles is replaced by the black or Sardinian starling (*S. unicolor*), which is abundant in some parts of Spain and Portugal. Mr. Tait says that it is very common in the interior of Portugal, and that it is a very restless bird, often seen flying up and down in small flocks. Although some individuals reside in the Peninsula all through the year, the bulk of the black starlings, which breed in Spain, appear to pass the winter in Algeria, where they feed upon the fruit of the date-palms. This starling nests both under the eaves of outhouses and also in crevices of rocks. Its nesting habits are said to be identical with those of the



ROSE-COLOURED STARLING (⅛ nat. size).

common starling, and the egg is of a similar pale blue colour. The black starling has the entire plumage black, glossed with purple, without any spots whatever; the smaller feathers being very long and tapering. It is shown in the lower figure of the illustration on p. 345.

Rose-Coloured Starling. The single representative of the genus *Pastor* differs from the true starlings in having the head furnished with a long and conspicuous crest, reaching to the upper part of the back. One of the most beautiful of European birds, the rose-coloured starling (*P. roseus*), has its winter-home in India, from which country it is, however, absent during the breeding-season. Occasionally wandering as far north as the west of Scotland, this bird is very erratic in its habits, and many years have passed since it has been seen in any

considerable numbers in the British Islands. In the summer of 1875, vast numbers visited Villa Franca; a small flock making its appearance on June 3rd, and alighting on the high ruined walls within the castle, and being followed in about half an hour by another flock of about one hundred. In a short time many people assembled at the places, and soon witnessed another sight, for towards evening appeared many thousands of these starlings, which, joining with first comers, stopped there till dusk, when they dispersed in numerous troops over the open country. On the following day from twelve to fourteen thousand rose-coloured starlings arrived and took entire possession of the castle; driving away by the force of superior numbers the common starlings, pigeons, and all other birds that nested in the ruins, and proceeding to fill every available hole and fissure. The birds began to lay about the 17th of June, the eggs being of a uniform white colour with a greenish tinge. The young were hatched about the 10th July, and were fed exclusively upon locusts. The old birds foraged in the country in flights of from ten to twenty, or even forty, returning in the same united fashion to their offspring. The rose-coloured starling is one of the most sociable and cheerful of birds. "Always busy and restless," says Signor de Betta, "it may be seen running here and there, accompanying every movement with its cries. The song of the male is a continual chatter, mixed with harsh and disagreeable sounds; both one and the other begin in the early morning, continuing for a length of time, and renewed at intervals after feeding. The males, always at strife, may be seen pursuing one another and exchanging blows with their bills, while in the most curious attitudes and with their long black crests elevated and expanded. They exhibit great affection for the hen birds which, never leaving the nest during the period of incubation, are protected and fed by them with all assiduity." These birds will not unfrequently associate with the common starling; and they retain their vivacious character even in captivity, where they form some of the most charming of aviary birds, darting to and fro on rapid flights or singing from some favourite perch. The male in summer-plumage has the head, crest, wings, and tail black, with a blue or violet gloss; the back and breast being of a beautiful rose colour, which is suffused with brown in the winter plumages. The young are uniform light greyish brown above, with the wings and tail dark brown edged with buff; the throat and lower parts being dull buffish-white.

Other Genera. There are numerous other genera of the family into the consideration of which the limits of our space forbid our entering. Among these are the true mynas (*Sturnia*) of India, distinguished from *Sturnus* by the beak being more slender, shorter than the head, and narrowing to a point; and differing from the allied *Agropsar* by the middle tail feathers being longer than the outer pairs. The pied starling (*Sturnopastor*) of India, as well as the African wattled starling (*Dilophus*), likewise belong to this group.

Ox-Peckers. Among the most useful of South African birds, from their habit of feeding on the parasites which infest domestic and other cattle, the ox-peckers are very unlike starlings in general appearance; from which they are distinguished by the beak being stout, broad at the base, and nearly straight, with the nostrils bare. The wings are long, with the first quill very short, and

the second nearly equal in length to the third; the tail being long, broad, and wedge-shaped; while the feet are strong, and furnished with sharp-curved claws, by means of which the birds retain their hold on the slippery skin of buffaloes. One species of ox-pecker inhabits North-Eastern Africa, Senegambia, and the Transvaal; while the South African ox-pecker (*Buphaga africana*) is found in Natal, and the red-billed species (*B. erythrorhyncha*) in most parts of Central Africa.



RED-BILLED OX-PECKER (½ nat. size).

These birds fly in small parties of six or eight, and have a somewhat laboured flight; they may be observed climbing over the oxen in a team, much as a woodpecker climbs a tree; and the cattle for the most part enjoy the operation of being freed from the ticks and other pests with which they are infested. On the first arrival of a flock of these birds, the cattle are, however, apt to be alarmed, and start



GLOSSY STARLINGS.

off as if they had been attacked by gad-flies. It must not be supposed that these birds confine their attention to cattle, since they perform the same kind offices for rhinoceroses, elephants, antelopes, and probably almost all the larger African mammals.

Although not loud, the notes of the ox-peckers are harsh and grating; and are always uttered when a flock approaches cattle to feed. Nothing appears to be ascertained as to the breeding-habits of these birds. In the figured species the general colour of the upper-parts is greyish brown; the wings being black, the tail brown, the throat grey, the under-parts pale fulvous, and the beak red.

Glossy Starlings and Grackles.

Family *Eulabetidæ*.

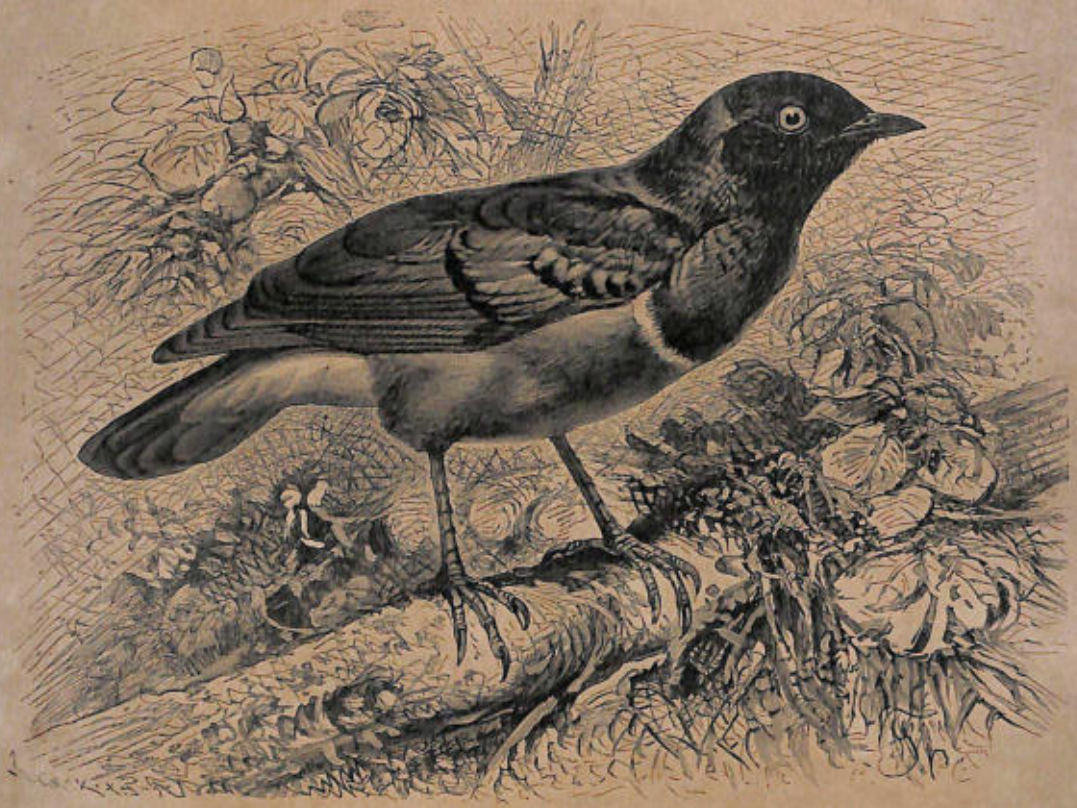
Whereas the true starlings and their allies have no trace of bristles at the rictus of the gape, and lay uniformly coloured eggs, the members of the present African and Asiatic family possess such bristles, and lay spotted eggs. Moreover, the members of the present family are mainly or entirely arboreal, instead of hunting for a large portion of their food on the ground.

African Glossy Starlings. The most beautiful members of all the starling-like birds are undoubtedly the African glossy starlings, of which a group of three species is represented in our coloured illustration. All the African glossy starlings are neatly-built birds, with the beak strong, of moderate length, compressed, swollen at the base, and notched; the nostrils being situated about the middle. The wings are large, the feet long and strong, and the tail of variable length; while the plumage is remarkable for its brilliant gloss, being generally adorned with shades of bluish green, violet, purple or copper-colour. Such species as have long graduated tails may be included in *Lamprotornis*, while those in which the tail is short and squared are classed as *Lamprocolius*. The glossy starlings are gregarious birds, ranging all over Africa, and feeding on vegetable as well as animal substances. Uttering harsh clamorous notes, they are rapid in their flight and lively in their movements; and while generally dwelling high up in the branches of the forest trees, they descend at times to pick up insects and other food on the ground. From the retiring habits of most of the species, they are but seldom seen. They either build in holes of trees, or make large cup-shaped nests, in which are deposited five or six spotted eggs.

Long-Tailed Glossy Starling. This species (*L. æneus*), which is the one represented in the upper figure of our coloured Plate, is a denizen of West Africa, although also ranging into the southern, eastern, and central districts of that continent. Measuring about 20 inches in total length, of which two-thirds are occupied by the long, graduated tail, this bird has the head, chin, and upper part of the throat black, with a golden lustre; the upper-parts and wings being dark metallic green, and the upper wing-coverts ornamented with small black spots; the middle of the throat, as well as the upper tail-coverts, tail, and under-parts being dark purple-violet, marked with darker cross-bands; while the middle of the breast is copper-red. The upper wing-coverts have black spots. The iris of the eye is yellow;

and the beak and feet are black. Feeding largely upon insects, these birds are more terrestrial in their habits than many others of the group.

Green Glossy Starling. The green glossy starling (*Lamprocolius chalybeus*), which is shown in the lower figure of our Plate, is an inhabitant of North-Eastern Africa, and is selected as a good example of the second genus of the group. With the exception of a spot in the region of the ear and the under wing-coverts, the whole plumage is of a steely bluish green, the secondaries and the feathers of the upper wing-coverts being marked at the end with a round blackish spot. Such



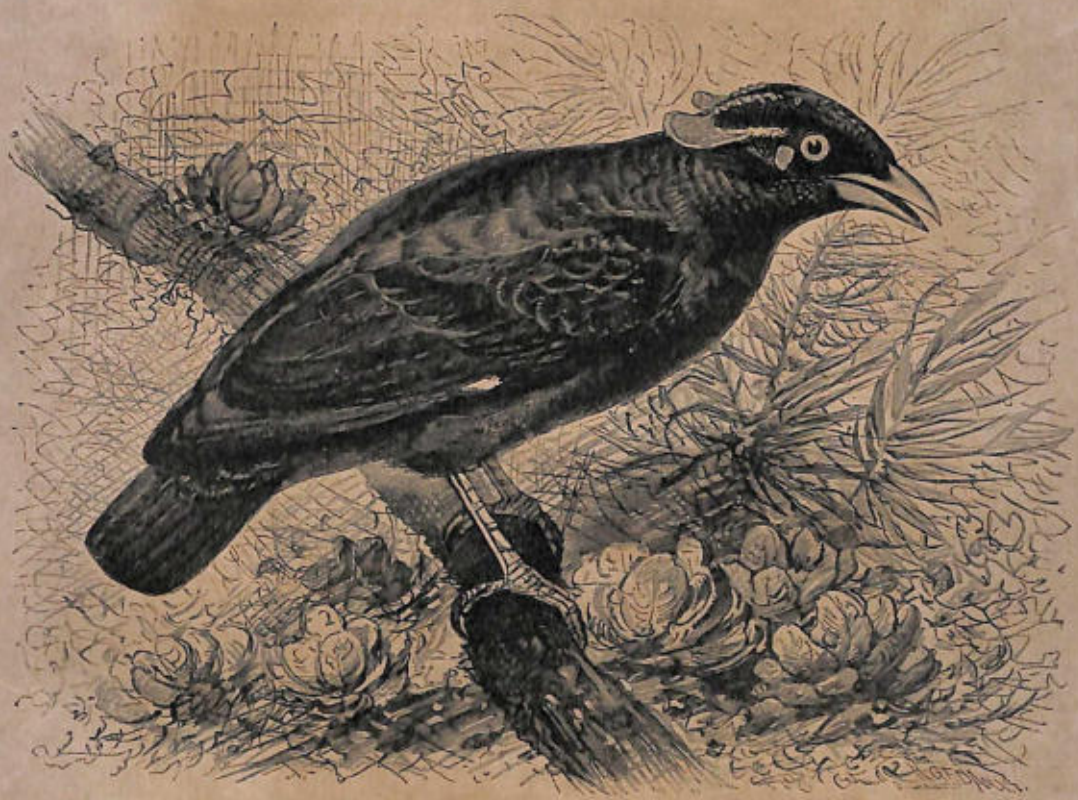
THE SUPERB GLOSSY STARLING.

is the wonderful shimmer of the plumage, which is similar in both sexes, that it shows totally different tints according to the light, and indeed can scarcely be described in words. In the young only the upper-parts are metallic green, the under-parts being dark brownish grey, devoid of lustre.

Although typically an inhabitant of Abyssinia, this beautiful bird ranges into Senegambia. It frequents alike the thickly-wooded river-valleys and the high mountains, ascending in Abyssinia to an elevation of some ten thousand feet; and while generally going about in pairs, in the breeding-season congregates in small flocks. Both in flight and general habits it resembles the European starling.

White-Bellied Glossy Starling. The pretty little bird (*L. leucogaster*), depicted in the middle figure of the Plate, is our last representative of the group, and differs

considerably in coloration from the foregoing species. The whole of the upper-parts and the throat, as far as the breast, are purplish blue, with a wonderful violet shimmer in certain lights; while the remainder of the under-parts are white, and the wings blackish brown, with a violet tinge; the whole of the darker portion of the plumage being shot with a coppery lustre. This bird is distributed over the whole of Central Africa, and extends northwards into Abyssinia and Western Arabia. A truly arboreal species, it is found both on the plains and in the



SOUTHERN GRACKLE (⅔ nat. size).

mountains, generally associating in parties of from six to twenty individuals; its general habits being very similar to those of the other members of the group.

The Grackles, or Hill-Mynas. Not to be confounded with the true mynas, mentioned later on, the grackles, or hill-mynas of India and the adjacent regions, are birds of glossy black plumage, easily distinguished by the presence of fleshy yellow or orange wattles on the head. The beak is thick, high, curved, and shorter than the head; while the feathers of the crown are short and inwardly curved, with a kind of parting down the middle of the head; the wing being rather blunt, the tail short and nearly squared, and the foot strong.

The southern grackle (*Eulabetes religiosa*), of Southern India and Ceylon may be taken as a well-known example of the genus; and is distinguished from the others by having bare skin on the sides of the neck, and two long patches on the neck. Its whole plumage is glossy black, with the exception of a patch of white

at the base of most of the primaries; the wattles are naked, being rich yellow, the beak orange-yellow, and the legs and feet citron-yellow. The total length of the adult is about 10 inches. Young birds have a dull black plumage, and are devoid of wattles.

Like its kindred, this bird is either resident in one spot throughout the year, or only locally migratory; it is chiefly confined to the large forests of Western India or Ceylon; but other species inhabit the outer Himalaya. The southern grackle breeds from March to October; generally laying only a pair of eggs, which are deposited in holes in trees. Its food consists entirely of various fruits, which it obtains among the higher branches of its native forests. All the grackles learn to whistle and talk when in captivity, and as they are excellent mimics they are much prized by the natives of India as cage-birds.

Asiatic Glossy Starlings.

These birds differ from the grackles in having no wattles; their plumage is highly glossy; the beak is short, with the culmen curved; the nostrils are small and round; and the wing is long and sharp, and the tail of moderate length, and graduated. Mr. Oates remarks that he is not aware how nearly related these birds are to the African glossy starlings, although there appear to be important differences between some of them. The range of the genus extends from South-Eastern Asia to Australia; the Indian glossy starling (*Calornis calybeïus*) being the only representative in the country from which it takes its name. The whole plumage is black, with a brilliant green gloss on most of it.

* The Drongos.

Family *Dicruridæ*.

The drongos, or king-crows, of South-Eastern Asia and Africa, form an easily recognised family, which is placed here by Dr. Sharpe, although Mr. Oates considers that its affinities are rather with the creepers, while other writers place it with the shrikes. Their generally black plumage, and deeply-forked tail of ten feathers, serve at once to distinguish drongos from all other members of the order. The edges of both mandibles are smooth, with a single notch in the upper one; the wing has ten primary quills, and the nostrils are clear of the line of the forehead. Both sexes are alike; and the young differ from their parents only by their plumage being paler. Several of the species have the head crested, and there are always bristles at the base of the beak. Entirely insectivorous, the drongos are habitually upon the wing, darting from a tree to catch an insect, and returning speedily to the same or another perch; and they are likewise fairly endowed with vocal powers.

Much alike in general characters, these birds present considerable difficulty in distinguishing the genera and species. In addition to the typical genus *Dicrurus*, as represented by the Indian black drongo, or king-crow (*D. ater*), ranging from Afghanistan to China, and several other species, Mr. Oates recognises no less than six genera of the family in India. Two species, which may be included in the type genus, are found in South Africa; while Australia has but a single representative (*Chibia bracteata*). The black drongo, which has the entire plumage deep black

with a steely-blue gloss, but the under tail-coverts generally tipped with white, is one of the most familiar of Indian birds, both in the hills and the plains, generally selecting the most exposed and barren tree or post for its perching-place. The nest, which is generally placed in a thickly-leafed bough, is composed of fine twigs and



THE BLACK INDIAN DRONGO.

grass, covered externally with cobwebs. Usually four, although occasionally five in number, the eggs may be either uniformly pure white, or salmon colour with brownish spots. Not unfrequently this bird may be observed perched on the back of cattle searching for insects.

The Orioles.

Family *Oriolidæ.*

The orioles comprise a number of birds from the temperate and tropical portions of the Old World, in which the bill is as long as the head, and gently curved to the tip, where it is notched; the head is never crested; the wings are long, with the first three quills equally graduated, and the third and fourth longest; while the tail is moderate and rounded; and the toes are free at the base, and have long curved claws. The nostrils are bare, and placed well in front of the base of the beak, and this character, together with the presence of twelve tail-feathers, at once distinguishes them from the drongos. Brilliant yellow generally adorns the plumage of the male orioles; in others the lower-parts are variegated with rich crimson. They are birds of frugivorous habits, and frequent forest trees in

preference to smaller cover. They are divided only into two genera, of which *Oriolus* has the lores feathered, while in *Sphecotheres* they are naked. Orioles inhabit the temperate parts of Europe, the whole of Africa, India, China, the Malayan Provinces, the Indian Islands, and Australia.

Golden Oriole.

Of the numerous birds visiting Northern Europe in the spring no species is better known than the golden oriole (*O. galbula*), at which time this bird may be observed migrating in small numbers; both sexes journeying in company. At this season the birds are silent, and seem anxious to



THE GOLDEN ORIOLE (½ nat. size).

escape notice, although, as they arrive before the beech trees (which clothe the mountain-sides in the north of Spain) have unfolded their leaves, they have some difficulty in concealing their brilliant plumage among the bare twigs. The oriole on the Continent reaches its nesting-haunts about the end of April, and at once claims its own peculiar area of forest. Each pair confines itself to a certain portion of a great wood, the intrusion of a strange male into the haunts of a pair of breeding birds being certain to result in a fight. Although the golden oriole is shy and retiring in Europe, its cousin is by no means so in India, where it often perches on a tree immediately over the tent of the traveller, and there pours out its flute-like notes. In addition to these flute-like tones, both sexes have also a cat-like call. The nest is usually placed on a bough,

and the young are attended with remarkable care by the parents. Although feeding mainly upon insects, which are often taken on the ground, the golden oriole during the fruit-season lays toll on the orchard. The range of the golden oriole includes the whole of Europe, except the extreme north, as well as Persia and other parts of South-Western Asia. In winter this species visits South Africa. The bright colour of the male golden oriole renders it peculiarly liable to be attacked by the sparrow-hawk; and, in such a contingency, the oriole does not trust to his thrush-like flight enabling him to elude his tormentor in the open, but on the earliest opportunity seeks refuge in the densest thickets available as cover. The oriole forms a good cage-bird; although old birds are not easily reconciled to the loss of their freedom, and are apt to pine away. Young birds, on the other hand, are easily tamed.

The adult male of this species is rich golden-yellow above; the wings being black, the primary coverts broadly edged with yellow, which forms a conspicuous spot; the tail is black, tipped with yellow, the outer feathers having more yellow than black; while the entire under-surface is golden-yellow. The female differs from the male in having the back and scapulars tinged with green.

Green Oriole. Among thirty odd species of the genus, we may select for mention the green oriole (*O. viridis*) of New South Wales, which frequents orchards and gardens, where it fills the summer air with its melodious notes. This oriole, says Prof. Ramsay, may often be seen perched on some shady tree, with its head thrown back, showing to perfection its mottled breast, singing in a low tone, and imitating the notes of many birds, such as the black magpie. While feeding, it frequently utters a harsh guttural sort of squeak; and, during the breeding-season, which commences at the end of September, and ends in January, it confines itself to a monotonous although melodious cry, the first part of which is quickly repeated, and ends in a lower note. This oriole builds a cup-shaped nest, principally composed of shreds of the bark of a species of gum-tree strongly woven together, and lined with leaves, or grass and hair; which is generally suspended between a fork at the extreme end of some horizontal bough, often in an exposed situation. The eggs vary in ground-colour from cream to dull white or very light brown, minutely dotted and blotched with umber and blackish brown. Green orioles feed principally on berries and wild fruits, particularly figs; although they sometimes capture insects on the wing. The adult male is dull yellowish olive above; the wings and tail being brown, washed with grey; while the throat is dull olivaceous; the fore-neck greyish, and the breast and sides of the body white, washed with olive-yellow, each feather having a dark central streak. The sexes when adult are almost identical in colour, but the male has the olive of the upper-parts of a deeper tint than the female.

* The Cassiques and Hangnests.

Family *Icteridæ*.

To a certain extent intermediate in structure between the crows and the finches, and agreeing with the starlings in the general structure of the skull, and

especially the backward prolongation of the hinder extremity of the lower mandible, the large assemblage of American birds known as cassiques and hang-nests may be regarded as the New World representatives of the starlings of the Old World, although, so far as habits are concerned, it does not appear that there is any very marked structural affinity between the two families. Distinguished by the length and slenderness of the beak, which in most cases equals the head in



THE CRESTED CASSIQUE (⅔ nat. size).

length, these birds generally possess pointed wings, which have never more than nine primaries; they have strong feet, and chiefly black plumage. Among the numerous genera only a few can be selected for notice. Congregating in flocks, after the manner of starlings, many of these birds build the long, pendent, bottle-like nests, from which the name of the family is derived. The family may be divided into three groups, the first comprising the rice-birds and cow-birds, the second the true hangnests, and the third the troupials; the characters of which are pointed out below.

Cassiques. The first subfamily (*Cassicinæ*) is represented by several closely allied genera, among which the crested cassique (*Ostinops decumanus*) of South America, and the yellow cassique (*Cassicus persicus*), which is likewise South American, are well-known species. It will be unnecessary here to mention the characters by which these genera are severally distinguished from one another; and it will suffice to say that the subfamily to which these belong is characterised by the naked exposed nostrils, and the presence of a shield on the forehead at the base of the beak. The crested cassique is characterised by the small crest from which it takes its name; and while the general colour of the upper-parts is deep black, with the feathers of the mantle and shoulders shaded with brown, and the upper and lower tail-coverts chestnut, the five outermost pairs of tail-feathers are a brilliant citron-yellow. The elongated form of the nest characterising the crested cassique is sufficiently indicated in our illustration.

The True Hangnests. The true hangnests, as represented by a large number of species ranging from North and Central America to Southern Brazil and Bolivia, constitute (together with an allied genus containing one species) a second subfamily (*Icterinæ*) in which the nostrils are more or less covered by a membrane, while the culmen of the beak is more or less incurved, and there is no shield on the forehead; the metatarsus being short, the feet adapted for perching, and the tail rounded. As a rule, the plumage is bright orange and yellow, relieved with black and white; the sexes being in some cases similar, and in others very dissimilar. Unlike the members of the preceding subfamily, these hangnests are thoroughly arboreal in their habits, and while the majority construct pendant nests like those of the cassiques, others appear to build open cup-shaped nests. The eggs are bluish or pinkish white, profusely spotted with purple and red. The best known species is the Baltimore hangnest (*Icterus galbula*), frequently termed the Baltimore oriole, of the United States. These birds build in large companies, the males generally arriving first at the breeding-places, where they are soon joined by their partners. The nest is wider and less elongated than that of the crested cassique. On a single tree sometimes as many as forty nests may be observed; and during November they will be found to contain both eggs and young birds. All the numerous species of the genus *Icterus* are good songsters, the notes of the Baltimore hangnest being especially melodious.

Rice-Birds. Belonging to another subfamily (*Agelæinæ*) differing from the last by the straight culmen of the beak and the elongated metatarsus, this genus, as typified by the common rice-bird or bobolink (*Dolichonyx oryzivorus*), is characterised by the short and conical beak, the long and pointed wings, the rigid acuminate feathers of the tail, and the stout and long-clawed feet. An inhabitant of North America, where it is especially common in the States, this well-known bird winters in Central America and the West Indies, returning northwards in vast flocks along the Atlantic coast in spring, when the males are in nearly full breeding-plumage, and are thus very conspicuous as they flock to the meadows and orchards. "Their number," says Dr. Coues, "seems out of all proportion to that of the females, but this is probably due to the silent and more retiring ways of the latter sex. They really pass through, in the vernal migration, quite rapidly, though they do not

appear to be at all in a hurry, as we see them by day. They throw themselves in a field, scatter on the ground feeding, and at the slightest alarm, or in mere wantonness, suddenly fly *en masse* to the nearest tree, fence, or bush, and begin to sing, producing an indescribable medley, hushed in an instant only to be resumed. Sometimes they sing as merrily, though with less concerted action, while they are rambling in the grass. Their daytime leisure for song and food is easily explained; for they migrate at this season almost entirely by night. Every night in early May, as we walk the streets, we can hear the mellow metallic clinking coming down through the darkness, from birds passing high overhead, and sounding clearer in the stillness. By the middle of May they have all passed; a few, it is stated, linger to breed south of New England, but the main body passes on, spreading over that portion of the Union and the neighbouring British provinces, occupying in pairs almost every meadow. The change of plumage is completed before the return movement is made." Millions return on their southern journey, late in the summer and during September. They are now songless, but have a comfortable, self-satisfied *chink*, befitting such fat and abandoned gourmands as they are, thronging in countless hordes the wild rice-tracts and the grain-fields. So they go until the first cold snap that sends them into winter-quarters at once. The bobolink nests upon the ground, making a rude and flimsy structure of dried grass, which is artfully concealed. It lays four or five eggs, bluish-white in ground-colour, blotched and spotted with dark chocolate. The male in the breeding-season has the head and lower-parts black; the hind-neck buff; the scapulars, rump, and upper tail-coverts ashy white; the interscapulars streaked with black, buff, and ashy; and the outer quills edged with yellowish. The nuptial garb just described is, however, unlike the plain plumage worn by both sexes after the breeding-season, when the general colour of the plumage is yellowish brown above, and brownish yellow below; the crown and back being conspicuously streaked with black, and the wings and tail blackish.

Cow-Birds.

Nearly allied to the last genus, the cow-birds possess a short, conical bill, long and pointed wings, slightly rounded tail, and strong feet. In the majority of the species black is the prevailing colour, being sometimes lustrous, with bronzed reflections. The cow-birds are mainly a South American genus, although one species is only too well known in the United States. Some of the species seize upon the nests of other birds, and having driven away the rightful possessors, proceed to rear their own young in their new home. The majority, however, are more truly parasitical, depositing their eggs in other birds' nests, and leaving the strangers to hatch and rear their own offspring. The common cow-bird (*Molothrus pecoris*) of the United States is a polygamous species; the sexes never mating, and their association being merely a herding together in quest of food. "In the West," says Dr. Coues, "every waggon-train passing over the prairies in summer is attended by flocks of these birds; every camp and stock coral, permanent or temporary, is besieged by the busy birds, eager to glean subsistence upon the wasted forage. Their familiarity under these circumstances is surprising. Perpetually wandering about the feet of the draught animals, or perching upon their backs, they become so accustomed to man's presence that they will hardly get out of the way. I have even known a young bird to suffer itself to be taken in the

hand; and it is no uncommon thing to have the birds fluttering within a few feet of one's head. The animals appear to rather like the birds, and suffer them to perch in a row upon their backbones, doubtless finding the scratching of their feet a comfortable sensation, to say nothing of the riddance from insect parasites."

The cow-bird's foster-parents are numerous, notably the summer yellow-bird, the Maryland yellow-throat, and the red-eyed vireo. It is rare to find more than two eggs of this cow-bird in a single nest, although as many as five have been found together. In colour the eggs are white, speckled with brown. The adult



THE COMMON COW-BIRD (⅓ nat. size).

of the common cow-bird is of a lustrous greenish black, with blue and purple reflections; the head and neck being deep wood-brown, with some purplish lustre. The female is dull coloured, of a nearly uniform greyish brown above, and paler beneath.

Writing of a South American member of the genus, Mr. W. H. Hudson observes that the male of the "screaming cow-bird of La Plata, when perched, emits a hollow-sounding internal note that swells at the end into a sharp metallic ring, almost bell-like; this is uttered with wings and tail depressed, the whole plumage being puffed out as in a strutting turkey-cock, while the bird hops

briskly up and down on its perch as if dancing. The bell-like note of the male is followed by an impetuous scream from the female, and the dance ends. Another species, the common Argentine cow-bird (*M. bonariensis*) of La Plata, when courting, puffs out his rich violet plumage, and, with wings vibrating, emits a succession of deep internal notes, followed by a set song in clear, ringing tones; and then suddenly taking wing he flies straight away, close to the surface, fluttering like a moth, and at a distance of twenty to thirty yards turns and flies in a wide circle round the female, singing loudly all the time, hedging her in with melody as it were."

Red-Shouldered Starling, etc. The bill in this genus is about as long as the head, stout at the base, and tapering rapidly to an acute point; while the wings are pointed, and the tail broad. Black associated with red or yellow is the predominat-



RED-SHOULDERED STARLING (§ nat. size).

ing colour of the male birds, but the females are more soberly attired. Several species are found in Central and Southern America, while others are peculiar to the United States. The type of the genus is the red-shouldered starling (*Agelæus phœniceus*), a bird commonly distributed throughout temperate North America, and especially abundant among the marshy tracts of the Eastern States. It nests in reeds and bushes near the ground or in a tussock of grass, building a bulky nest of coarse fibrous materials, such as strips of rushes or marsh grass. The eggs are pale blue, dotted and blotched with dark markings. In autumn this bird becomes highly gregarious, thronging in the grain-fields, where it does much mischief. The male is lustrous black, with the lesser wing-coverts scarlet, broadly bordered

with brownish yellow; while the female is blackish brown above with pale streaks, and below whitish with many dusky streaks. The young male bird at first resembles the female, but is larger, and generally suffused with buff.

Troupials.

Omitting mention of several genera of the family, we come to a genus, *Quiscalus*, of the third subfamily or group, rejoicing in a variety of names, such as crow-blackbirds, grackles, and boat-tails, but as the first two of these are liable to lead to confusion, it is better to adopt for them the French name of troupials, which, however, is often applied to the family. In



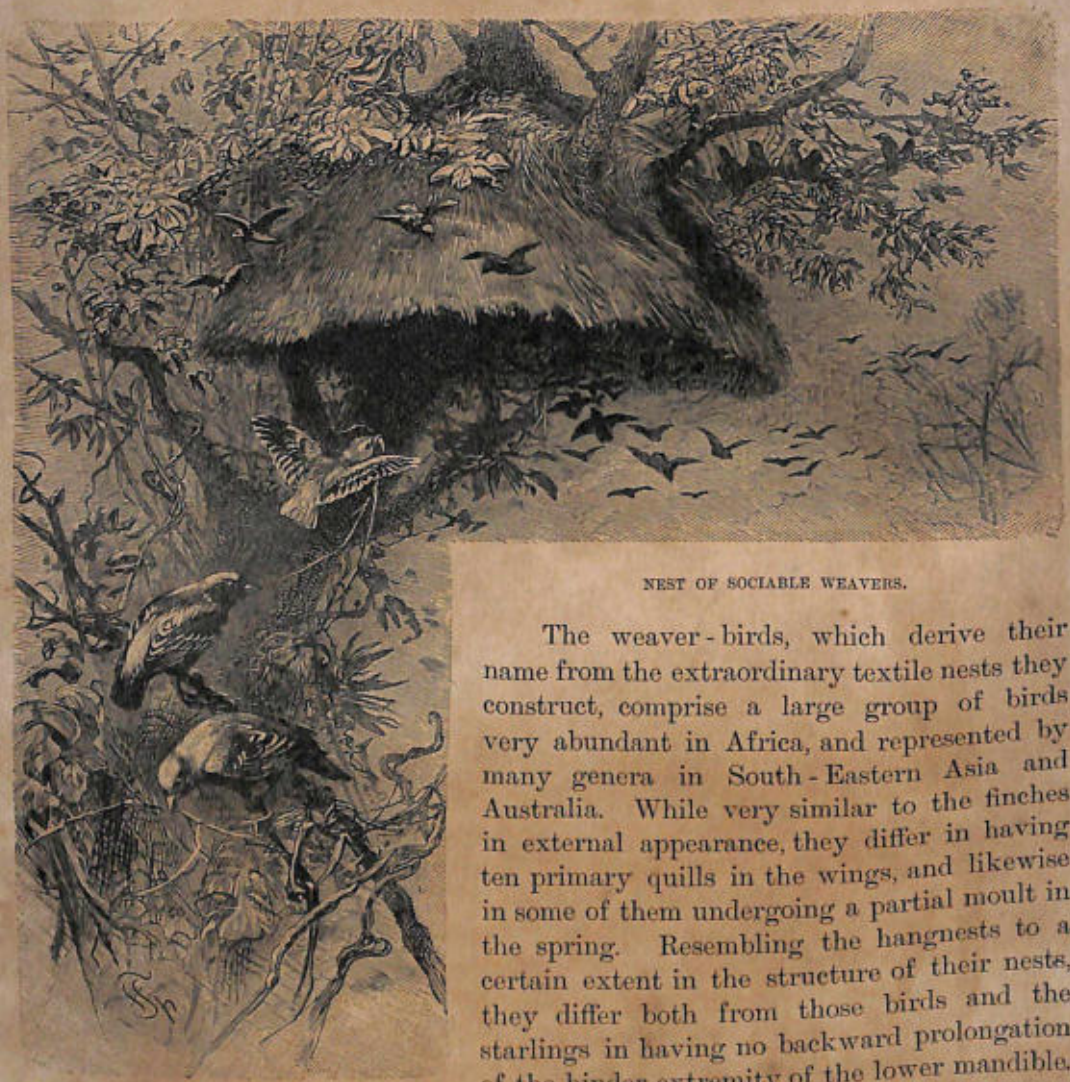
THE PURPLE TROUPIAL (⅔ nat. size).

these the beak is equal in length to the head, and somewhat crow-like in shape; the wings are relatively short, the tail of varying length, and the feet long. The best known member of the genus is the purple troupial (*Q. purpureus*) of the Atlantic States, the other species being more southern in their distribution. It is a migratory gregarious bird of very general distribution, building in a tree or bush, and making a large nest, usually of mud. The eggs are generally green or blue in ground-colour, variegated with dark brown and purple markings. These birds at times inflict great injury upon the crops, much to the annoyance of the agriculturist; but they also destroy large quantities of injurious insects. They have a propensity for destroying the eggs of other birds, especially those

of the American robin or migratory thrush, lurking about the robin's vicinity until the parents are away, and then pouncing on the nest, seizing an egg or young one, and hastily retreating. The adult male is black above and below, variously glossed with green, purple, blue violet and bronze; the female is similar but her tints are more subdued.

* The Weaver-Birds.

Family *Ploceidæ.*



NEST OF SOCIABLE WEAVERS.

The weaver-birds, which derive their name from the extraordinary textile nests they construct, comprise a large group of birds very abundant in Africa, and represented by many genera in South-Eastern Asia and Australia. While very similar to the finches in external appearance, they differ in having ten primary quills in the wings, and likewise in some of them undergoing a partial moult in the spring. Resembling the hangnests to a certain extent in the structure of their nests, they differ both from those birds and the starlings in having no backward prolongation of the hinder extremity of the lower mandible. Having a strong conical beak, with the culmen projecting on to the forehead and arched at the tip, they have the nostrils pierced within the line of the forehead or close to it, while the space between the nostril and the edge of the mandible is



WEAVER BIRDS.

greater than that between the former and the culmen; there is never any distinct notch in the upper mandible. The wings are somewhat rounded, with the first primary quill very short, while the legs and toes are stout and strongly scaled. The family may be divided into two groups or subfamilies, namely, the typical weaver-birds, or *Ploceinæ*, in which the first primary of the wing is nearly as long as the metatarsus, and there is a spring moult; and the whydah birds and their allies, or *Viduinæ*, in which the first primary is much shorter than the metatarsus, and the only moult is autumnal.

The Ox-Birds and their Allies. Commencing with the first or typical subfamily, we have first to notice the small African genus of true ox-birds, which have a rather long, conical, and laterally compressed beak, the wings somewhat rounded and reaching a little below the base of the tail, with the second primary quill only a little shorter than the third and fourth, which are the longest; the tail being of moderate length and somewhat rounded, while the claws are strong and curved. This genus is typically represented by the common ox-bird (*Textor alector*) of Western Africa, shown in the background of the figure on p. 364. This bird has a nearly uniform shining black plumage, with the bases of the contour feathers white, the beak being horny yellow, with its tips and edges bluish, and the feet blackish grey.

The red-billed black weaver (*T. niger*) is found in the Transvaal, Damaraland, and the lake regions; the possession of a red bill easily distinguishing this large finch-like and very noisy bird. It is gregarious in its habits, breeding in colonies, the members of which construct many nests in a single tree. The nests consist externally of an immense mass of dried grass, twigs, and sticks, in which are to be found from four to six separate nests or holes of an oval form, composed of grass only, but united to each other by intricate masses of sticks defying the ingress of any intruder except a small snake. In each of these separate holes are laid three or four eggs exactly resembling sparrows' eggs, but much larger. Curiously enough, the birds roost in these nests which are used year after year, any injury to the structure being at once repaired by all the members of the community. Sir Andrew Smith found this bird frequenting herds of buffaloes, and perching on their backs in search of the parasitical insects which infest their hides. Like other birds of the family, it feeds upon berries, seeds, and insects. The general colour of the adult male is black, with the first half of each wing-feather white; but the young bird has some whitish patches on the neck and breast.

White-Headed Weaver. This weaver (*D. leucocephala*), which represents another genus, is a comparatively small species found in the interior of Africa and Abyssinia. Like other members of the family, the present species is absent from dense forests, preferring to dwell upon grass-lands in the more open portions of the country. It is by choice somewhat gregarious, taking up its abode on rough meadow-lands, and seeking out the neighbourhood of cattle. Although a true weaver, it does not construct so neat a nest as most of its allies. The adult male has the head and under-parts white, the back wings and tail chocolate-brown, and the rump and tail-coverts scarlet; it is depicted in the upper figure of the illustration on the next page.

The True Weaver-Birds. The true weaver-birds form the comparatively small group, common to East and West Africa and the Oriental region, exclusive of the Philippine Islands. While in all the preceding genera the culmen of the beak is flattened at the base and sometimes crested, in the present and allied genera it is rounded at the base; the true weaver-birds being specially distinguished by having the nostrils rounded and exposed, and the claw of the



COMMON AND WHITE-HEADED OX-BIRDS (½ nat. size).

first toe very strong and highly curved. The genus *Ploceus* is confined to the Indian and Malayan regions, and is typically represented by the common weaver-bird, or baya (*P. baya*) of India and Ceylon. All these birds construct long flask-shaped nests, with a tubular entrance, and lay pure white eggs.

Masked Weaver-Bird. The masked weaver-bird (*Hyphantornis larvata*), of Abyssinia, may be taken as a well-known representative of an exclusively African genus, with over thirty species, which may be distinguished from the last by the exposed oval nostrils being partly reached by the plumes at the base, and also shut in by a horny membrane. The figured species may be

recognised by the scarlet iris of the eye, the black beak, and greyish black legs. It is reported to lay pale bluish green eggs, with a few violet-brown spots at the larger end. An allied species from the same district is the Abyssinian weaver-bird (*H. galbula*), in which the iris is orange-brown, the beak black (except in the breeding-plumage of the male, when it becomes horn-coloured), and the leg flesh-coloured. A third form is the olive weaver-bird (*H. capensis*) of South Africa. Generally living in flocks, the members of the last-named species are more numerous in the Transvaal than in Natal. According



ABYSSINIAN AND MASKED WEAVER-BIRDS (¾ nat. size).

to Mr. Ayres, they are fond of sucking the honey from the scarlet flowers of the Cape broom. The nest is constructed of coarse grasses, and formed somewhat in the shape of a chemist's retort, with the neck cut short and the aperture downwards; while across the entrance runs a kind of bar to prevent the eggs from falling out. This nest is lined with the soft flowering heads of grass, which furnish a warm bed for the young. The eggs are of a beautiful, spotless green colour. Mr. Layard says that these weavers become very tame in confinement, and will readily answer to the call. If they are supplied with cotton or thread, they will weave it most industriously into the bars of the cage, forming a dense mass which it is impossible to unravel. This work they perform entirely

with their bills, clinging the while to the sides of the cage with their powerful claws. They have a loud churring cry. The adult has the crown of the head and the sides of the neck gamboge-yellow; the nape, back, and rump are lemon-yellow; the back of the neck and shoulders greenish yellow; the wing-feathers a dark purplish brown edged with yellow; the tail olive-brown tinted with yellow; while the throat and lower-parts are saffron-yellow.

Paradise Whydah Birds.

With this exclusively African genus (*Vidua*) of long-tailed and strikingly-coloured birds we come to the second subfamily, the distinctive characters of which have been already indicated. The paradise-whydah birds, of which there are several species, may be taken to include all those in which the two central pairs of tail-feathers of the males are greatly elongated, although they are frequently subdivided into distinct genera, according as to whether some or all of these feathers are attenuated and wire-like. The long-tailed whydah bird (*Vidua paradisea*), represented in the upper part of our coloured Plate, is an inhabitant of South Africa, where it frequents swampy ground and the long reeds about ponds. Its flight is feeble. In the breeding-season especially, when the male has assumed his nuptial livery and long tail-feathers, the flight is so laboured that the children constantly run them down. They are quite unable to fly against the wind, and in rainy weather can hardly be got to move out of the thick bushes in which they conceal themselves. The Kaffir children stretch bird-limed lines across the fields of millet and Kaffir corn, and take great numbers of the males by their tails becoming entangled in the lines. This bird builds its nest in long grass close to the ground, generally placing it in a tussock of herbage, to the blades and stalks of which it is roughly joined. The nest itself is rather a rough structure, composed of fine grass lined with the seed-ends; the opening is at the side. Mr. Bowker states that the average number of females is as fifteen to one male. He adds that the long tail worn by the male in the breeding-season is not an inconvenience; and the bird never seems to enjoy himself so much as during a high wind in which he shows off to advantage, spreading his tail out like a fan. The male in nuptial plumage is of a general glossy black; the feathers of the shoulders are fulvous and brilliant crimson, and the tail is enormously developed. The female plumage is of a pale yellowish brown, but the wing-feathers are black with pale yellowish brown edges.

Bishop-Birds.

Nearly the whole of the remaining genera of the subfamily have the tail shorter than the wing; and among these some of the most remarkable are the gorgeously-coloured bishop-birds of Africa, a group of which is depicted in the right lower half of our coloured illustration. These birds have the tail squared, with the two central feathers not markedly produced beyond the rest; while the feathering of the body is soft and velvety; and there is a distinct winter and summer plumage, in the latter of which a frill is developed round the neck. Among the handsomest of the group is the red bishop-bird, or red Kaffir finch (*Pyromelana oryx*), of the Cape Colony, Natal, and the Transvaal. A bird of social habits, gathering together in immense flocks both in winter and summer, which during the latter season appear to consist almost entirely of males in their gaudy red and black plumage, the red bishop-bird breeds in the month of September, constructing

its nest of fine grass and suspending it among the reeds of the rivers. The eggs are pure light blue. In winter the flocks of bishop-birds do much damage to the grain-fields. It is often imported into Europe as a cage-bird. The adult male in nuptial plumage has the upper-parts, throat, and vent, brilliant scarlet; the wings and tail are brown, and the forehead, cheeks, and chin black. After the breeding-season is over, the male assumes the brown plumage of the female. Another common bird throughout the Cape Colony is the black-and-yellow bishop-bird (*P. capensis*), affecting alike the loneliest swamps and the homesteads of farmers.



SOCIABLE WEAVER-BIRD ($\frac{2}{3}$ nat. size).

It breeds in the neighbourhood of water, constructing its nest of strong grasses and suspending it between the stalks of two or three reeds. The eggs are very pale green, thickly marked with dark greenish brown blotches and spots. This bishop-bird generally lives in small companies in the open fields, and feeds chiefly upon grass seeds. The adult male has the head and upper-parts rich velvety black, the rump and shoulders brilliant yellow, and the wings brown.

Sociable Weaver-Birds. The birds of this genus, *Philæterus*, which are likewise exclusively African, differ from the bishop-birds in having the plumage similar throughout the year, and no frill round the neck, while they are distinguished from several allied forms by having the nostrils clearly exposed and placed well in front of the plumes at the base of the beak, and by the small size of the bastard-primary.

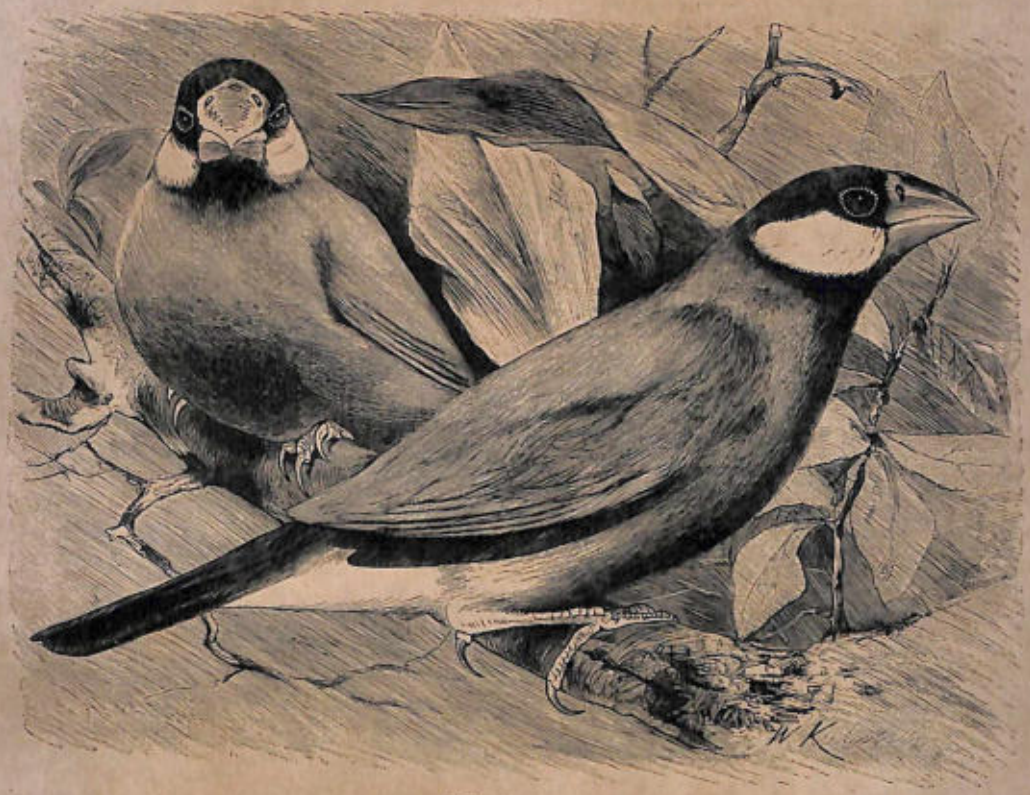
Among the four representatives of the genus the best known is the common sociable weaver-bird (*P. socius*), of the interior of South Africa. This species congregates in large flocks, many pairs incubating their eggs under the same roof, which is composed of whole cartloads of grass piled on a branch of some camel-thorn tree in one enormous mass of an irregular umbrella shape, looking like a miniature haystack and almost solid, but with the under surface (which is nearly flat) honeycombed all over with little cavities, which serve not only as places for incubation, but also as a refuge against rain and wind. Dr. Guillemard remarks that the nests of the sociable weaver-birds probably last for a great number of years. They are constantly being repaired by their active little inhabitants. It is curious that even the initiated eye is constantly being deceived by these peculiar domed-topped structures, since at a distance they closely resemble native huts. The nesting-chambers themselves are warmly lined with feathers. The sociable weaver-bird subsists chiefly upon seeds, and often feeds in company with many individuals of its own kind. The eggs are drab in ground-colour, closely speckled with purple-grey. The male birds are somewhat pugnacious, frequently indulging in fights with their rivals. The plumage of the adult males is drab-brown above, edged with grey. The chin is black and the under-parts are pale isabelline brown, the flanks being varied with black, edged with whitish.

Cut-Throat Weaver-Finches. With these birds we reach a group of genera in which the nostrils are more or less completely hidden by the nasal plumes, and which are specially distinguished by the tail being somewhat elongated and its feathers narrow, as well as by the pointed wing and the swollen and rounded beak, in which the cutting-edge of the upper mandible is festooned near the base. The genus *Amadina* includes three African species, one (*A. fasciata*) having the throat marked by a crimson band extending to the ear-coverts. This species ranges across Central and Northern Africa, and is represented in South Africa by another (*A. erythrocephala*), in which the whole of the head and throat are red.

The Munias. It would be impossible in the limits of our space to point out how the munias are distinguished from all their allies, but it may be mentioned that the central tail-feathers are produced and pointed, while the whole tail is wedge-shaped. They possess a powerful, swollen, and rounded beak, which is most strongly developed in the common Java sparrow. The wings are moderately long; and the tail is graduated and rounded at the extremity. Some thirty species of munias are known, ranging through the Oriental region to New Guinea and Timor, while several species also inhabit the African continent; Sharpe's munia being a native of West Africa, while *Munia nana* is found in the island of Madagascar. The Java sparrow is also known in Africa, but as an introduced bird, and in Zanzibar, Mauritius, and Réunion, just as it has become wild in parts of India, as at Madras and in Tenasserim.

One of the commonest of cage-birds in Europe is the well-known rice-bird, paddy-bird, or Java sparrow (*M. oryzivora*), which has long been domesticated. Latterly, indeed, pure white specimens have been extensively bred in confinement, and have become an article of trade, being valued for their snowy plumage, which harmonises with their pink bills. In Java and other parts of Asia this munia is

regarded as a pest on account of the ravages which it inflicts upon growing fields of rice. The nest is constructed of dry grass or other available materials, and the eggs are white. The adult male has the crown of the head black; the cheeks are pure white; the upper and lower parts, including the wings, are uniform slate grey; the rump and tail are black. Some individuals possess a song of considerable sweetness, but the usual note of this species is commonplace and unattractive.



JAVA SPARROW.

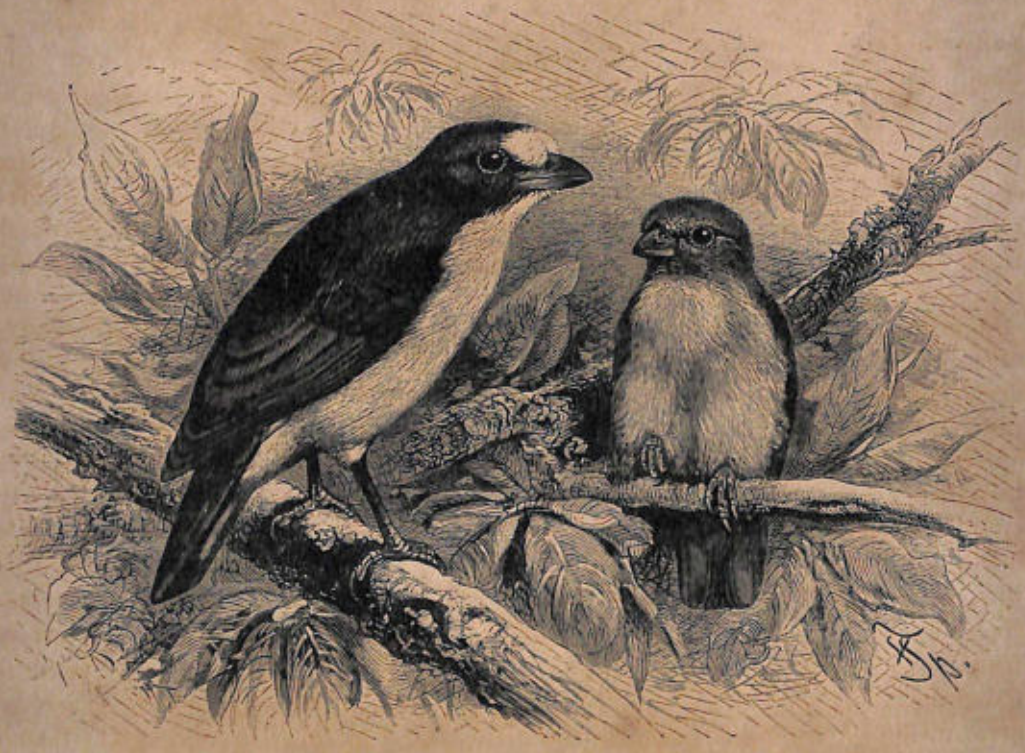
The Blood Weaver-Finches. The last group of the family to which we shall refer is that of the blood weaver-finches. These birds have the tail longer than the wing, the inner secondaries so elongated as to equal the primaries in length, the beak curved, and the nostrils entirely hidden by plumelets. As typically represented by the waxbill weaver-finch (*Estrilda astrilda*), they take their name from the prevalence of scarlet in their coloration, and are naturally confined to Africa and Arabia, although some have been introduced into Madagascar and St. Helena. There are about a dozen species.

* The Tanagers.

Family *Tanagridæ*.

Numerous both as regards species and genera, and brilliant in coloration, the tanagers have been not inaptly described as dentirostral finches, since they possess

a conical, finch-like beak, triangular at the base and notched near the tip. The notch in the beak is, however, scarcely apparent, or obsolete in some of the genera, while in others it is greatly developed. Chiefly remarkable for their gay colours, the tanagers feed much more upon fruits and insects than is the case with the finches, while some members of the group possess vocal powers of a high order. All have but nine primary quills in the wing. Exclusively American, the family is represented by upwards of four hundred species, the majority of which are restricted to the inter-tropical regions of Central and South America, although a few migrate as far north as the United States in summer.



VIOLET TANAGER (nat. size).

Violet Tanager and its Allies. Of the six subfamilies into which the tanagers are divided by Sclater, the violet tanager (*Euphonia violacea*) and its allies constitute the typical representatives of the second. In this group the beak is short, swollen at the base, but not very much broadened; while the hooked upper mandible usually has two or three slight serrations behind the terminal notch. The wings are moderate, with the first three primaries longer than the rest, and nearly equal in length, while both the tail and metatarsus are short. The violet tanager is a lovely little bird, with a rapid flight, frequenting the very tops of the trees in which it dwells, its soft, tuneful note often denoting its presence before the musician itself is seen. The nest of the violet tanager is comparatively large for so small a bird, spherical in shape, built of dry grass, the finer stems of creepers, and tufts of cotton. The interior is lined with tufts of grass. From three to four eggs are laid in a clutch, reddish yellow in colour, spotted with small brown spots. The strain of this

tanager consists of a succession of pleasing notes, softly poured forth and long sustained. The violet tanager is a little gourmand, and feeds eagerly on ripe fruit; preferring soft fruits, such as bananas, and plundering the gardens so eagerly as sometimes to fairly strip a whole tree. It flourishes as a cage-bird if supplied with plenty of room, fed upon an adequate variety of fruits, and kept in a warm room. The latter precaution is necessary, since this bird is susceptible of cold and cannot bear frost. The adult male has the upper-parts violet; the forehead and lower-parts are pure yellow; the tail-feathers are steel blue above, dark beneath. The female lacks the ornamental colours of her partner, being of a dull olive-green above, beneath yellowish grey.

Scarlet Tanagers. The splendid scarlet tanagers belong to the typical subfamily, in which the beak is more lengthened and awl-like than in the last, with a single terminal notch, which may be obsolete; while both the tail and metatarsus are long. Of some two hundred species included in the subfamily, the typical tanagers (*Tanagra*) have the plumage blue and yellow, while in the present genus scarlet generally predominates in the coloration of the males. Writing of the species (*Pyranga rubra*) in the United States, Mr. Nuttall observes that "this splendid and transient resident, accompanying fine weather in all his wanderings, arrives in his winter station in tropical America from the beginning to the middle of May, and extends his migrations probably to Nova Scotia as well as Canada. With the shy, unsocial, and suspicious habits of his gaudy fraternity, he takes up his abode in the deepest recesses of the forest, where, timidly flitting from observation, he darts from tree to tree like a flashing meteor. A gaudy sylph, conscious of his brilliance, and the exposure to which it subjects him, he seems to avoid remark, and is only solicitous to be known to his humble mate, and hid from all beside. He therefore rarely approaches the habitations of men, unless, perhaps, the skirts of the orchard, where he sometimes, however, builds his nest, and takes a taste of the early and inviting though forbidden cherries." The nest is built on the horizontal branch of some shady forest tree, constructed of stems of dry weeds, or slender fir twigs loosely framed together, lined with slender roots and wiry stems, the whole nest being so loosely welded together as to admit the light between the interstices. The eggs are dull blue, spotted with two or three shades of brown or purple. The female scarlet tanager is a devoted parent, and shows great maternal solicitude for the safety of her young. Even the male of this species has been known to follow one of his brood for half a mile, feeding it with insects through the wires of the cage in which it was confined. The scarlet tanager is the "red-bird" of Americans. Unfortunately, its crimson body, contrasting with wings and tail black as night, makes it only too conspicuous an object, the never-failing bait to the greed of the dealer in bird skins. The adult bird is uniform scarlet above, with the wings and tail pure black. The female is far less exposed to danger than her mate, being clear olive-green above, and below greenish yellow, with the wings and tail dusky, glossed with green. Adult males often show abnormal colouring, the body being yellow, orange, or flame colour, or red patches appearing on the wings.

Crimson-Headed Tanager. Another gorgeously-coloured representative of the tanagers is the crimson-headed tanager (*P. ludoviciana*) of the Western United States and Mexico. In Southern Colorado Mr. Henshaw found this tanager in small numbers

among cotton-woods along the streams, at an elevation of about seven thousand five hundred feet, and much more abundantly among the pines, up to nine thousand feet and even ten thousand feet above sea level. He afterwards observed that it was common in Southern Arizona, and found it lingering along the Gila River, even so late as the middle of October, at which time nearly all these birds had migrated southward. As others had done, he noted the close similarity that obtains between this and the scarlet tanager. "It is busy the whole time gleaning from among the pines and spruces the larger beetles and insects which infest them, and generally keeps well up among the higher branches, whence it makes its presence known by occasional bursts of melody." Dr. George Suckley gave the following account of this species:—"The beautiful Louisiana tanager is quite abundant in certain seasons in the vicinity of Fort Steilacoom. In 1854 but a limited number made their appearance, while, on the contrary, in the summer of 1856 I could readily have obtained a hundred specimens. I have had frequent opportunities of studying their habits, and have never yet seen them descend to ground as stated by Nuttall, the reverse being the rule (at least at Paget Sound); the difficulty being generally to find the bird sufficiently low down on fir-tree branches to allow fine shot to reach it with any degree of certainty. . . . The favourite habitat of the species, in those localities where I have observed it, is among the tall, red fir trees belonging to that magnificent species, the *Abies douglasi*. They seemingly prefer the edges of the forest, rarely retiring to its depths unless for concealment when alarmed. In early summer, at Fort Steilacoom, they are generally seen during the middle of the day, sunning themselves in the firs, occasionally darting from one of these trees to another, or to some of the neighbouring white oaks on the prairies. Later in the season they may be seen very actively flying about in quest of insect food for their young. Both sexes during the breeding-season are much less shy; the males during the daytime frequently sitting on some low limb, rendering the scene joyous with their delightful melody." The eggs of this tanager are green, sparingly dotted with very dark purplish brown.

White-Capped Tanager.

One of the loveliest of the family is the white-capped tanager (*Stephanophorus leucocephalus*), a summer visitor to Argentina, where, says Mr. W. H. Hudson, "it makes its appearance in spring in the woods bordering on the Plata River, and is usually seen singly or in pairs. The nest is built in a tree ten or twelve feet from the ground, and is somewhat shallow and lined with soft dry grass. The female lays four eggs, white and spotted with red. During incubation the male sits concealed in the thick foliage close by, amusing itself by the hour with singing, its performance consisting of chattering disconnected notes, uttered in so low a tone as to make one fancy that the bird is merely trying to recall some melody it has forgotten, or endeavouring to construct a new one by jerking out a variety of sounds at random. The bird never gets beyond this unsatisfactory stage, however, and must be admired for its exquisite beauty alone." Azara named this species the "Blue White-Headed Beautiful," and the term was justified, for the entire plumage of both sexes is a lovely deep corn-flower blue, surmounted by a cap of silvery-white feathers; a crimson spot ornamenting the forehead, looking like a drop of blood.

The Honey-Creepers.

Family *Cœrebidæ.*

These birds constitute a small group of some forty species. They are allied to the true warblers, so closely indeed, that some of the latter possess the deeply bifid, pencillate tongue, which was once supposed to be peculiar to the honey-creepers. Unlike the creepers of the Old World, the honey-creepers have soft-



WEST INDIAN HONEY CREEPER OR BANANA-QUIT (⅔ nat. size).

feathered, squared tails. They are almost wholly confined to the tropical parts of South America, only a single species ranging as far north as Florida; but they are most numerously represented in the islands of the West Indian group.

West Indian Honey-Creepers. Among the various genera of the family, we select for notice the West Indian honey-creepers, of which a species (*Certhiola flaveola*) is represented in our illustration. The members of this genus have the beak rather shorter than the head, stout at the base, but tapering rapidly to the extremely acute tip, and the whole bill much curved; the wings are long, but the tail is short and rounded.

Banana-Quit. The habits of this, the figured species, have been best described by Gosse, in his work on the *Birds of Jamaica*. Scarcely larger than the average size of the humming-birds, this little creeper is often seen in company with them, probing the same flowers and for the same purpose, but in a very different manner. "Instead of hovering in front of each blossom, a task for which its short wings would be utterly incompetent, the banana-quit alights on the tree, and proceeds in the most business-like manner to peep into the flowers, hopping actively from twig to twig, and throwing the body into all positions, often clinging by the feet with the back downwards, the better to reach the interior of a blossom, with its curved beak and pencilled tongue. The minute insects which are always found in the interior of flowers are the objects of his search and the reward of its perseverance. Unsuspectingly familiar, these birds often resort to the blossoming shrubs of gardens and yards. A large moringa tree, that is profusely set all the year through with fragrant spikes of bloom, is a favourite resort of both these and the humming-birds. One within a few feet of my window is, while I write this note, being actively scrutinised by two active little creatures, that pursue their examination with a zeal perfectly undisturbed by my looking on, while the same blossoms are rifled on one side by a minute humming-bird, and on the other by that gorgeous butterfly, *Urania sloaneus*—an interesting association. The quit often utters a soft, sibilant note as it peeps about. The nest of this bird is very frequently, perhaps usually, built in those low trees and bushes from whose twigs depend the paper nests of the brown wasps, and in close contiguity with them. The grass-quits are said to manifest the same predilection; it is a singular exercise of instinct, almost of reason, for the object is doubtless the defence afforded by the presence of the formidable insects, but upon what terms the league of amity is contracted between the neighbours I am ignorant. It is in the months of May, June, and July that the creeper performs the business of incubation. On the 4th of May I observed a banana-quit with a bit of silk-cotton in her beak, and on searching found a nest just commenced in a sage-bush. The structure, though but a skeleton, was evidently about to be a dome, and so far was constructed of silk-cotton. Since then I have seen several completed nests. One before me is in the form of a globe, with a small opening below the side. The walls are very thick, composed of dry grass, intermixed irregularly with down." The eggs are greenish white, speckled with reddish at the larger end. In colour the upper-parts of this species are dark brown, with a conspicuous white eyebrow; the breast and the rest of the under-parts being bright yellow.

H. A. MACPHERSON.

[NOTE.—The account of those families to which an asterisk is prefixed has been entirely or in great part written by the EDITOR.]



GROUP OF FINCHES.

1, Hawfinch; 2, Greenfinch; 3, Linnet; 4, Brambling; 5, Chaffinch.

CHAPTER III.

The Perching-Birds,—*continued.*

The Finches.

Family *Fringillidæ.*

The finches comprise a large number of genera of small hard-billed and seed-eating birds, distributed over the northern and temperate regions of both the Eastern and Western Hemispheres, although unknown in Australia. They are characterised by the smooth edges of the mandibles; the doubly laminated hinder-surface of the metatarsus; the presence of nine primary quills of which the first and second are approximately equal in length; while the secondary quills reach about three-quarters the length of the wing. The tail has twelve feathers; the beak is more or less conical in shape, with the nostrils pierced close to the line of the forehead, and near the culmen; and the bristles at the rictus of the gape are few and short. The lower mandible has no backward prolongation behind the quadrate bone. In the nestling the plumage is variable; and the sexes are generally unlike. By Mr. Oates the finches are divided, from the characters of the skull and beak, into three subfamilies, of which the first is

The Grosbeak Group.

Subfamily *Coccothraustinæ.*

A general stoutness of beak is accompanied in this group by marked development in the depth of the lower mandible; many of the species, such as the evening grosbeak of North America, being noticeable for the beauty of their coloration. The members of the grosbeak group are inhabitants of the northern regions of both the Old and New Worlds, and extend as far south as India.

Greenfinches. These birds have the bill moderately stout and rather acute; the distance between the nostrils being equal to the depth of the mandible. Green and yellow predominate in the plumage. The greenfinches inhabit the whole of Europe, as well as North-West Africa, Palestine, and Turkestan; while they are also represented in Eastern Siberia, Japan, and China. The common greenfinch (*Ligurinus chloris*) is fond of gardens and small plantations, especially during the summer, when its monotonous song is heard at intervals throughout the day. It has, however, some soft and plaintive notes which, once heard, will always be remembered with pleasure. Nor is this bird devoid of

imitative talent, becoming excessively tame and confiding, and having been known to reproduce the song of the canary. Yarrell states that the greenfinch is a late breeder, but while fresh eggs may sometimes be found in a nest as late as the month of September, we once saw a newly-fledged greenfinch taking short flights from bough to bough as early as the 19th May. The greenfinch builds a coarse, untidy nest of fibrous roots, moss, and wool, lined with finer roots, horse-hair, and a few feathers. A remarkable combination of two nests of the greenfinch built on a single platform, and placed in a large ornamental heath, is recorded by Gurney. The greenfinch is fond of building in the neighbourhood of water, hence the young birds occasionally tumble out of the nest and are drowned. The eggs are white, spotted with reddish brown and grey. The greenfinch not unfrequently pairs with the canary in confinement; and in a wild state occasionally mates with the goldfinch. The hybrids resulting from the latter cross most resemble the greenfinch in shape and colour, but the head and wings never fail to show the goldfinch blood. The greenfinch also interbreeds with the linnet, and in confinement has produced offspring by pairing with the bullfinch and twite. During the autumn greenfinches range the fields in large flocks, feeding on the seeds of wild mustard and many other pests of the husbandman. The male greenfinch is olive-yellow above, overshaded with ashy grey; the under surface of the body being yellow. The South European form is smaller and brighter than the birds which breed in the British Isles and Northern Europe. Yellow, black, white, and cinnamon varieties of the greenfinch have come under our notice.

Hawfinches. The hawfinches are readily distinguished by their large and clumsy bills, which are adapted to enable them to feed upon hard kernels. Hawfinches are found in suitable localities throughout Europe and Siberia. The Japanese form is paler and lighter in colour than the European (*Coccothraustes vulgaris*); while Hume's hawfinch (*C. humei*) is an Indian species, differing from the European birds in having a lighter and less richly-coloured head, and by the sides of the body being pale tawny or orange-brown instead of vinaceous. The hawfinch is a well-known bird in many parts of Europe, and is locally distributed over England, although rarely visiting Scotland, and uncommon in Ireland. It frequents the skirts of forests, especially where hornbeam flourishes, since it feeds on the seeds of that tree. Seldom seen in open country, it resides in gardens and orchards, especially during the summer months; its flight being rapid and undulating. The male should be seen in bright sunshine, if his beauty of plumage is to be appreciated; the light being admirably adapted to burnish up his deep brown back and blue-black wings. The hawfinch is a shy bird, and seldom courts attention; when alarmed, its first action is to crouch close to the branch upon which it happens to be perching, so as, if possible, to escape unnoticed. Mr. Seebohm remarks that "the hawfinch is not much of a songster. It has few notes, which can scarcely be called more than a low chatter. There is nothing very striking in its performance; but when several are twittering away together the general effect is very pleasant. Its call-note is said to resemble the well-known *zh* of the greenfinch. The hawfinch pairs about the middle of April, and its nest is rarely built before the trees are in full foliage. The site of the nest differs considerably. A favourite place is in the apple or pear-trees in an orchard,

or in an old whitethorn often in quite an exposed situation; and when it breeds in woods it sometimes selects a hornbeam, and less frequently a holly. The hawfinch does not often breed in shrubberies, and its nest is somewhat rarely placed in evergreen trees; but it has been found amongst ivy. It will also breed in tall oak-trees, and occasionally nests in fir-trees and plantations. Sometimes the nest is only a few feet from the ground, while at others it is as much as forty feet. Building is usually commenced by the latter end of April or early in May, and sometimes several nests will be found in the same plantation. The nest is a very beautiful piece of handiwork, similar to that of the bullfinch, on an enlarged scale. The outside is invariably made of twigs, frequently intermixed with lichens, and sometimes with dry plants; and the cup is formed of dry grasses lined with fine roots, and often a little hair. As a rule it is very flat, and somewhat bulky, and the cup is generally shallow and neatly finished. The eggs vary from four to six in number, and are usually laid about the second week in May, sometimes earlier. There are two very distinct types; the usual one is pale olive or bluish green in ground-colour, streaked with dark olive-brown, and having a few spots of the same colour on the surface, and with underlying markings of greyish brown. The second differs in having the ground-colour buff, and the underlying spots more inclined to violet-grey." During the autumn the broods of young hawfinches lead a family life, making frequent inroads into the kitchen gardens to feed upon peas; the pods of which are easily opened by their powerful mandibles. In winter the hawfinch sometimes conquers its shyness sufficiently to approach houses, and even to partake of crumbs thrown upon the lawn; but this is in hard weather, when the birds are driven to extremities. It should be noted that the injuries inflicted on the garden are compensated by the destruction which the hawfinch carries out among noxious insects; its food during the early months of the summer consisting principally of caterpillars. The general colour of the adult male is chocolate-brown above, with a broad collar of ash-grey separating the crown of the head from the mantle; the lower-back, rump, and upper tail-coverts are cinnamon-brown; the wings black, glossed with steel blue at the end of the square-shaped inner primaries and outer secondaries; the primaries have a large spot of white about the middle of the inner web; the tail-feathers are blackish, edged with brown, the outer feathers being tipped with white on the inner web; while the throat is black, and the lower-parts vinaceous brown.

Rose-Breasted Grosbeak, etc. In these birds the bill is very heavy, the lower mandible being as deep as the upper; the wing is longer than the tail, and pointed, the secondaries falling short of the primaries by more than the length of the metatarsus, while the feet are short and stout. These birds are found in North America generally, ranging throughout Central America to Colombia, Ecuador, and the Antilles. The common rose-breasted grosbeak (*Hedymeles virginianus*) is well known in the United States, where it is valued for its handsome plumage and charming song. Dr. Coues gives the following account of its habits:—"I have nowhere found this beautiful bird more abundant than along the Red River of the north, and there may be no locality where its nidification and breeding-habits can be studied to greater advantage. On entering the belt of noble timber that borders the river in June, we are sure

to be saluted with the rich, rolling song of the rose-breasted male; and, as we penetrate into the deeper recesses, pressing through the stubborn luxuriance of vegetation into the little shady glades that the bird loves so well, we may catch a glimpse of the shy and retiring female darting into concealment, disturbed by our approach. She is almost sure to be followed the next moment by her ardent spouse, solicitous for her safety, and bent on reassuring her by his



RED CARDINAL AND ROSE-BREASTED GROSBEAK (⅔ nat. size).

presence and caresses. Sometimes during this month, as we enter a grove of saplings, and glance carefully overhead, we may see the nest placed but a few feet from the ground in the fork of a limb. The female, alarmed, will flutter away stealthily, and we may not catch another glimpse of her nor of her mate, even though we hear them both anxiously consulting together at a little distance. The nest is not such an elegant affair as might be desired; it is in fact bulky and rude, if not actually slovenly. It is formed entirely of the long, slender tortuous stems of woody climbers and similar stout rootlets; the base and outer walls being very

loosely interlaced, the inner more compactly woven, with a tolerably firm brim of circularly disposed fibres. Sometimes there is a little horsehair lining, oftener not. The eggs are of a light and rather pale green colour, profusely speckled with dull reddish brown." The summer range of this grosbeak extends to Labrador. The general colour of the adult male is black above; the lower back and rump being pure white, slightly mottled with black tips; the wings black, with the secondaries tipped with white; the tail-feathers black, the three outer ones marked with white, on the inner web; the crown of the head, lores, the sides of the neck, and throat are black; the fore-neck and chest are beautified with a large patch of rose-colour, extending in a line down the centre of the breast; the breast and flanks are white, the thighs spotted with black; and the under wing-coverts rose-colour. This beautiful dress is only gradually assumed, three years being needed for the assumption of the perfect adult male plumage.

Red Cardinals. The red cardinals have the bill very large and stout, pointed, and conical; the wings very short and rounded, and the tail longer than the wings, and rounded; while a long crest is present. They offer an instance, not very common among birds, of a group in which the males are nearly all alike, so that the specific characters depend upon the females. There can, however, be no doubt about the differences in the latter; although the males differ from one another mainly in intensity of colour, and to a slight extent in sizes. The most brilliant forms appear to be those from tropical localities. These birds are found in the United States, ranging south into Mexico and British Honduras. One of the best known of North American birds is the common red cardinal, or Virginian nightingale (*Cardinalis virginianus*). Dr. Coues says that this cardinal inhabits by choice, thickets, tangle, and undergrowth of all kinds, whence issue its rich, rolling, whistling notes, while the performer, brightly clad as he is, often eludes observation by his shyness, vigilance, and activity. The nest, built loosely of bark-strips, twigs, leaves, and grasses, is placed in a bush-vine or low, thick tree; and in this the cardinal lays rather a peculiar egg, some specimens recalling those of a night-hawk's, in coloration at least, while others are more like those of the rose-breasted grosbeak in the pattern of markings. While the ground-colour was white in all of about fifty cases noticed, the spotting is of every shade of brown, from pale reddish to heavy chocolate; but it is usually rather dark, and there is a great show of the various purplish brown or stone-grey markings. The typical form of the Virginian nightingale ranges westward from the Eastern United States to Kansas, Nebraska, the Indian Territory, and Texas; where it may be either stationary or slightly migratory. A smaller form is found in Eastern Mexico, which is a deeper red, being of a rich rosy scarlet. The Californian form has a larger bill than the type, and is rather smaller in size; the black mask on the face not being continued across the forehead. From Western Mexico there comes a form similar to the last, but smaller, and of a much more rosy red, the crest feathers being elongated and stiffened. The adult male of the typical form is deep scarlet-vermilion, or rosy-red above, with the forehead, chin, and upper throat black; the wings dusky, externally rosy, and the under surface rich vermilion. The female is dull ochreous brown above; the long, crested feathers, wings, and tail being dull vermilion, and the under-parts buff, washed with vermilion.

The True Finches.

Subfamily *Fringillinæ*.

The true finches are distinguished from the grosbeak group by their less powerful bills, and different cranial characters; and although their bills are variously modified to meet their manner of life, on the whole they possess many common characteristics. They are found principally in temperate climates.

The Chaffinches. Chaffinches possess a rather long and slender bill, conical in shape; and the wings are furnished with a first primary so small as to seem wanting, the rest of these feathers varying in their comparative length. The tail is moderately long and decidedly forked. These finches inhabit Europe generally, as well as Western Siberia, Persia, Turkestan, Madeira, and the Canaries and Azores.

Common Chaffinch. The common chaffinch (*Fringilla cœlebs*), is abundant in most parts of Europe, being in some districts even more plentiful than the house-sparrow. In the British Isles, as on the Continent, it is a general favourite, nesting in close proximity to dwelling-houses, and rearing its young almost under the windows. During the winter, chaffinches consort in large flocks, which break up at the close of the cold weather, when their familiar notes enliven groves and orchards with their melody. In early spring the chaffinch begins to pair, when the male birds are no longer tolerant of the society of their fellows, but exhibit a high degree of jealousy towards their rivals. Even in the middle of June we have seen cock-birds engaged in combat, although such contests usually precede the nesting-season. The chaffinch builds its nest in a fruit-tree or tall hedgerow; and we recollect one nest built on the trunk of a large tree, which looked as if it had been placed there by accident rather than by design, so exactly did its grey trimming harmonise with the colour of the bark. Mr. Gray remarks that the chaffinch "varies the structure of its nest according to the locality which it happens to frequent. In rural places, away from the dust and smoke prevailing near cities and large towns, the nest is a perfect model in its way for neatness and compactness of form; but in less favourable situations, where the building materials are not so fresh, it is slovenly and untidy. Any large series of nests gives ample proof of this, some being composed entirely of moss closely interwoven, others of lichens laced all over with spiders' webs, while those obtained in the outskirts of Glasgow are built of dirty straws, pieces of paper, and bits of blackened moss intermixed." Mr. Dresser describes a nest which he took in Finland as being of the most artistic structure. It was placed upon a birch-tree, and neatly ornamented with pieces of yellow and grey lichens and small bits of birch-bark, so as to resemble a portion of the tree itself; and was finally most carefully lined with soft moss and bits of down and wool, through which some fine roots showed every here and there. A remarkable nest found in Denmark was decorated all over the outside with small pieces of newspaper. The eggs of the chaffinch are generally purplish grey in ground-colour, washed with green, and blotched and spotted with dark red; but we have seen perfectly blue, unspotted eggs, although this variety is rare. The chaffinch feeds during the spring and summer months principally upon insects, and we have watched a male chaffinch gathering aphides from off the

under surface of the leaves of some beeches, clinging head downwards like a tomtit. A trait noticed in a village on the Rhine was that the chaffinches to a large extent deserted the shelter of the trees when singing, preferring at such times to occupy a more conspicuous position upon some cottage roof, or the gable of a barn. The chaffinch is to a large extent a bird of passage, moving from one part of the country to another, according to the supply of food and the condition of the weather. In the breeding-season isolated pairs of chaffinches may be found nesting in localities little adapted by natural circumstances to afford them a home, as, for example, when a pair of these birds elect to take up their summer quarters beside some northern farm where they have to perch upon the stone walls in default of timber; but the chaffinch is a bird of resource, and if hard pressed will even nest upon the ground. The young birds frequently associate together as early as the middle of July, the sexes then being hardly distinguishable. The chaffinch is a fairly early nester; and we have known the young to fly as early as the 19th of May even in the West Highlands, although they do not usually hatch before the last days of that month. On the Continent we have found the chaffinch plentiful on mountain-ranges of moderate elevation, as in Central France and the Black Forest. In Switzerland it is a common bird about the summer châlets, descending into the plains before severe weather sets in. The chaffinch is subject to considerable variation of plumage; and some few years ago we saw an entirely yellow specimen, which was identified by the discovery of a tiny patch of pink feathers on the breast. We have also seen others of a uniform bright yellow, and others again of a very light cinnamon. The male in summer has the mantle, back, and scapulars, chestnut-brown, the wing-coverts white, or black tipped with white; the quills black margined with pale olive-yellow; the inner primaries white at the base, forming a speculum; the secondaries white at the base, forming a band with white tips to the grey coverts; forehead black, the crown slaty blue, the chin and breast pale vinous red, and the lower-parts vinous white. The female is ashy brown above washed with olive-yellow, the wings being conspicuously pied with white, and the lower-parts are ashy brown.

Teydean Chaffinch. This chaffinch (*F. teydea*) is peculiar to Teneriffe, inhabiting the dreary heights of the Peak and surrounding plateaux. It frequents the pine-forests, feeding on the seeds of the pines, and breaking the cone with its powerful beak in order to get at its contents. The note of this bird is plaintive and often repeated, and bears some resemblance to that of the serin finch. A somewhat rare species, and only occurring on the lower grounds when driven by a heavy fall of snow from its usual haunts, this chaffinch is known to the goat-herds, tending their flocks in the highest parts of the mountain. The adult male has the entire upper-parts rich dark blue; the wings and tail black, edged with slate blue; and the under-parts blue, fading into dull white on the abdomen. In the female bird, the blue garb of the male is replaced by dull greyish brown.

Brambling. The brambling (*F. montifringilla*) is one of the characteristic birds of the northern parts of the Old World, nesting in the forest-regions of the Arctic circles, whence it journeys to winter in Southern Europe, Persia, and even India. In Siberia, Dr. Radde states that "the brambling remains occasionally during the summer and breeds there. On the 16th May 1859 I found

it not far from Tunkinsk; and on the 14th July 1855 I met with a family of them a few versts above the village of Kotchirikowa, the young birds of which were fledged. The male then killed was in moult, the crown being almost featherless. Only a few visit the high steppes of Dauria in spring; thus, for instance, a male was shot in the hedge of the kitchen garden at Kulssutayefsk; on the other hand they were numerous during the autumn migration at the Tarei-Nor. On the 15th of August I saw only a few males, on the 16th only a female; and on the 26th large flocks, consisting of young birds of both sexes, arrived. On the 30th they increased in numbers and frequented the neighbourhood of the kitchen garden. Later, when the night frosts set in, they took refuge at night in the high reeds which grow round the ponds. Here they remained till the 11th of September; but then the large flocks were wanting, and I only saw stragglers up to the 15th of September."



BRAMBLING.

Usually the brambling lays a larger number of eggs than any other of the finches, seldom less than six and more generally seven; and when compelled to leave its nest to seek food, or for any other purpose, the bird is in the habit of covering its eggs, which are laid late in May or early in June. According to Mr. Collett the brambling generally builds in a birch or spruce close to the main stem, and about six or seven yards from the ground. The nest is constructed like that of the chaffinch, but generally more of moss. The eggs closely resemble those of the chaffinch; but in the latter the general colour is greyish brown, not greyish blue, and the spots are smaller. Gould states that all the nests which he observed were composed of green mosses and fine, dried grass, interwoven with cobwebs and externally decorated with flat pieces of white lichen and thin threads of birch bark. They were lined with fine wool and some feathers of the white grouse; but we have seen quite a variety of feathers in the nests of these birds, including those of the nutcracker. During the autumn considerable numbers of bramblings cross the North Sea to winter in the British Isles; their arrival being usually heralded by the reiteration of their harsh call-note. They frequent stubble-fields and farm-yards in common with chaffinches, greenfinches, and sparrows, but prefer to subsist upon beech-mast. The adult male in breeding-plumage has the general colour above blue-black, with generally a few sandy margins to the feathers; the lower back and rump being white, the wing-coverts orange-rufous, tipped with white; the wing-quills black, the primaries being edged with pale yellow, and the inner ones white at the base forming a speculum, the tail-feathers are black, with the outer pair broadly white for more than half the outer web; the crown and sides of the face are black; the throat and breast pale orange-rufous, and the flanks spotted with black.

The Siskins. This group comprehends a number of small finches, characterised by the possession of a long and acute bill, long wings, and a short, deeply-forked tail; green and yellow predominating in their plumage. All are highly gregarious in habits. They belong to both the Old and New Worlds, having representatives in Abyssinia, the Himalaya, Siberia, the United States, and especially South America, where several species are found in Chili, Bolivia, Ecuador, and other parts of that continent.

American Siskin. One of the most charming birds of the United States is the yellow-bird or American siskin (*Chrysomitris tristis*), which is also common in many parts of Canada. It is a lively, graceful species, full of vivacity, and leads a social life, roving about in small communities. Even in the breeding-season these birds are partial to the company of their fellows, and fly in flocks between their nests and their favourite feeding-grounds, where they consume the seeds of various wild plants. The nest is small and compact, built of soft, downy substances. The eggs are white, with a rosy blush when fresh. After the breeding-season, the family parties unite permanently, and rove over the prairies in search of weedy places where they can find subsistence. The adult male in summer is bright golden yellow above and below; the crown and wings being black, the great coverts tipped with white; and the tail black spotted with white. In September the general plumage changes to pale flaxen brown above, and whitish brown below.

Common Siskin. From Japan to the British Isles the common siskin (*C. spinus*) is found in suitable localities, breeding chiefly in the northern part of its range. During the breeding-season the cock-birds are restless and lively, singing nearly all day, generally while on the wing, and sending their joyous call-notes ringing through the air. The nest is very like that of the goldfinch, although not so neat; the one example that has come under our notice having been placed in a fir-tree about twelve feet from the ground. Although only occasionally nesting in England, the siskin breeds regularly in Scotland; and it has been recorded as breeding in Ireland. In winter it frequents alder groves, living in flocks, and searching the catkins for their seeds; and we have also seen it feeding on thistle-heads and the seeds of wild grasses. It occasionally interpairs with the lesser redpoll and goldfinch in confinement. The general colour of the male siskin is yellowish green above, the rump being bright yellow; the quills are blackish, the primaries being edged with bright yellow; the tail-feathers are blackish, edged with yellow, and all but the central feathers yellow at the base; the chin is black, and the throat and breast are bright yellow.

Citril Finch. A less well-known member of the siskin group is the citril finch (*C. citrinella*), which is an inhabitant of the Tyrol, many parts of Switzerland, Greece, and other districts in the south of Europe. Avoiding the plains, this bird generally nests among pine-forests, as far as possible from human habitations. In the Jura, Mr. Scott Wilson states that after some search his party at length discovered a nest of this finch "placed high up in a spruce-fir, at the extreme end of a branch. The *chasseur* climbed up, and brought down the nest with three eggs. This nest, which contained several feathers of the nutcracker, was cup-shaped, and constructed chiefly of dry grass stems, moss, and thistle-down,

woven together with fine roots and hair, lined with thistle-down and feathers. Another nest contained no feathers, being lined entirely with thistle-down. A third was lined entirely with hair, and very little thistle-down had been used in its construction." The eggs are greenish blue in ground-colour, speckled with reddish grey and blood-red. The citril finch is a favourite among continental bird fanciers, being easily tamed, and occasionally hybridising with other finches in captivity. Although it passes the summer among the mountain forests, it



CITRIL FINCH, SNOW-FINCH, AND LESSER REDPOLL (½ nat. size).

descends from the higher grounds during severe weather. It is valued as a cage-bird, principally because it possesses a loud, pleasant song, sometimes compared to that of the canary. The adult male in breeding-plumage has the general colour above dull olive-green, with dusky shaft-streaks to the feathers; the rump and upper tail-coverts being brighter yellow; the nape and sides of the throat are ashy grey; the wings and tail dusky brown, edged with ashy yellow; and the crown of the head, as well as the feathers round the eye, the fore-part of the cheeks, and the throat and chest olive-yellow.

Linnets. The linnets have a hard and conical bill, a somewhat pointed wing, the tail rather long and forked, the metatarsus short, and the toes stout. They are also characterised by the possession of a nearly uniform brown or whitish brown plumage, generally associated to some small extent with pale crimson. Chiefly found in the northern parts of the Old World, they are also represented in the Arctic portions of North America.

Common Linnet. The common linnet (*Linaria cannabina*) inhabits most parts of Europe, being generally common from Spain eastwards to Central Asia, although assuming brighter plumage in Turkestan and other distant parts of its range. The linnet in England frequents commons covered with gorse, in which its nest is often placed; but sometimes it nests in a hedge or small tree. Generally an early breeder, we have seen the young in the nest as late as the month of August. It builds a loose, untidy nest of fine twigs and fibres lined with hair, wool, and sometimes a few feathers, in which it lays from four to six eggs of a greenish-white ground-colour, blotched with red. After the breeding-season linnets range through the fields in vast flocks, often composed of one sex almost exclusively. As autumn advances, many of the linnets that have been bred in the English woodlands cross the sea to other countries; while others again join company with bands of greenfinches in search of food. The linnet is frequently white or pied, but the most beautiful variety is of a cinnamon-brown which harmonises with the rose-coloured breast. The male linnet is warm reddish brown above; the forehead, fore-neck, and chest, being crimson; and the breast and under-parts dull buffy white.

Lesser Redpoll. By some ornithologists the lesser redpoll (*L. rufescens*) is regarded as a variety of the mealy redpoll of Northern Europe, the former bird being chiefly confined as a breeding species to the British Isles and certain parts of the Alps, though it has also nested on the island of Heligoland. The lesser redpoll is an early breeder, selecting a variety of trees to contain its nest, including alder, hazel, crab, birch, willow, and walnut; as many as five nests having been seen at once in a single hawthorn hedge. The height from the ground at which the nest is placed varies from four to twenty feet; and the composition of the nest also varies, the exterior generally consisting of moss and dried grass, with a lining of beautiful down from the catkin of the willow; but we have seen nests composed of dead fir twigs, and others built of hawthorn stems. The nest is often lined with fine grass and hairs, together with a few feathers; but one was composed exclusively of cotton-waste.

Much less liable to exhibit white or pied phases of plumage than the linnet, the lesser redpoll is occasionally of a nearly uniform cinnamon-brown. In captivity it interbreeds with the canary, but the offspring of this cross are small and insignificant brown birds, devoid of the fine musical powers which most canary males possess. The typical redpoll is light brown above, with dark centres to the feathers; the forehead being dark crimson, while the throat and breast are suffused with rosy pink, especially in the breeding-season. The small insular form of redpoll, which for many years was supposed to breed only in Great Britain, differs from the former bird in being smaller and of a more reddish colour. The sexes are generally alike, but the female does not assume the rosy tint upon the breast.

Snow-Finches. The snow-finches form a small group possessing the characteristic form of the true finches, but with the long wings falling short of the tail by less than the length of the metatarsus. Chocolate or reddish brown appears to predominate in the plumage of this group, often associated with rose-colour, but the type of the genus is conspicuously pied with white. Snow-finches are chiefly found in the mountains of Central Asia, but some species range over the northern parts of Siberia, Japan, and Northern China. The best known is the common snow-finch, of the mountains of Southern Europe, and ranging eastwards to Palestine, but replaced in Persia, Turkestan, and Afghanistan by the eastern snow-finch.

Common Snow-Finch. The common snow-finch (*Montifringilla nivalis*) breeds in the highest regions of the mountain ranges of Central Europe, adapting its habits to the desolate regions in which it passes the summer; and we owe to Mr. Scott Wilson the following account of its habits. "It was observed at a greater height than any other Alpine bird. At the foot of the Lammern glacier, seven thousand six hundred feet, we found it breeding at the summit of the Furka Pass, as well as at the Gemmi. It lays about the end of May or the beginning of June, at a time when the ground in these Alpine regions is entirely covered with snow; from which cause I suppose it is obliged to place its nest under the roofs of buildings, or, where there are no buildings, in rocks which do not hold the snow, the former not only affording them a dry nesting-place, but one which also protects the nest from the storms of snow and sleet, which have by no means ceased to fall by the end of May. A nest obtained on the Furka is principally made of dry grass-stalks, intermingled with which are tufts of hair, wool, leaves, shavings of wood, and a few feathers. The inside walls are lined with ptarmigan's feathers, both white and brown, these being woven together very compactly with horsehair, and in a nest before me also with strands of green worsted. The bottom of the nest is not lined with feathers. The outside diameter, which is nearly round, is 8¼ inches; the inside diameter 3½ inches; thus the inside cup is small in proportion. The eggs are pure white, and from three to five in number." Mr. Wilson adds that the snow-finches in winter descend from the Alpine regions to the lower valleys. The snow-finch is a beautiful bird, rather larger than the greenfinch or sparrow, with long wings, in which the primary quill-feathers are much longer than the rest, as in some other birds of airy and graceful flight. The strong contrast of jet-black and purest white in the plumage, notably in the tail, which has two black feathers in the middle, while the rest are as white as snow, makes the bird conspicuous at a long distance, and a more striking object than the browner snow-bunting, which occasionally strays from the north to the Alps. There are few more beautiful sights than the wheelings and whirlings of a flock of snow-finches, with their white feathers glistening in the sun one moment, while the next their black ones will show clear against the snow. The adult snow-finch has the upper-parts brown, with light edgings to the feathers; the hind-neck and sides of the neck are ashy grey; the wings and tail are black and white, some of the feathers being edged with brown; while the lower-parts are white throughout.

Desert-Finches. This group has been founded to contain the palest forms of the rose-finches, the only two species known being inhabitants of desert



DESERT FINCH AND DESERT LARK.

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DESERT FINCH AND DESERT LARK.

countries. The bill is short and much arched, with both mandibles much curved. The wings are very long, reaching within a third of an inch of the end of the tail, when closed, and the metatarsus is comparatively long. The plumage of both sexes in this genus is grey or brown, suffused with pink. The desert-finch (*Erythrospiza githaginea*), the western representative of the genus, is found in the Canaries, the Sahara, and Egypt, extending eastwards through Afghanistan and Baluchistan to the Punjab, while the Mongolian desert-finch (*E. mongolica*) inhabits the deserts of Central Asia, extending its range eastwards into Western China.

The common desert-finch is an inhabitant of the most sterile regions. Its habits in the Canaries have been described by Dr. Bolle, who writes that "it is always



DESERT-FINCH (⅔ nat. size).

found in sociable little groups, when the cares of the breeding-season do not keep it solitary. The cheerful little bird dances from stone to stone, or glides about near the ground; but seldom can our sight follow it far into the landscape, for the reddish-grey feathers of the old bird mix closely with the colours of the stones and leafless stems and twigs of euphorbia, as the buff of the young does with the pale yellow of the sand or chalk. We should lose it if its voice, which is one of its most striking peculiarities, did not guide us to it. Listen! A note like that of a small trumpet trembles through the air and vibrates continuously; and if we are very attentive, we shall hear, just before and just after it, two gentle, light notes,

ringing like silver bells through the still desert, or the almost imperceptible chords of an harmonium played by unseen hands. Again it changes, and this time its notes resemble the deep croak of the green frog of the Canaries, but less coarse, hastily repeated one after another. . . . The desert-finch does not appear frequently on the steep, rocky hills. . . . It is much more partial to the black lava-streams of the desert, which, full of gaping rents and chasms, hardly permits a blade of grass to become green. They feed entirely or almost so on the seeds either of grasses, which are found like a mealy kind of bread in their stomachs when killed, or the oily seeds of composite and cruciferous plants, which they shell, like other finches, by moving them most carefully backwards and forwards between the mandibles of their strong beaks." This bird will also eat tender young leaves, Mr. Hume having observed it in Sind feeding in desert places in patches of mustard and other cultivation. It cannot long dispense with water, and must often fly some miles daily to get it; and the presence of these finches in the desert is always a good omen for the thirsty traveller. "I have constantly seen them," continues our author, "fly to drink in flocks. They drink much at a time in long draughts, between which they lift up their heads. After drinking they are very fond of bathing. I have never seen them roll about in the dust like sparrows. The breeding-time begins in March, and like those of most true desert-birds the nest is well concealed, and with such foresight that it can hardly ever be found. . . . I know, however, from the goat-herds of Fuertaventura, that the moras, as they are called there, build in crevices under large overhanging stones upon the ground. The nest has a tolerably strong texture, and is woven with the coarse straws of the desert-grass and lined within with great feathers, mostly of the ostrich and bustard, as well as the wool of the camel and hair of the goat. The number of eggs is from three to five. . . . They are rather large for the bird, pale sea-green, or lighter, with small spots and points of reddish brown. These finches certainly breed twice, if not more frequently. The second moult takes place in July." The desert-finch occasionally strays from its southern home into the Mediterranean region. The adult male in the breeding-season has the upper plumage, including the crown, ashy grey; the forehead, cheeks, rump, and all the lower plumage of a beautiful rose-pink; and the wings and tail brown, edged with rose-pink. The female is similar, but with all her tints duller.

Rock-Sparrows. The members of this group resemble the typical sparrows in structure and habits, but differ in having a much stronger bill and longer wings. Unlike the true sparrows, the female rock-sparrows have however, no distinctive plumage of their own, but resemble more or less closely the male birds of their own species. The rock-sparrows are found in Southern Europe, extending into Central Europe, and ranging eastwards into Central Asia and Siberia, as well as Northern China. One species is found in India as a winter visitor, while two are resident in Africa.

The European rock-sparrow (*Petronia stulta*) is found in some districts of Spain and Portugal, and the South of France, as well as in Greece and Palestine. Its habits resemble those of the common sparrow; but it is generally a very shy bird, flying away on the approach of danger, and constantly keeping a good lookout. It nests in the ruins of old castles and crevices of the rocks, building a

large, untidy nest, composed of stems of grass and plant fibres, lined with hair, feathers, and other materials. It lays two or three eggs in a clutch, white in ground-colour, streaked and spotted with ash-grey and brown. The parents wait assiduously upon the young, and manifest the greatest distress if the safety of their progeny be endangered. In autumn they gather into flocks, and some migrate from their higher breeding-grounds. The flight of this bird is rapid



ROCK-SPARROW, SPANISH SPARROW, TREE-SPARROW, AND HOUSE-SPARROW (½ nat. size).

and well sustained; and the usual note a harsh chirrup. Although partial to fruit, the rock-sparrow feeds principally upon insects during the summer months, visiting the stubble-fields in autumn. Upon the approach of winter, rock-sparrows often consort with other small birds, in the company of which they frequent the roads and even villages. The general colour of the male is brown above; the mantle and back being broadly streaked with black, and having a whitish brown spot at the tip of the outer webs of the feathers; while the crown

is light brown in the centre, bordered with dark brown, and followed by a broad whitish brown eyebrow; the wings and tail are blackish brown; the cheeks, throat, and under surfaces pale ashy brown; and the lower throat varied with a patch of pale yellow.

True Sparrows. The genus *Passer* contains the true sparrows, which are represented over the greater part of the Old World; and, as restricted by Mr. Oates, are characterised by both sexes exhibiting a peculiar pattern upon the outer webs of the first primaries. The bill is stout and short, and the abbreviated wings fall short of the tail by more than the length of the metatarsus. Originally absent from the New World, the true sparrows have been introduced into the United States, where they have become a serious pest, their injurious character becoming more and more appreciated as the species spreads; they are indigenous to the greater part of the Old World, excepting Australia and the Moluccan Islands.

House-Sparrow. The house-sparrow (*P. domesticus*), which nests only too numerously in many country districts, is essentially a dweller among men. With the members of its earlier brood ready to leave the nest in May, it produces many broods in the season, sometimes evicting the house-martin from its mud-plastered home, though occasionally the troublesome intruder is walled up by the irate martins. The eggs of the house-sparrow are greenish white in ground-colour, blotched or spotted with ashy grey and dusky brown. When the young are hatched, the old birds redouble their diligence in procuring food. It is generally supposed that sparrows feed largely upon insects, and there is no doubt that in many districts this is the case for a considerable part of the year. In autumn these birds band together in flocks, and, leaving their haunts in street and alley, join their country brethren in anticipating the farmer's harvest. Few persons but practical men are at all aware of the vast injury annually inflicted upon the farming community by the hordes of sparrows which ravage the corn-fields. Nor is their mischief limited to assailing standing crops of grain. On the contrary, they inflict considerable injury upon gardeners by picking up freshly-sown seeds of every kind. They destroy green peas quite as effectually as the hawfinch, and are in many other respects most undesirable neighbours. In America the influence of the house-sparrow has already proved disastrous to many of the indigenous birds, which have been driven from their proper haunts by the intruder. Even in remote districts of the Highlands of Scotland, the sparrow is gaining ground every year, and taking the place of more welcome guests. The sparrow builds a cumbrous nest of straw, hay, dry grass, rags, or any other material that comes handy; the nest being often placed in a waterspout, a chink of a wall, the thatch of a barn, or the frieze of a building. Occasionally it is placed in an open tree or hedgerow, but the nest is then domed as a protection against the weather; and it is almost always profusely lined with feathers. Taking great pains to maintain its plumage in good condition, the sparrow not only indulges in frequent baths, like most of the finch tribe, but in summer shows a partiality for dusting its feathers in lark fashion. Sparrows exhibit some pretty variations of plumage; all the birds in a brood being occasionally spotted with white, or at any rate cream-coloured; male birds in particular being frequently variegated

with white, which most affects the quill-feathers. The adult cock in summer has the plumage of the upper-parts chestnut, streaked with black on the mantle and back; the primaries being blackish, edged with pale rufous; the median coverts black, tipped with white, forming a wing-bar; the tail-feathers dusky brown; the crown of the head and nape ashy grey; a broad streak of chestnut extending downwards from the upper-parts of the eye; the cheeks ashy white; the throat and fore-neck black; the sides of the breast brownish ash; and the under-parts white. The female is a dull brown bird, lacking the black gorget of the other sex.

Tree-Sparrow. The haunts of the tree-sparrow (*P. montanus*) are more remote from human dwellings than are those of its congener the house-sparrow. Sometimes, it is true, a pair or two of tree-sparrows may take up their abode in some old wall beside a cottage or farmhouse; but trees are their favourite resorts. Not unfrequently the tree-sparrows build under old nests of rooks; the nest being not so bulky or untidy as that of the house-sparrow. The eggs are bluish white in ground-colour, blotched and spotted or suffused with hair-brown. Sometimes tree-sparrows nest in the crevices of a chalk cliff; and a colony has been found established under the iron girder of a railway bridge. The movements of the tree-sparrow are more graceful than those of the common bird, from which it can also be distinguished by its more musical and shriller chirp; while, unlike the house-sparrow, the tree-sparrow possesses a short but pleasing song. Far more shy than the house-sparrow, the tree-sparrow, instead of courting observation, shuns publicity; and its flight is more rapid than that of its cousin. On one or two occasions we have seen the two species consorting together; and we have observed the tree-sparrows flying with flocks of greenfinches during the autumn migration. The majority of those we have seen in confinement seemed too wild to give their confidence readily to any human being; but a male of this species, caught in the month of February, lost its dread of man in a very few weeks, and sang freely in a cage. Although, as already said, the house-sparrow is so subject to variations of plumage, we never yet met with a white or pied specimen of the tree-sparrow. The adult is fawn-coloured above, the feathers of the mantle having ashy edgings and broad black streaks; while the lesser wing-coverts are uniform chestnut; the medium wing-coverts black, with broad white tips forming a wing-bar; the chin black; the cheeks white, spotted with black; and the under-parts ashy.

Spanish Sparrow. The Spanish sparrow (*P. hispaniolensis*) replaces the English bird in many parts of the Mediterranean region, including Sardinia, Corsica, Sicily, and Malta, nesting in the walls of houses and the crevices of rocks. It is abundant in Algeria, especially amongst the reeds in the salt-marshes; and Mr. O. Salvin gives the following notes upon its habits in the Atlas, observing that it "is found in great numbers during the breeding-season among the tamarisk thickets on the Chemoria and in the high sedge at Zana. The Arabs destroy the eggs, nest, and young wherever they find them, as their great numbers do much damage to the crops of corn. The nests are placed as thickly as they can stand, the whole colony, consisting of perhaps one hundred pairs, occupying only five or six trees. The noise and ceaseless chattering proceeding from one of these sparrow-towns can easily be imagined; and, guided by the sound alone, one may walk directly to the spot for a considerable distance. One Sunday morning four

Arabs came to our tent, and, gravely sitting down in a row, opened the hoods of their burnouses and displayed eight hundred or a thousand sparrow eggs, which they arranged in four heaps before them, and remained in their sitting posture contemplating them with evident satisfaction. We were rather taken by surprise, but reserved the best for our collections, leaving the rest for omelettes." The egg of the Spanish sparrow is somewhat smaller than that of the house-sparrow, white in ground-colour, blotched and streaked with dark grey. The male has the crown and nape dark chestnut; the back black, streaked with cream-colour; the cheeks and eye-stripe pure white; the lesser wing-coverts chestnut, tipped with white; and the throat and upper breast deep black. The female is dull brown.

Cape Sparrow. A well-known bird in many parts of South Africa is the Cape sparrow (*P. diffusus*), which takes up its abode near dwelling-houses, and reproduces exactly the habits of the European house-sparrow. In some districts the Cape sparrows build their nests in low, thorny bushes; but they are equally partial to holes in walls and the caves of thatched roofs. The nest is a large structure loosely put together, consisting of sticks, straws, and feathers lined with wool; the eggs being light green in ground-colour, blotched with brown. Having all the pert ways of its European relative, the Cape sparrow is partial to corn, but also consumes many insects. The adult male has the crown, throat, and breast black; the back of the head and neck brown; the back and rump rufous; a white eye-stripe running backwards from above the eye; the wings and tail brown; and the lower-parts dirty white.

Serin Finches. The type of this small group of little finches possesses a short, hard, conical bill, with the upper mandible slightly exceeding the lower; the wings being moderate in length and the tail rather deeply forked. The metatarsus is slender, and scutellate in front, while the toes are small. Yellow usually predominates in the plumage of the serins; the females generally having the flanks much striated with dark brown. Of the nineteen species of serins, sixteen are peculiar to Africa; and of these the greater number are found in the southern portions of that continent.

The serin finch, which forms the type, ranges through Central and Southern Europe to Asia Minor, Palestine, and Egypt; Tristram's serin inhabits Palestine; while the red-fronted serin is found in the Caucasus and Turkestan. The true serin finch (*Serinus hortulanus*) is partial to orchards and gardens, and is a bright vivacious bird, often to be seen upon the wing, indulging in irregular flights, trilling all the time. Wintering in the southern quarters of that continent and in North Africa, it is a summer visitor to Central Europe. Its nest is a neat structure, generally placed at the extremity of a bough, composed of vegetable fibres, moss, and fine stems, lined with feathers and sometimes a little horsehair. Generally preferring fruit-trees to the beech, oak, or alder, we have seen it nesting in fir-trees in walled gardens. Mr. Dresser gives the following account of its breeding-habits, observing that "the serin finch inhabits the foot of the mountains skirting the plains, but does not appear to affect the plains themselves; nor is it found in the mountains, being there replaced by the citril finch. It is usually to be met with in the orchards and gardens and in the vineyards, frequently in gardens which are surrounded by houses, in which last

locality it is tolerably tame,—though, so far as my own experience goes, it is very shy and difficult of approach. During the fortnight I spent at Staufen, I never got within range of one outside the town, though on several occasions I saw and heard it. In the town itself I several times saw specimens; but as they doubtless had nests in the neighbourhood, and as, besides, it would not well do to shoot in the town, I did not obtain a specimen. It may easily be recognised by its call-note and flight. The former somewhat resembles that of the canary, but may easily be distinguished by anyone who has heard it. Its song is poor, and lacks both depth and melody, being merely a continuous twittering warble, generally uttered, it would seem, as the bird is seated on the topmost spray of some tree, usually a fruit-



SERIN AND RED-FRONTED FINCHES ($\frac{1}{2}$ nat. size).

tree. Its flight is exceedingly swift, and may not inaptly be compared to that of a sand-martin, which it far more nearly resembles than that of any other finch. It sometimes sings whilst on the wing; that is, it will fly up from the spray on which it has been seated like a tree-pipit, and will continue its song during the short time it is in the air. It feeds chiefly on seeds of various kinds—at least, all those I have at different times shot, and the contents of whose stomachs I examined, had been feeding on these alone—grass-seeds and those of the various wild plants and weeds, chiefly such as are oily; and it appears always to shell the seeds and discard the husks before swallowing them. It seeks after food in fields, gardens, and especially in the vineyards, in which last it is usually to be found. The nest is a very neat, compact, little structure, very carefully made, and neatly shaped. It is built of fine roots and grass-bents, and neatly lined with feathers and horsehair. The

outer portion of the nest appears to be interwoven with spiders' webs; and a few bits of lichen and grey moss are affixed here and there. A nest in the possession of Mr. Carl Sachse, taken near Frankfort, is built in the fork between three upright small branches of a lilac tree, and is constructed entirely of fine grass-stems and rootlets, intermixed with cotton and woollen threads. These latter are utilised more especially to bind the structure to the branches, which is most effectually and strongly done, one of the branches being encircled at least a dozen times with a long piece of tolerably stout, woollen thread. The lining consists merely of somewhat finer grass stems than those used in the construction of the exterior portion." The eggs vary from four to five in number, and are blotched with dark reddish brown. When migrating in the north of Spain, these birds do not seem to travel in large flocks, but rather in small parties, sometimes even singly, though the



THE CANARY (⅔ nat. size).

latter were presumably only stragglers from the main detachment of the migrating host. The serin finch bulks considerably amongst the small birds netted in the environs of Paris; and occasionally it even straggles to the south coast of Great Britain, where it has been taken on the southern shores on a good many occasions, especially in the neighbourhood of Brighton; its visits to Britain generally taking place in the spring of the year. The plumage of the male serin finch is pale brown above, with dark centres to the feathers; the forehead and nape being yellow; the lower back and rump bright yellow; the cheeks ashy grey; the quills blackish or dusky brown, edged with yellow; the throat and breast yellow; and the sides of the body and flanks ashy brown, washed with yellow and streaked with black.

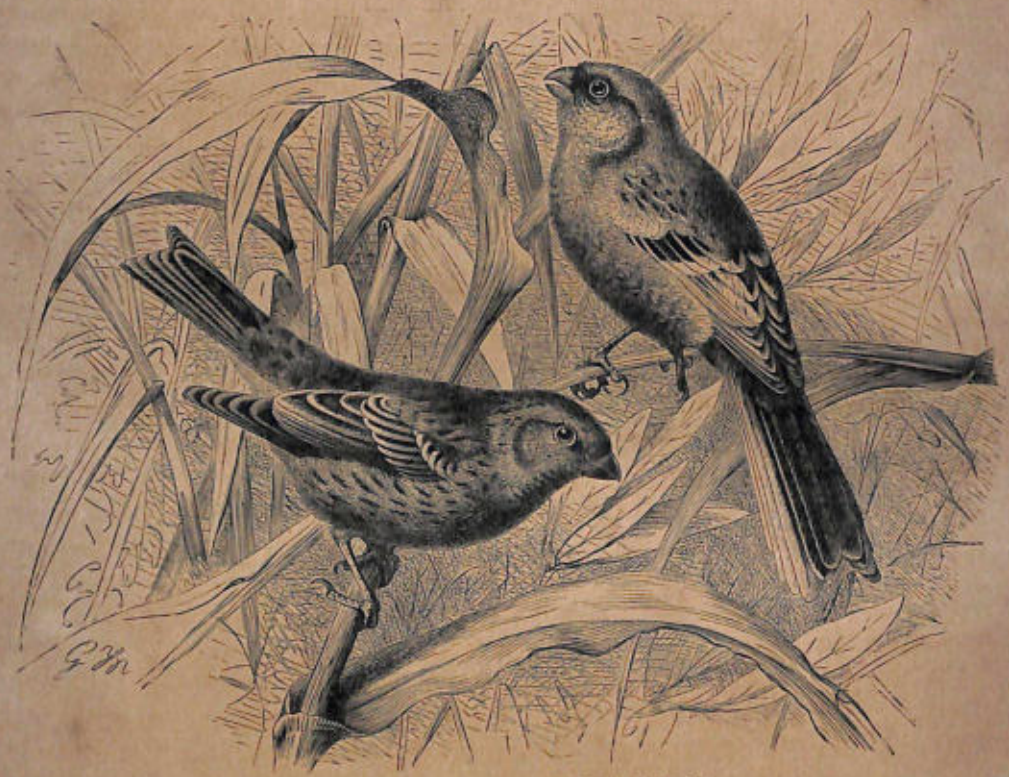
Canary. Found in most of the islands from which it takes its name, in Las Palmas the canary (*S. canarius*) is wonderfully abundant, and may be seen in great flocks throughout the breeding-season, as if there was not room for all to

pair and breed. In Teneriffe, it commences breeding near the coast in January, while in the high mountains it nests in June and July, ascending to its elevated haunts in the end of May; the nest being generally placed in an evergreen tree or shrub. The eggs are bluish green in ground-colour, and spotted with reddish brown. The song of the wild male is sweet and powerful, but does not possess the variety of notes heard from cage-birds. The wild canary has occasionally reached the southern shores of Great Britain as a storm-driven wanderer. The male has the upper-parts ashy brown washed with yellow, and streaked with blackish brown; the forehead, rump, and lower-parts being yellow; and the sides ashy streaked with black.

Rose-Finches. The brightly dressed finches of this group have the bill of proportionately smaller dimensions than the pine grosbeak, to which they are nearly related. The sides of the bills are convex, and the culmen moderately curved; the wings are long and pointed; the tail is much shorter than the wings, and considerably forked; while the feet are small and weak. The males are remarkable for their crimson plumage; the females and young males being plain coloured. Rose-finches are found in North-Eastern and Eastern Asia, Asia Minor, Palestine, the Indian region, and China, one species breeding as far west as Pomerania; and although the vast majority belong to the Old World, four species are peculiar to North America, one of which closely resembles an Old World form.

Scarlet Grosbeak. A common bird in the North of Europe is the scarlet grosbeak or rose-finch (*Carpodacus erythrinus*), regarding which Dr. Taczanowski, after mentioning that they only come to Poland to breed, observes that "they first appear generally about the 15th of May; and after a few days they are found at their regular nesting-places. They arrive singly, and take up their habitation in the bushes near water in the middle of fields and marshes; nowhere numerous, they are generally rather rare. The males announce their arrival by a characteristic song which is easily recognised even at a great distance. They are very restless, whereas the female on the other hand is quiet. When singing, the male generally perches on top of a tree or bush, always in full view, and during the short intervals of the song utters a deep, clear whistle which may be rendered as follows—*tiu tiu fi tiu, tiu, tiu fi tiu tiu;* after having repeated this about ten times, it descends amongst the branches and searches after food. While thus engaged it sometimes warbles in a very low tone. After about a quarter of an hour of repose it reappears in full view and recommences its song. In singing, it raises the feathers of its crown and throat, and in the sun looks much more beautiful than it really is. The food consists chiefly of the various seeds of trees and bushes, tender buds, etc. They seldom feed on seeds of plants, but sometimes they resort to the fields to pick up hemp-seed. They are not often seen on the ground, and only go there in search of materials for their nest. The latter is placed on small bushes generally on thorns, wild rose-trees, hawthorns, and among hops. In form it resembles that of *Sylvia cinerea*, and is constructed of fine, elastic, dry bents, particularly of ranunculus and hop, clover, and umbelliferous plants. The interior is formed of delicate, dry roots and shoots of plants, often interlaced with a few horsehairs or other coarse hairs. The nest is loosely constructed and the exterior almost carelessly, but it is regular and neat in the inside and in form is almost semicircular. It is placed in a fork of the

bush without being fastened to the branches, and is always well hidden in the foliage. . . . The general complement of eggs is five, rarely four or six. They are slightly elongated, slender, oval, or sometimes almost pyriform. In colour they are of a beautiful blue-green, almost like the eggs of the song-thrush, and are marked with spots of reddish black, more numerous at the larger end and but few on the rest of the surface. . . . In general character they resemble those of the common bullfinch, but are less in size, and the ground-colour is more intense and pure, while at the same time the spots are deeper. During the period of incubation, and when the young are still small, the male sings continually, but in different places and often far off, but it frequently returns to the vicinity of the



SCARLET AND SIBERIAN GROSBEAKS (½ nat. size).

nest. When any person approaches, it calls exactly like a canary, and the female uses the same alarm-note. As soon as the young commence to be feathered, the male ceases his song and becomes as shy as the female. When they leave the nest, the whole family conceal themselves in the foliage, and it is very difficult to get sight of them, and they remain thus until they leave. Owing to their shy habits then, I cannot say when they do leave, but suppose it is as soon as the young birds can travel. In Siberia they are common, and remain longer there than they do here. They nest there upon young conifers." Mr. Seebohm, who appears to be one of the few British ornithologists who have studied the habits of the rose-finch in Northern Europe, states that "its song is a very striking one, and not to be confused with that of any other bird. It is a loud clear whistle,

'*tŭ-whit' tŭ-tū-ĭ.*' Although never varied, the song is sometimes repeated twice in rapid succession, and when it is heard, the bird may usually be seen perched conspicuously on the top of a bush or low tree. The marshy forest-banks of the great Siberian rivers are a favourite resort of this bird; and in the Baltic provinces, where it is common, and in the valley of the upper Volga it is described as frequenting willows and other low trees in marshy districts." In winter the scarlet rose-finch ranges over the plains of India, sometimes in large flocks, but more generally in small parties, frequenting alike groves, gardens, and jungles; at this season of the year its habits much resembling those of the true finches. In Gilgit it breeds at an elevation of ten thousand feet above the sea, fresh eggs having been obtained there in the second half of July. Early in September it leaves the hills and comes down into the valley, soon after migrating to winter quarters. In Central and Western Europe the scarlet grosbeak is only known as a rare straggler, generally on an autumnal migration, and as such, it has occurred in the British Isles. The general colour of the adult male is dark brown above, washed with rosy or pale crimson; the wings and tail are dark brown; the lower back and rump dull rosy; the crown of the head dull crimson, extending to the hind-neck; the cheeks, throat and breast bright crimson; the centre of the breast and under-parts dull white, slightly washed with crimson; Indian specimens as a rule being much more brilliant than those obtained in Northern Europe. The female lacks the bright colours of the other sex, being of an olive-brown above, with the lower back and rump olive-brown; the wing-coverts dark brown, edged with olive and tipped with yellowish white, forming a double wing-bar; the wing-quills and tail dark brown, edged with olive; the throat dull white streaked with brown; the fore-neck and breast ochreous buff with distinct dusky centres to the feathers; the under-parts white; and the sides of the body and flanks brown with dusky stripes. Mr. Seebohm states that males in the first winter plumage are scarcely distinguishable from adult females, and even in summer plumage are sometimes indistinguishable from them.

Bullfinches. The bullfinches can generally be recognised by their large head, short, swollen beak, and abbreviated wings, the tail being either square or slightly forked. Their pattern of plumage assists identification, since both sexes unite the characters of a white rump, together with deep black wings and tail. The common bullfinch (*Pyrrhula rubicilla*) inhabits the woods and thickets of Northern Europe and Siberia, giving place in Central and Southern Europe, as well as in the British Isles, to a similar form, identical in the arrangement of colours, but of duller tints and inferior size. The Azores possess a peculiar species of bullfinch, which has almost entirely lost the bright colours adorning the males of the other members of the genus; and another plain-coloured species is the brown bullfinch of the Himalaya, whose range apparently overlaps that of yet another Himalayan species, the red-headed bullfinch. The orange bullfinch is found in Kashmir and the adjoining territories. During the summer the habits of the common bullfinch are shy and retiring, but in the spring this bird appears commonly in gardens, where it commits serious ravages upon the buds of fruit-trees. Mr. Seebohm observes that there can be little doubt that bullfinches pair for life; and it may be considered certain that these birds are of an affectionate disposition, the cock being rarely absent

from its mate at any time of the year. Generally commencing to build about the middle of May in ordinary seasons, the bullfinch may lay a full clutch of eggs as early as the middle of April; and the nest is generally placed in a low tree or bush, seldom at a greater height than five feet from the gound. Composed of slender twigs, it is flat and shallow, but firmly woven together, and lined with root-fibres; the eggs varying from four to six in number, and being greenish blue in ground-colour, speckled and spotted with purplish grey, and dark purplish markings. Two or even three broods of young are sometimes reared in a season, in all of which the male sex largely predominates; indeed, there are cases where all the young in a brood have been of this sex. When the young leave the nest, they live with their parents in family parties, searching the hedgerows for the berries of privet and other wild shrubs. In the breeding-season the cock bullfinch is a pugnacious bird, always ready to do battle with any intruder who may venture into his territory. The bullfinch does not appear to be migratory to any large extent, although it wanders considerable distances when pressed by hunger. In England it is seldom that more than nine or ten are seen in a flock, but in Southern Sweden the large form wanders about in big droves, sometimes composed exclusively of the male sex. Generally feeding almost entirely on wild seeds, fruit-buds, and berries, in severe weather the bullfinch devours the seeds of the common plantain. The flight of the bullfinch is generally low and undulating; but at times these birds may be seen flying at a considerable elevation, and alighting on the tops of the tallest forest trees. The natural song is feeble and without pretension; not that this species is devoid of musical taste, for the young males, if untrained, essay to sing their natural notes as soon as they are about four weeks old, but rather that the bird stands in need of a tutor, by whose patience its capacity for reproducing a lively air may be turned to practical account. The Germans bestow great pains upon the teaching of their tiny pupils, and are content to turn out only a limited number of really accomplished birds. The call-note is low and plaintive, and one of the most familiar of the varied sounds that from time to time break the silence of English woodlands. The plumage is subject to considerable variation, even in a wild state; one of the most remarkable varieties being creamy-dun colour, contrasting strongly with the jetty black crown, wings, and tail. The cock-bird sometimes combines a rosy breast with upper-parts of snowy whiteness. Typically the adult male is bluish grey above; the crown, wings, and tail, being glossy black; the rump white, and conspicuous when the bird is seen upon the wing; and the lower-parts pale vermilion, varying much in intensity. The female's breast is chocolate-brown.



THE BULLFINCH.

The Pine-Grosbeak. Included by some writers among the bullfinches, but by others referred to a distinct genus, the pine-grosbeak (*Pinicola enucleator*),

is an inhabitant of the pine-woods of the northern regions of both the Eastern and Western Hemispheres. A gorgeously-coloured bird in its adult plumage, the pine-grosbeak seems to be remarkable for the variation in the time of the assumption of this dress; there being little doubt that cock-birds have bred while in their immature plumage. The wings are of moderate length; the tail being of medium length, and distinctly forked; while the feet are small, and the metatarsus does not exceed the third toe in length. The sexes are easily distinguished by the crimson red plumage of the adult male, although immature cocks cannot thus be distinguished. Mr. Seebohm remarks that the summer home of the pine-grosbeak is in a very picturesque country. "Almost all the forest districts of Siberia are hilly, and in the north, as the trees become smaller, they are also more thinly scattered over the ground, and the interminable extent of wood is broken by occasional flat, open marshes, which become gay with flowers as soon as the snow melts. The scenery is more park-like than farther south, and birds are much more plentiful and more easily seen. The pine-grosbeaks arrive at their breeding-grounds in small flocks in April, and continue to be gregarious until summer comes, when they disperse for the purpose of building their nests. They appear to be somewhat shy and retiring birds, because they do not frequent the roads like the bullfinches, the snow-buntings, and the mealy redpolls. But this is by no means the case; they confine themselves principally to the woods where they are not difficult to approach, even when the sportsman is obliged to hunt them in snow-shoes, six feet long, to support his weight upon the untrodden surface. In the large pine-forests they prefer the banks of the rivers or the outskirts of some open place, and may often escape detection from the habit of frequenting the tops of the trees. Within the Arctic Circle many of the trees are small, and on the hilly ground they are scattered in small clumps, or sometimes in isolated trees, the drooping boughs of the spruce-firs looking very graceful on the white snow. In places like these the pine-grosbeak may often be seen perched conspicuously on the top of a spruce-fir, twenty or thirty feet from the ground, but looking so much like the last spike of the tree as frequently to escape notice. . . The call-note is a plaintive single note, somewhat like that of our bullfinch, but incapable of being expressed on paper. The song is very melodious, not very loud or long, but flute-like. When I first heard it, I took it for the song of some rare Siberian thrush, and was quite disappointed when I shot the bird to find it only a pine-grosbeak. The flight is undulating and powerful. We found several nests which could only have belonged to birds of this species, but our search for eggs was unsuccessful. The breeding-season is said to be the end of May or beginning of June. The nests are generally placed in a spruce-fir tree ten or twelve feet from the ground, on a thick branch close to the main stem. The nest is made on the same model as that of the hawfinch and bullfinch, but of coarser materials. The outside is a framework of slender fir twigs; and the inside, which projects above the outside, is composed of roots of fine grass, and a lichen which grows upon the branches of the trees, and might easily be mistaken for hair. . . The number of eggs varies from three to four. . . The ground-colour is pale greenish blue, boldly spotted, principally at the larger end, with surface-spots varying from rich brown to almost black, and with underlying spots of greyer brown." The general colour of the adult male is rosy crimson.

with ashy bases to the feathers; the wings and tail being dusky brown, with the feathers edged with rose-colour. The female has the general colour of the upper-parts ashy grey; the crown of the head and sides of the face golden olive-yellow, spreading on to the mantle; and the throat and under surface ashy grey, washed with golden-olive.

The Crossbills.

These are sufficiently distinguished from all other members of the avian class by the crossing of the tips of the two mandibles of the beak. In general conformation the beak is hard, strong, and thick at the base, with the lower mandible curving upwards, and its point crossing that of the upper one; a structural conformation enabling these birds to extract with facility the seeds deeply buried beneath the overlapping scales of the fir-cones on which they feed. This peculiar structure is, however, developed only in the adult, young birds in the nest having the beak of normal conformation. As regards other characters, the crossbills have the wings long and pointed, and the tail forked and relatively short in proportion to the wings.

While the males of the crossbills are gaily attired in scarlet crimson and orange plumage; green and yellow are the predominating hues of the females. Crossbills inhabit the pine-forests of both the Old and New Worlds, extending from Siberia to the Himalaya in the Eastern Hemisphere, and in the Western ranging from Arctic North America into Mexico.

When wandering through the pine-forests of Northern Scotland or Western Norway, the cry of the crossbill (*Loxia curvirostra*) often greets the traveller from amongst the fir-cones, directing his attention to the bright-plumaged birds skilfully extracting the seeds of the conifers, whilst hanging gracefully in every variety of attitude. One such scene is firmly imprinted on our memory; where, while the edge of a pine-wood, richly carpeted with blaeberries, lay in the back-ground, in the foreground a little flock of crossbills were swinging gaily round the branches of an isolated forest tree; and visitors to Bournemouth will recall memories of these birds among the pines which form their favourite nesting-resort. One of the most recent descriptions of the habits of the crossbill in the nesting-season is by Mr. Ussher, who writes that he has had unusually good opportunities of observing these birds, since no less than four pairs built within a short distance of his house. Among them, one was a male in the immature yellow plumage, while the other three cock-birds were red, or red mingled with brown. Early in March one of these crossbills was observed carrying twigs to the top of a Scotch fir, in which the nest was subsequently discovered, although it could only be seen from the ground by a person standing immediately below it and looking straight up through the tree against the sky. "This tree," writes Mr. Ussher, from whose description the remainder of this account is abbreviated, "is the outer of a group, and is bare of living branches to within a short distance of its top, which consists of a mass of green, bending over from the west winds, in the midst of which the nest was built among the thick tufts. The finder saw the crossbills visit it frequently with building materials; and I saw several times the birds fly to and from it, and recognised the male by his redness. This pair probably reared their young in safety, for, on 10th May, a pair of crossbills were seen feeding their young on larch-trees in the vicinity of this nest. A second nest was subse-

quently discovered, which was in the top of a Scotch fir about two hundred and fifty yards from the first. It was built in the fork formed by several small lateral branches with the leader, which at that point takes a bend; and the nest, which is small for so large a bird, might easily be mistaken from the ground for a knot or enlargement of the crooked leader. It was placed in a perfect little cluster or bower of smaller branches; and was composed externally of fine dead twigs of larch and Scotch fir, and within them of green moss, interwoven with wool, a few horsehairs, and flakes of finer bark. The birds used not to cease their call-notes while flying to a neighbouring tree and thence into the nesting-tree; and the call of the female was heard apparently coming from the nest itself. It was like the syllables *yep yep*, or *yup yup*, while that of the male is much sharper, like *gip gip*. In a young bird taken from this nest the points of the mandibles were straight, not crossed, but the edges of the upper one overlapped the lower on both sides. The down was all gone, and the plumage exhibited dark spots on a lighter ground both on the upper and under surfaces. It was replaced in the tree, from which it must have subsequently fallen, for a nestling was found in the adjoining field and placed in a cage near the nesting-tree, where the old crossbills, which had other young in the trees, continued to feed it often in the presence of observers. In the meantime it became accustomed to feed on bruised hempseed when it was removed to the house, where it soon became full-grown, and tame. The notes of the last pair of crossbills, when excited, used often to attract another pair—the male a red one—that frequented the neighbouring trees, and which on such occasions would join their neighbours in the excitement; their nest was discovered by the birds being seen carrying building materials to it. They picked up bits of hay off the ground, not heeding the observer standing near them."

Although the crossbill appears to reside permanently in many parts of its range, there can be no doubt of its roving habits; in certain years great flights appearing in the British Isles, and taking up their abode in parts of the country well planted with belts of fir-trees, as was the case in 1888, when numbers of these birds were reported as having made their appearance in different parts. Sometimes, too, large flocks appear on their journey across the North Sea; and in June 1888, crossbills visited the island of Heligoland in numerous flights, varying from ten to fifty birds. Hawthorns in the gardens were then crowded with them, and on some days there must have been hundreds dispersed amongst the foliage. A single straggler was caught about the same time on board the Bull light-vessel, off the mouth of the Humber. The change and coloration of the plumage of the crossbill has given rise to some amount of discussion; but we are inclined to adopt the views set forth in the British Museum Catalogue of Birds. In the full plumage the adult male is pale vermilion above, the feathers having dusky bases; the crown of the head is pale vermilion, like the back and under surface; the primaries and tail-feathers are dark brown; and the lower abdomen, the sides of the body, and the flanks ashy brown washed with vermilion. After the first moult the tints of the male become more orange and uniform, but the flanks are striped, and there are also more or less striped feathers about the other portions of the body. It is now conclusively proved that the bright colours of the male are gradually

assumed, and that it takes two or even three moults before the full red plumage is gained. The plumage of the female differs from the male in being olive-yellow, where the latter is red; the head, lower back, and rump being much brighter than the mantle, which is dusky brown, while the under surface of the body is yellow, with ashy bases to the feathers.

There has been some doubt whether there is more than one species of crossbill, and on this subject Mr. Oates, in his *Birds of British India*, writes as follows:—"The crossbills of the Himalaya (*L. himalayana*) form a very small race, which I think it advisable to keep distinct. There is a very marked difference in size between the Himalayan birds and *L. curvirostra*, from Northern Europe, on the one hand, and *L. japonica*, from Japan, on the other: and the only crossbills which approach the Indian birds in size are from America. Sharpe's view, that all these crossbills form but one species is no doubt correct; at the same time, the Himalayan crossbills are in my opinion quite distinguishable from all others in size, and it is consequently more convenient to retain them as distinct." The range of the small Himalayan form extends from China and Ladak to Sikhim, and thence into Tibet and Western China: and recently a crossbill (*L. luzoniensis*), has been found in the Philippines.

Nearly allied to the crossbills is the scarlet finch (*Hæmatospiza sipahi*), from the mountains of Nipal and Sikhim, distinguished by the very strong and stout beak being of normal form. The cock-bird of this species is red, while the hen is green; a remarkable feature of both sexes being the white colour of the bases of the feathers of the head and neck, which are seen conspicuously when the feathers are at all ruffled. The wing is of considerable length, reaching beyond the middle of the tail. The scarlet finch is an inhabitant of both forest and bushy districts, and utters a loud whistling note.

Laysan Finch.

The genus *Telespyza* includes a handsome finch recently discovered in the Pacific, and is characterised by the bill being short and much arched, with the upper mandible showing a tendency to cross the lower, as in the crossbill; the wings are of moderate length, reaching to about the end of the basal third of the tail-feathers; the tail is slightly forked; and the feet are remarkably large and strong. This bird is peculiar to the island of Laysan, in the Pacific: and we owe its discovery to Mr. Scott Wilson, who obtained a specimen at Honolulu. This was one of about forty, brought there by Captain Bohm, who had found the birds common among the scrubby bushes covering the surface of their island home, where they were so excessively tame and unsophisticated that their capture with the hand was an easy matter. Mr. Wilson says that a specimen which he brought alive to England has a very clear metallic note, which may be rendered, *chwit, chwee*. It also twitters and chirps as it hops from side to side of the cage, and is altogether lively in its movements; while it is able to force the wires of its cage by means of its powerful bill. The adult has the head and sides of the face olive-green, shading behind into dark chestnut-brown on the back, where each feather has the centre black; the rump and upper tail-coverts are chestnut-brown; the primaries black, edged with yellowish; the tail is black, having each feather edged with greenish yellow; and the throat and breast are bright greenish yellow passing into white on the under-parts.

Other Finches.

The Oriental genera *Propyrrhula* and *Pyrrhospiza*, intermediate between the crossbills and rose-finches, are among the most interesting of the remaining members of the subfamily. The red-headed rose-finch (*Propyrrhula subhimalayensis*) is found in the more open parts of the woods in North-Western India. The male has a brownish crimson body with bright crimson forehead, cheeks, and throat, the brown wings and tail having reddish margins; the female is not unlike the female of *Hæmatospiza sipahi* (p. 404), but much yellower in coloration. The female of the red-breasted rose-finch (*Pyrrhospiza punicea*) is almost exactly like the females of all the species of *Carpodacus*, including not only the common species, *C. erythrinus* already noticed, but the Caucasian species *C. rubicilla* and the Central Asian Severtzow's finch, *C. severtzowi*. The male, however, is easily distinguishable, being a brownish bird with crimson forehead and throat and breast, the crown being black, like the back, the feathers being each margined with light brown. The horn-brown bill is stouter and shorter than that of the red-headed rose-finch, but it is of much the same shape as that of the scarlet finch. The red-breasted rose-finch is a Himalayan bird, ranging from Kashmir to Tibet and Western China at elevations of from ten thousand to seventeen thousand feet. A nest of this species was found in Ladak, built of coarse grass in a furze-bush, and containing greenish brown spotted eggs. Mr. Oates includes in this species *P. humii*, which is also found in the Himalaya, and has the head and breast rosy instead of crimson, while the brown of the back is quite pale.

The Buntings.

Subfamily Emberizinæ.

The birds of this large group possess a conical and sharply-pointed bill; but the edges of the two mandibles, unlike those of the other finches, are not in contact throughout their length, forming a gap or angle about midway between the gape and the tip of the bill. The upper mandible, moreover, has the palate furnished with a hard, horny knob. In a few of the species the claw of the first toe is elongated like that of a lark. The great majority of the buntings belong to the northern parts of the Old World, although some species inhabit Central Asia or reside permanently in India; many of them possessing an extensive range. The snow-bunting supports life further north than any other of the smaller birds.

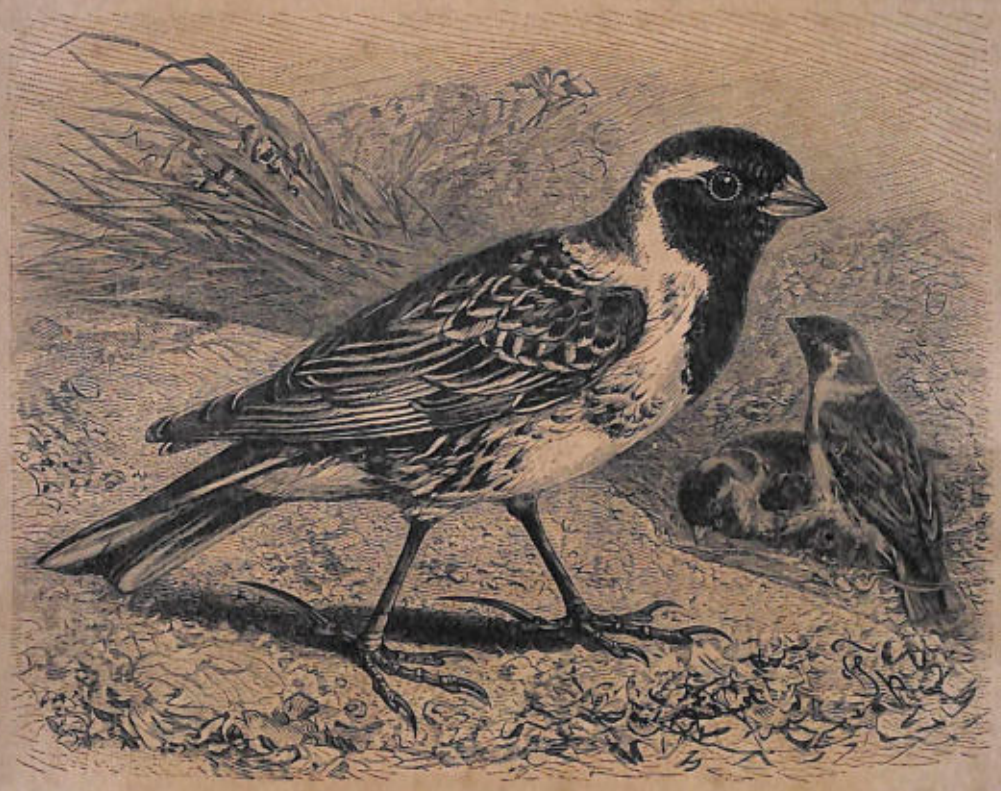
The Snow-Bunting.

In this genus (*Plectrophenax*) the bill is small and conical; the wings are very long and pointed; and the tail is moderate and slightly forked; while the claw of the first toe is straight and elongated. The genus is represented solely by the snow-bunting (*P. nivalis*), which is an Arctic form, common to all the northern portions of the world, and occasionally straying on migration into Central and even Southern Europe. Many species of birds migrate over England during the hours of darkness; and on a frosty night at the commencement of winter we have been able to recognise the joyous sound of the twittering of the "snowflake" ringing through the still air as the birds sped on their way through the darkness. Although some snow-buntings pass the entire year upon certain Scottish mountains, it was not until the summer of 1885 that several parties of these birds were

observed on the higher mountain-tops of the west of Sutherland by Mr. Peach, who in the following year captured the young of this species in a corrie. In 1888 Mr. J. Young announced that during the previous summer he had taken a nest of the snow-bunting in the north of Scotland, containing the only eggs of the species discovered up to that time on the mainland of Great Britain. Upon that occasion the observer in question was searching for ptarmigan upon the mountains between Sutherland and Caithness, and while descending some difficult ground he recognised the call-note of the snow-bunting, and with some difficulty reached the nest, which contained five richly-coloured eggs, and was composed of bents and moss, lined with a few ptarmigan's feathers, and one or two small pieces of wool. Since then, additional nests of the snow-bunting have been found in Scotland, one of the number having been secured for the national collection. Professor Newton says that a considerable number of snow-buntings pass the summer in the Faroes, where, on the south islands, they are restricted to the mountain-tops; although, on the northern ones, they frequent the lower grounds in small colonies. Throughout Iceland the species is perhaps the commonest of small birds, a pair or more being established in nearly every convenient locality, even amongst the most desolate lava-streams; and it breeds there almost on the sea-level as well as up to the snow-line. As is shown by the accumulation of old materials often found therein, the birds commonly use the same nest-hole more than once. The eggs vary from four to six in number, and are white in ground-colour, more or less tinged with palish greenish blue, splashed with dull lilac, and spotted with brownish red. They are laid in a nest built of dry grass and roots lined with hair or soft feathers, especially those of the ptarmigan. The snow-bunting has occasionally nested, and even hatched its young in confinement; but we are not aware of the young having been brought to maturity under artificial conditions. The adult male has the crown ruddy brownish black; the scapulars are black, edged with reddish brown; the primaries black; the secondaries white, the outer ones being marked on both edges with black; the central tail-feathers are black tipped with white; the under tail-feathers white streaked with black on the outer edges; a rusty band crosses the breast, and the lower-parts are white. In summer the light tips to the feathers of the upper-parts are shed, and the bird then appears to be black and white, black predominating.

Lapland Bunting. One of the most widely distributed of small birds is the Lapland bunting (*Calcarius lapponicus*), a circumpolar bird, inhabiting the high northern regions only during the summer months, and migrating southwards to more congenial winter quarters before the arrival of frost and snow in its northern home. It is also found throughout the northern parts of North America. During the summer season this bird frequents the fell-mosses of Norway and Sweden, especially such as are covered with grass and willow-scrub and are situated below the snow region. Not inhabiting the high mountains on which the snow-bunting breeds, it prefers the upland swamps, and Mr. Seebohm states that in Northern Europe the Lapland bunting seeks the swampiest ground it can find, so long as there are tussocks of dry grass full of flowers where it can breed. If there be also a few stunted willows or birches upon which it can perch, so much the better. The nest is nearly always placed in some hole in a side of the little

mounds or tussocks abounding on the marshy parts of the tundra, and is composed of dry grass and roots, and profusely lined with feathers. The eggs vary from pale grey to pale brown in ground-colour, and are streaked with dark brown with underlying blotches of brown. Nests of this species found in Norway were built of dry grass and lined with feathers; one in particular being lined with the feathers of a snipe, and thus having an unusually pretty appearance. The newly-hatched young are said to be clothed with dark down. The song of this bunting, which is sweet and musical, is usually poured forth when the bird is in the air,



LAPLAND BUNTING (⅔ nat. size).

soaring like a lark, and is continued until it alights on some grassy knoll or stunted bush. Oddly enough, the female has almost as rich a song as the male. Formerly the Lapland bunting rarely straggled so far westwards as the British Isles during its autumnal migration, but nowadays it not only breeds nearer than it used to do, but small numbers of this bird visit the southern shores of Great Britain yearly. Before 1892 the Lapland bunting had been captured most frequently in Kent, more particularly near Dover; but in the autumn of that year great numbers visited Eastern and Southern England; the first arrivals being observed in Norfolk during September, and these being soon after followed by large flocks. Numbers were also obtained during the winter of 1892–3 on the downs near Brighton; and the species has occurred in equal abundance in Northumberland. Lapland buntings, according to Mr. Gurney, become tame

sooner than snow-buntings, while their notes are somewhat more silvery in tone. "In captivity their habits seem no more terrestrial than snow-buntings. As spring drew on, the tints of the birds in my aviary were observed to deepen, and they even showed a disposition to nest by carrying about bents of hay." The male Lapland bunting in breeding-plumage has the entire head, throat, and upper breast black; a rich chestnut collar reaches from behind the head on to the back; and the upper-parts are brownish black margined with buff and white. The adult female differs from the male in having light margins to the feathers of the head, throat, and flanks, while the feathers of the chin and upper throat are buffish white, with half-concealed black bases. After the autumnal moult, all the feathers have light edges. Males of the year closely resemble adult females, but differ from them in having no black centres to the feathers on the nape.

The Typical Buntings. The genus *Emberiza* includes the typical buntings, all of which are crestless, and have forked tails; the bill being hard, short, and conical; the first primary small, and the fourth or fifth commonly the longest in the wing, and considerably longer than the next; while the metatarsus is covered with scales in front and on the sides, with an entire plate forming a sharp ridge behind. These buntings are represented by numerous species from the temperate and northern parts of the Old World, as well as from North Africa and India.

Reed-Bunting. The reed-bunting or reed-sparrow (*Emberiza schœniclus*) is found on swampy ground over almost the whole of continental Europe from the South of Spain to the North Cape. Among the aits and osier beds of the Thames and its tributaries, it forms a conspicuous object in the summer time, as it chants its sweet snatches of song from some prominent position by the waterside. The female builds her nest among rushes or long grass on the side of a bank, or in a dense tussock of the morass which forms her home, not unfrequently amid a tiny forest of cotton-grass, whose white tufts of delicate down transform a few acres of black bog into a miniature paradise of beauty. The eggs are drab in ground-colour, and streaked with black and dark purple. The young of this bunting, like those of certain other species which nest upon the ground, frequently leave their nest before they can fly, trusting to their protective colours to secure their safety. Resident in some districts, this bunting in others is a partial migrant, a considerable number passing the winter in the British Isles, where they occasionally seek shelter in the centre of large woods at a distance from their usual aquatic haunts. Their food consists of seeds of water-plants, small molluscs, and insects; but occasionally they feed in the stubble-fields. The bird is gregarious, and fond of associating in small and even large flocks during the winter and spring months. We have but rarely come across white individuals of this species, nor have we yet examined a pied specimen. The general colour of the adult male in the breeding-season is rufous, with broad black centres to the feathers of the back; the wing-coverts are chestnut; the primaries blackish, edged with rufous; the tail-feathers dark brown, the two outer ones being edged with white; the crown of the head as well as the sides of the face and ear-coverts are entirely black, and separated from the back by a broad band of white, which forms a collar joining the white sides of the head; the throat is black, and the remainder of the under surface white, streaked with black on the sides of the body.



BUNTINGS.

1. Reed; 2. Yellow; 3. Common; 4. Lapland; 5. Snow.

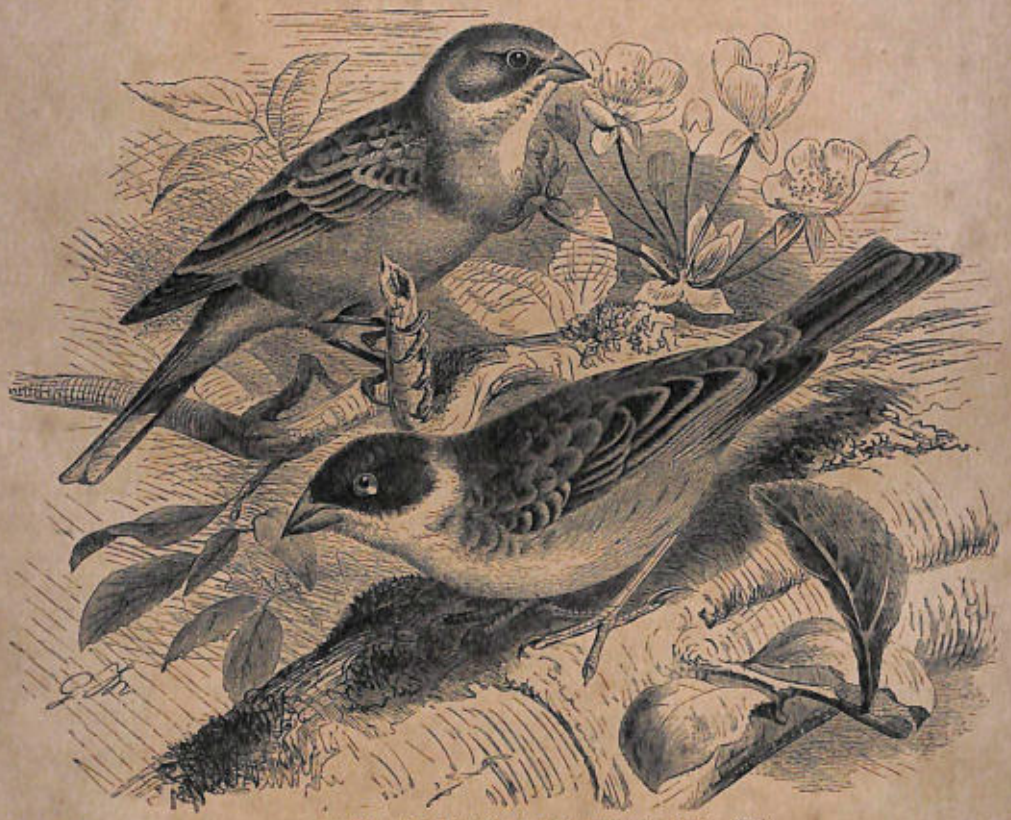
Little Bunting.

Among the Arctic birds from time to time straying into Western Europe during their seasonal migrations, must be mentioned the little bunting (*E. pusilla*). Near Archangel Messrs. Alston and Harvie-Brown found it very common in the summer, although local in its choice of nesting-grounds. They often heard its low, sweet song, which is compared rather to that of a warbler than of a bunting, and they observed that it frequented the pine-woods and mixed timber. Mr. Seebohm supplies the following account of his finding the eggs of this bunting in the valley of the Yenesei. There "it was extremely abundant, and its unobtrusive and quiet song was constantly heard before the snow, which was lying to a depth of five or six feet up to the first of June, had sufficiently melted to make the forest penetrable. I found the first nest of this bird on the 23rd of June. I was on the south bank of the Koorayika, a tributary of the Yenesei, and was scrambling through the forest down the hill towards my boat, amongst tangled underwood and fallen tree-trunks, rotten and moss-grown, when a little bunting started out of the grass at my feet. It did not fly away, but flitted from branch to branch within six feet of me. I knew at once that it must have a nest; and in a quarter of a minute I found it, half hidden in the grass and moss. It contained five eggs. I have seldom seen a bird so tame. The nest was nothing but a hole made in the dead leaves, grass, and moss, copiously and carefully lined with fine dead grass. I took a second nest in the forest, on the opposite bank of the river, on the 29th of June, containing three eggs; this nest was in a similar position to the foregoing, and the behaviour of the parent bird precisely the same. On the 30th of June we cast anchor about one hundred and ten versts below the Koorayika, and I went on shore to shoot, and found a third nest of this interesting little bird, containing five eggs which were slightly incubated; this nest was lined with reindeer-hair. On the 6th of July, a few miles further down the river, I went on shore again and found another nest of the little bunting, this time containing six eggs; it was similar to the last, rather more sparingly lined with reindeer hair, but the tameness of the bird was just the same. The eggs in the first nest are very handsome, almost exact miniatures of those of the corn-bunting. The ground-colour is pale grey, with bold twisted blotches and irregular round spots of very dark grey, and equally large underlying shell-markings of paler grey. The eggs in the second nest are much redder, being brown rather than grey, but the markings are similar." The adult male little bunting in breeding-dress has the upper-parts rufous brown, with broad black centres to the feathers; the centre of the crown is vinous chestnut, with a broad black streak on each side, forming a band; a superciliary line, lores, sides of face, ear-coverts and throat, are all vinous chestnut. The remainder of the lower-parts are dull white, the lower throat, fore-neck, and breast, as well as the sides of the body, streaked with black. The adult female scarcely differs from the male, but is not quite so bright coloured.

Common Bunting.

This dull-coloured heavy bird (*E. miliaria*) is common in many parts of Europe, from Southern Spain to the Hebrides; but being to a large extent dependent upon grain-crops for its existence, its distribution naturally varies with that cereal. Sometimes it frequents the pastures, uttering its droning song from the top of some tall hedgerow tree; but more often it frequents arable

fields, where it utters its short mechanical song from a clod of earth, a clump of dockweed, or the coping of some stone wall or turf dyke. Although Mr. Dresser asserts that the corn-bunting, as this species is often termed, is seen only in pairs during the breeding-season, we have seen as many as a hundred of these birds flying together at the end of May, and can vouch for their associating together in numbers even in the nesting-time. Sometimes they roost upon the ground like skylarks, but we have known them roost habitually in a fir-plantation. They feed partially on insects, but in autumn and mid-winter they appear to subsist almost entirely on grain. The nest of the common bunting is a loose structure, built



ORTOLAN BUNTING AND BLACK-HEADED BUNTING (⅔ nat. size).

upon the ground in a tuft of rough herbage, and constructed of dry grass bents and pieces of moss, lined with finer stems of grass and sometimes a little hair. The eggs vary greatly in coloration, being either white or buff in ground-colour, blotched and streaked with purplish brown, grey, and pale brown. Not unfrequently the common bunting assumes a white or cream-coloured plumage; one shot a few years ago being as yellow as a canary. The usual colour is dull brown above, streaked with darker brown; the under-parts being buffy white, and the breast and flanks streaked with black.

Black-Headed Bunting.

South-Eastern Europe is the home of the handsome black-headed bunting (*E. melanocephala*), which but rarely strays into Western Europe, though it has been obtained repeatedly upon the island of Heligoland, and

on two occasions in Great Britain. In Greece and Turkey, on the other hand, it is a common summer bird. Lindermayer gives the following account of its habits:—"This bunting arrives always in the last five days of April in Greece, and, like other migrants, appears everywhere at once, so that the flats near the sea, which are covered with vines and other creepers, and also places where the olive-trees are scattered about, are alive with this lovely and melodious bird. It is peculiarly partial to vineyards, where it builds on the vines, pomegranates, thorns, or almond trees. Its nest is always formed of dried straws, and is carefully made and lined with horsehair. Five eggs are the usual complement, and these are pale sea-green, covered with scattered dark brown spots, though sometimes quite unspotted. I have received hundreds of nests, and often found them myself, as they are not difficult to discover, the bird not being at all shy, and only leaving the nest when approached within a distance of about a yard. I have often known the female to lay afresh after her eggs have been removed. During the breeding-season the male sits near the nest, on a branch or a tree-top, and continually serenades his mate with his sweet song. If scared away, even by a shot, it retreats to the nearest tree and continues its song." This bunting much resembles the common species in general habits, often sitting on the top of a bush or low tree, and pouring forth its simple notes, or flying from one elevated part to another with its legs dangling down. The adult male in the breeding-time has the crown and sides of the head black, the entire back and scapulars chestnut, the primaries and tail-feathers brown, the whole under surface, as well as the sides of the neck, rich canary-yellow, and the sides of the breast and flanks chestnut. The female is a dull-plumaged bird by comparison with her brilliant mate, having the upper-parts nearly uniform brown, but the under-surface yellow, with ashy margins to the breast feathers, and the flanks tinged with ash colour.

Yellow-Breasted Bunting.

This beautiful bunting (*E. aureola*) is distributed over the northern parts of the Old World from Russia to the Pacific, and has even strayed as far west as Heligoland, and been captured also in Italy. Dr. Dybowski found this bunting to be one of the commonest birds in Eastern Siberia, where it frequents the valleys, particularly on the plain, and where bushes abound. It generally perches on the top of a plant or bush, and there sings continually, its song being short and often interrupted, but sweet. The peasants look on it as the best songster in Dauria; but that is according to their taste, for there are many other birds there which sing better. These birds arrive on their breeding-ground about the middle of May, and commence building their nests early in June, although most of them only begin breeding late in this month. Their nests are placed on the ground and constructed of dry bents, lined with horsehair. The female sits hard, and will permit anyone to approach quite close to her; while, when driven off her eggs, she keeps flying about with the male closely in attendance, perching every now and then on the neighbouring bushes, and uttering a note of lamentation like that of the whinchat. The eggs of this bunting generally resemble those of the reed-bunting, but the ground-colour is tinged with greenish. In the neighbourhood of Archangel the yellow-breasted bunting constantly frequents swampy meadows, or marshes overgrown with birches and willows. The general colour of the male is deep chestnut; the forehead, sides of the face, and upper throat being

jet-black, and the under-surface of the body bright yellow, except that the chest is banded by a zone of chestnut. The female is greyish brown, like a hen-sparrow, above; the lower-parts being pale yellow, striped on the flanks with dark brown.

Yellow Bunting. The yellow bunting (*E. citrinella*) is a common bird in Northern Europe, extending eastwards into Siberia, and frequenting alike the more cultivated valleys of Norway and the south of Europe. Mr. Dresser observes that it is to be seen on almost every hedgerow in many parts of England. "Perched on the top of the highest available twig, the male may be heard incessantly pouring out his monotonous but not disagreeable song, and during the breeding-season his notes fall upon the ear from the early morn till late into the evening. As twilight sets in, the yellow bunting may still be heard, and is perhaps the last bird to give a parting note to the retiring day, with the exception of his congener the corn-bunting, who sings till it is quite dusk." The yellow bunting generally nests upon some bank, occasionally in a furze bush. The eggs are white, scribbled over with fine, hair-like markings. In autumn the yellow buntings collect in flocks, feeding on blackberries and other wild fruits, as well as upon all the grain that they can glean in the open fields. As the season advances, they seek the neighbourhood of homesteads, and search for worms and other insects upon heaps of manure. Although the yellow bunting is generally supposed to be a resident species in Great Britain, there can be no doubt that it is only a summer visitant to its more northern breeding-grounds. Large numbers of this species sometimes occur on migration at Heligoland. The male has the head and throat bright yellow, and the back brown, inclined to rufous, all the feathers having dark centres; the wings and tail are blackish brown, the outer tail-feathers having the inner webs partly white. In winter the plumage is rendered more dingy by fulvous edgings to the feathers. The female is greyish brown above, having the lower parts of the back, the rump, and upper tail-coverts pale cinnamon; the lower-parts being citron yellow and the upper breast mottled with brown and tinged with olive-green.

Cirl Bunting. Closely allied to the last, but more pleasing in both character and coloration, is the cirl bunting (*E. cirlus*), which is thinly distributed through Central Europe, being in some districts even more common than the yellow bunting, but generally taking rank as a scarce bird. English ornithologists know it best as a resident in the southern counties, particularly in the west; but it has nested as far north as Yorkshire. It is numerous in North Devon, around Barnstaple especially, where it is a shier bird than the yellow bunting, and is fond of concealing itself in the spring and summer in thick hedges. Both in the spring and again in the autumn the male bird is often to be seen perched on the branch of some hedgerow elm, from whence he delivers his very unpretending song.

In Germany the cirl bunting is migratory, leaving its northern habitat in November, perhaps even much earlier, and wintering far to the southward, and returning in April. It frequents the same kind of places as the yellow bunting, such as the bushy banks of streams, meadows, and hedges, small groves and mountainous districts in the neighbourhood of fields and gardens. In many other respects the cirl bunting resembles the yellow bunting. In spring it prefers to take up its position in a high and open place on the tops of trees, but later in the season

is found lower down, and always likes to hide in dense thickets. It hops a good deal upon the ground, is by no means shy, and when frightened up, soon settles on the nearest low bush and shows little fear. In its flight it also resembles its near relative, quarrelling and snapping at it when none of its own species are near with whom it can fall out; and it is equally quarrelsome, and at times as restless as that bird. These buntings eat both insects and seeds. Although Mr. Seebohm considers that the song of the cirl bunting bears some resemblance to that of the lesser redpoll and lesser whitethroat, it still more closely resembles that of the yellow bunting, but is never ended with the long-drawn note which marks the song of the



CIRL BUNTING AND MEADOW BUNTING (⅞ nat. size).

latter. The cirl bunting breeds early, nesting in positions similar to those adopted by the yellow bunting, and constructing its nest on a bank or amongst briars and brambles, usually at no great distance from the ground. The nest is built of dry roots and grasses, lined with fine roots and a little hair. The eggs are bluish white, in ground-colour streaked and blotched with very dark brown; two clutches being usually laid in a season. The song of the male commences early in the year, and is usually delivered from the lower branches of an elm or the top of some hedgerow tree, but occasionally from a bare telegraph wire. It is continued throughout August and September. In hard weather cirl buntings associate with other birds, such as larks, in the open fields. In confinement the cirl bunting is a shy species, very difficult to tame; although Montagu reared a young one from the nest, which

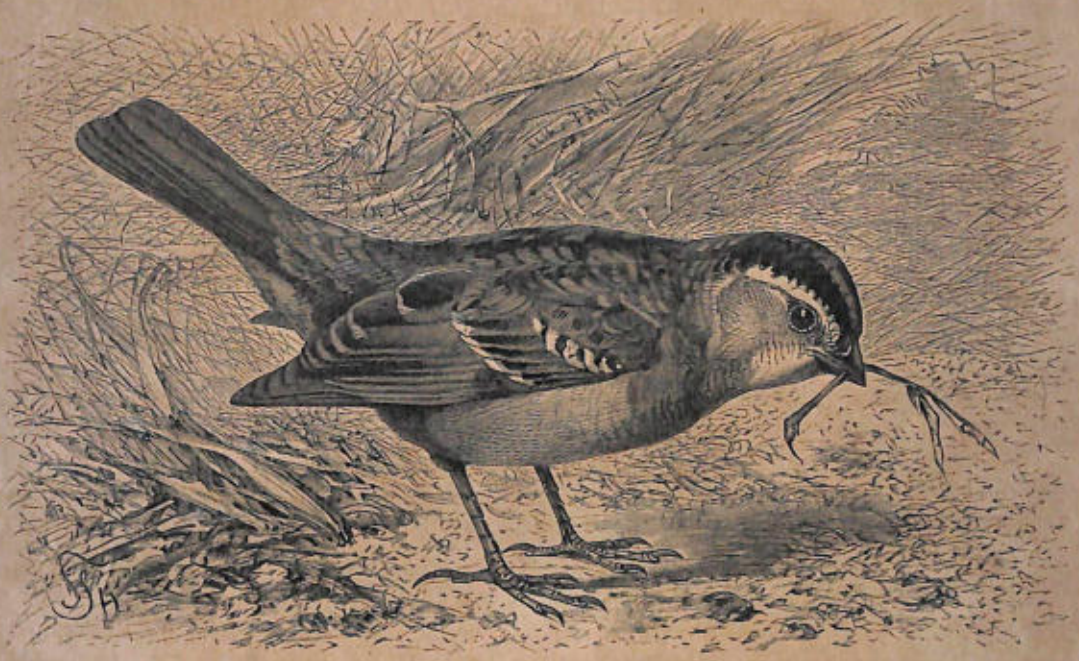
was sufficiently tame to take insects from the hand, showing a great partiality to such a repast, and, when let out of the cage, catching flies in the windows. The cirl bunting bears some resemblance to the yellow bunting in plumage, but the male is readily distinguished by the fact that the head and nape are olive-green, and the rump and upper tail-coverts olive-green streaked with dusky; while a bright stripe extends over the eye, and another below it. The wings and tail are similar to those of the yellow bunting, but the lesser wing-coverts are olive-green instead of chestnut. The throat is dull black, below which is a broad patch of yellow, and a zone of olive-green extends across the breast, shading into chestnut. The female cirl bunting can always be distinguished from the female yellow bunting by the head never showing any trace of yellow, the under-parts being not so bright a yellow; while the rump and upper tail-coverts are olive instead of chestnut.

Ortolan Bunting.

The far-famed ortolan (*E. hortulana*), shown in the upper figure on p. 410, for which fabulous prices were sometimes paid by the epicures of the last century, is a near relative of the cirl bunting; and, like that species, is more common in Southern Europe than further north. The tameness of the ortolan buntings outside the city of Pampeluna, in Spain, is almost ludicrous. So little do they apprehend injury, that they will allow visitors to lie on the grass while they forage round for earth-worms; these birds feeding partly on grass seeds and partly on worms. The ortolan bunting often resorts to the edges of thickets and the skirts of fir-woods; and its song somewhat resembles that of the yellow bunting. In Sweden the ortolan sings both during the day and throughout the light nights of the Arctic summer. The nests, which are invariably placed upon the ground, and generally in the open fields, are built of dry grass or roots, and lined with fine fibres or hair. The eggs vary in ground-colour from bluish white to pale salmon colour, spotted and blotched with rich purple-brown. Mr. Seebohm observes that "it is somewhat remarkable that a bird so common on the Continent, and all the countries adjacent to the British Islands, should be so rare in Britain. I found the ortolan bunting breeding on the mountains in the pine regions both of Greece and Asia Minor. When I was at Valconswaards we constantly heard its plaintive, monotonous song as it sat perched for a long time on the branch of a tree, in the lanes or in the hedges that surrounded the fields close to the village; and in the wilder districts of Norway it was by no means uncommon in the trees by the roadside. It is not a shy bird, and frequently remains for a very long time on the same twig, generally near the top of the tree, especially in the evening, when its simple song harmonises with the melancholy stillness of the outskirts of the country village. Throughout Europe it is a strictly migratory bird; in Greece and Asia Minor, where the season of the spring migration may be said to be the months of March and April it ranks amongst the later migrants. In South Holland the season of 1876 was a somewhat late one, and the arrival of migratory birds began during the last week of March and ended during the last week of May; and it was not until the middle of the latter month that we heard the song of the ortolan bunting. These birds leave Europe in September, arriving in North Africa in large flocks. On their way south great numbers are caught in nets and fattened for the table, and many are sent to this country alive from Holland and

Belgium. The adult male has the head grey, tinged with greenish yellow; a ring of feathers round the eyes and throat being pale citron-yellow; the general colour of the upper-parts is reddish brown with black streaks to the feathers of the mantle and back; the eyelid is white; the fore-neck and chest are dusky greenish olive, and the remainder of the under-parts is reddish cinnamon.

Meadow Bunting. The meadow-bunting (*E. cia*) is a lively member of the family met with, locally, in many parts of Central Europe, living chiefly in mountain-valleys such as those to be found in Central France. Each pair generally occupies its own particular district, and, while the females incubate their eggs, the males rehearse their songs, generally perching in a prominent position on the top of some bush. The nest of the meadow-bunting is made of



THE SPARROW-BUNTING.

dry stalks and moss, lined with horsehair and wool. Mr. Dresser found this bird numerous in the neighbourhood of Barcelona, where it frequented the cactus hedges, flying when disturbed from plant to plant, and often perching on the very top of the cacti, uttering its call-note, *zi zi zi*. This species chiefly affects the hill-sides and barren dry places where but few stunted bushes are scattered about; but in some parts of Europe it has been found frequenting the vineyards. It feeds on various seeds of wild plants, and to some extent on insects. The eggs are easily distinguished by their continuous markings, which appear as if they were made by a pen without taking it from the surface of the egg. In colour they are pale grey, marked with blackish brown lines. The adult male has the head and neck bluish grey, with two black bands along the sides of the crown, and two other black bands passing through the eye, forming a moustache; while the upper-parts are bright russet, streaked with black; the rump chestnut-red; the throat white; the

neck and chest delicate bluish grey; and the rest of the under-parts russet-red. The female has the head, nape, and body varied with black and russet; the rump and under tail-coverts bright russet; the front of the neck and chest shaded with dull grey and spotted with brown: and the flanks of a deeper russet, and more or less spotted with brown.

Allied Genera.

There are several genera more or less closely allied to the true buntings, which can only be incidentally alluded to here. Among these, the crested bunting (*Melophus melanicteris*), of the Himalaya, Upper India, Burma, and China, is the only representative of a genus characterised by the presence of a crest on the head, which is larger in the male than in the female. The tail is less forked than in the true buntings; and the sexes differ in coloration, although both display a considerable amount of red on the wings and tail. This bunting is solitary in its habits, and generally found on rocky hills and the banks of streams. The American bunting (*Euspiza americana*) represents a second genus, and the Cape bunting (*Fringillaria capensis*) a third, in which there are several species. The sparrow-bunting (*Zonotrichia albicollis*), belonging to a group of genera in which the tail is longer than the wing, differs from the true buntings by the exposed nostrils, which are protected by an operculum; and is especially characterised by the spotted back and sparrow-like form. The genus, which includes numerous species, is exclusively American.

H. A. MACPHERSON.



CHAPTER IV.

The Perching-Birds,—*continued.*

Larks to Waxwings.

Families *Alaudidæ* to *Ampelidæ*.

Represented by upwards of a hundred species, arranged under several generic heads, the larks form a family which is almost entirely confined to the Old World in its distribution; some of the more highly-specialised forms being peculiar to desert-regions, where they have become specially adapted to their environment both in structure and in their protective coloration. The shape of the bill varies too much in different genera to be of value as a diagnostic character; but the feet are well defined. Thus the metatarsus is scutellated, and blunt behind as in front; that is to say, it is covered with two series of plates behind and before, which meet on the inner surface of the limb. Other characters are the very long straight claw of the first toe, the long pointed wing, and the lengthened inner secondary wing-feathers. Save for a notch in the upper one, the edges of both mandibles are perfectly smooth.

The Skylarks. The birds of the genus *Alauda* are distinguished by having the first of the ten primaries very small, while the second, third, and fourth are nearly equal, although the third is somewhat the longest; the secondaries are comparatively long; and the tail is moderate and slightly forked. The bill is rather slender, long, arched, and slightly compressed, with plumelets covering the nostrils. The skylarks, of which there are but three species, are principally found in the temperate portions of Europe and Siberia, although extending their range southwards into China and the plains of India. The common skylark (*A. arvensis*) is one of the most abundant of European birds, nesting in the British Isles, which are also visited by myriads of this species from the Continent during the autumn and winter months. So great is their abundance that they have become an extensive article of commerce; and on the Sussex Downs extraordinary numbers are netted to supply the poulterers. Popular sentiment has never failed to recognise the exceeding beauty of the liquid notes of the lark, its cheery carol far surpassing that of all other British birds save the nightingale. Frequenting heaths and pasture lands, and generally most abundant in open country, during the winter the skylark is a gregarious species; and on a sharp frosty morning many hundreds may be observed congregating in a single field, flying restlessly hither and thither, with low warbling call-notes to their companions. The salt-marshes bordering upon many parts of the British coasts are well adapted to the habits of the skylark; the birds generally placing

their nest in the side of a tussock of rough grass. It is a simple structure, lined with fine grass. The young are exposed to the attacks of ground vermin, owing to their being reared upon the ground; but they are screened from their enemies by the highly protective character of their first plumage, which is spotted with buff, and assimilates to the colour of dried grasses even more closely than the darker tints of the adult birds. The skylark sometimes nests in very



SKYLARK, WOODLARK, AND CRESTED LARK (⅔ nat. size).

exposed situations; one pair having built their nest on the bank of a cricket-field, immediately abutting upon a highroad. In the breeding-season it is a singularly fearless bird; and the parents of a young brood will often allow a stranger to approach within a very few yards before they take wing. Waited upon by their parents most sedulously, the young birds leave the nest long before they are strong upon the wing; these "pushers" being often caught alive by boys, who take advantage of their feeble flight to capture them when exhausted, after a short but persistent chase. In confinement the skylark

retains its kindly character, a fact well known to bird-dealers, who often place an old skylark in a cage with a brood of young birds, knowing by experience that the former is sure to take compassion upon the helpless nestlings. The young birds reared from the nest become exceedingly attached to their owners, and readily acquire the notes of any bird under whose tuition they may be placed. Such birds as are captured adult, and in open weather, are, however, apt to pine for the loss of their liberty; but those that are caught when deep snow is lying on the ground are more susceptible of domestication, and soon begin to sing. The eggs of the skylark are white in ground-colour, thickly blotched and freckled with brown and grey. Young birds may be found in the nest at any time from April to September. Skylarks do not wash, but delight in cleansing their plumage by dusting their feathers in dry earth; this being done in order to remove ticks or other parasites that may be adhering to them. On their migrations, skylarks often appear at the light-houses in dense hordes, and vast numbers are killed upon the island of Heligoland. Although the song is principally uttered during the spring and summer months, we have often heard wild larks singing in snatches in November, and in the Highlands the skylark begins to sing in summer about an hour before daybreak.

The food of the skylark consists of the seeds of oats, wheat, barley, and wild plants, together with such insects as it meets with in the ploughed fields. In plumage these birds are subject to considerable variation, so much so as to constitute local races. Black, white, and cream-coloured varieties occur occasionally, but only in very small numbers in comparison with the abundance of birds in ordinary plumage. The adult has the upper-parts brown, tinged more or less with rufous, many of the feathers having dark centres; the wings are dark brown, the primaries being narrowly edged with white on the outer webs; the tail is brown, with the exception of the outer feathers, which are nearly all white; the throat and breast are buff, streaked with brown; and the rest of the under surface creamy white. Both sexes are alike.

The Woodlark. Although formerly included in the same genus with the skylark, the woodlark (*Lullula arborea*) is now very generally referred to a genus apart, of which it is the sole representative. It may be readily distinguished from the former by its shorter tail, more distinctly marked breast, and by a distinct light streak over the eye and ear-coverts; while its size is considerably smaller. It is figured on the illustration on p. 418. Unlike the skylark, which frequents open country, the woodlark prefers fields that border upon woods,—"in localities," writes Mr. Dresser, "where the soil is sandy and partially covered with second growth, large trees being sparsely scattered here and there; this species is generally numerous but it does not frequent the dense forest. In its habits it is lively and sprightly, fond of the society of its congeners, and not quarrelsome, but rather more shy than the skylark. It frequents the ground far more than is commonly supposed, and indeed only perches occasionally upon the outer branches, chiefly during the breeding-season, when singing. It seeks its food almost always, if not solely, on the ground, and runs with celerity and ease. It roosts on the ground in open places close to the woods, under weeds or grass, or in the old weed-covered furrows, and retires early to rest. It is more affected by the cold weather than the skylark,

and migrates earlier to the southward than that species. Its song is sweet and flute-like, more melancholy than that of the skylark, and is generally uttered from the top of some tree, or else when the bird is on the wing. It rises to some height before commencing, then ascends, singing, higher and higher, throwing itself from side to side, hovers and floats in the air, and when the song is ended drops with closed wings to the ground again. It sings not only in the mornings and evenings but also at other times of the day, and in the night, especially at night."

The woodlark constantly builds upon the ground, usually in a tuft of grass, or in a depression of the earth, sheltered by a low bush. Built of stems of grass and moss, and lined with hair and wool or fine bents, the nest is more compact than that of the skylark. The eggs are generally white in ground-colour, finely freckled, and blotched with brown and purplish markings, which are often bold, and sometimes arranged in a zone. The woodlark occasionally nests in confinement. A very local bird in the British Isles, especially in the breeding-season, when it is chiefly found in the southern and western counties, particularly Devonshire, the woodlark is common in Southern Norway and Sweden, and extends eastwards through Central Russia, ranging south to Spain, Morocco, and Egypt. The plumage of the adult is brown above, each feather being striped with dark brown and edged with rufous; a broad, yellowish white stripe extends from each eye to the nape, forming an irregular collar; the rump and upper tail-coverts are greyish brown; and the tail is dark brown, with the central pair of feathers much lighter than the others, while the outer pair are dirty white towards the tip, and their outer webs bordered with white.

The Crested Larks.

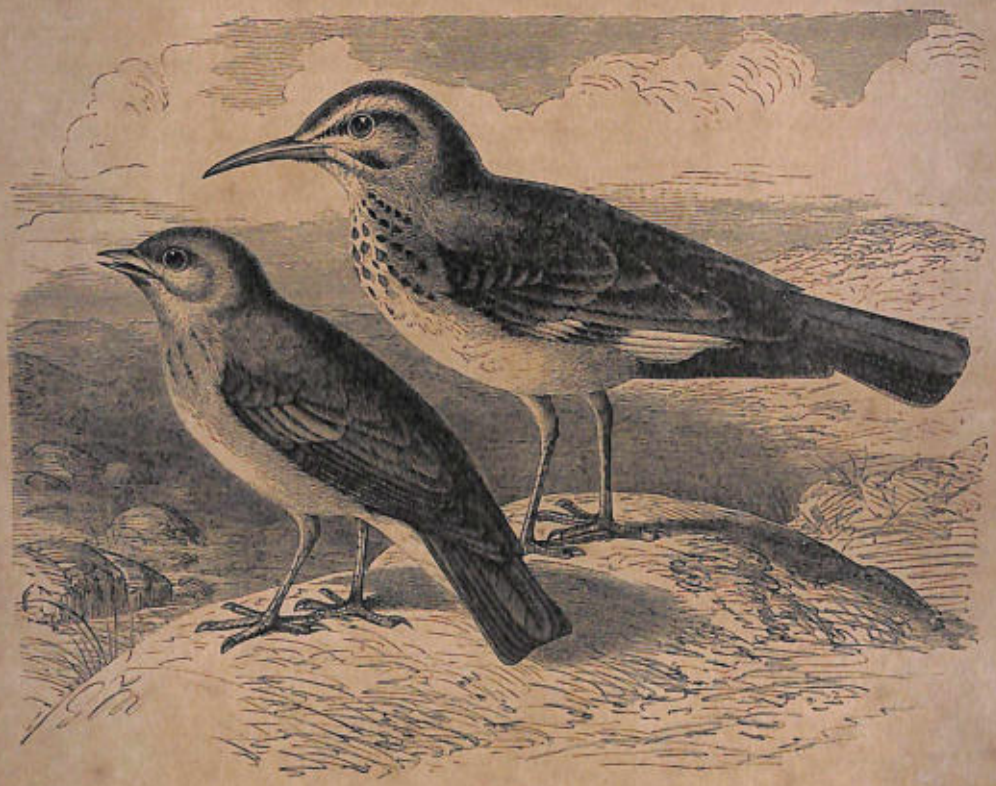
The crested larks, as typically represented by the European species (*Galerita cristata*), are sufficiently distinguished from both the foregoing genera by the presence on the head of a crest composed of a few very long feathers springing from the centre of the crown. The common species is a partial resident in Continental Europe, and a rare accidental visitor to the shores of Great Britain. In the spring of the year it may be seen in the north of Spain travelling in flocks apparently composed exclusively of its own kind, which generally frequent the ploughed fields in preference to grass-lands. These large flocks are relatively wild; but on other occasions crested larks may be observed running tamely on the turf bordering the highroad, elevating their crests as they run along together. Mr. Dresser states that "in its habits the crested lark is confiding and fearless, and in the neighbourhood of villages and inhabited places is one of the most unsuspicious and tame birds. When in Southern Germany and Hungary, where it is very common, I observed it on almost all the highroads and in the streets of the small towns and villages pecking about amongst the horse-droppings almost as tamely as a London sparrow. They appear very fond of inhabited places, and frequent highroads, seldom being found very far from these, and when disturbed by a passing vehicle will either run on one side and let it pass, or fly on, again and again, as the traveller approaches them. In different parts of Europe they are resident or migratory according as the locality is suitable or not for winter quarters; but in most parts they are partial migrants, merely shifting their quarters according to season." In Germany, Naumann writes, "they leave their northern haunts in the winter, which

they spend in smaller or larger companies in milder climates. Many winter on the Main and Rhine, and in Franconia and Thuringia, arriving there in October and November, and disappearing at the first commencement of spring. Here in Northern Germany these larks are resident or partially migratory, these latter rambling in pairs or small companies from place to place, and arriving in winter where they are not observed in summer, but seldom remain there long. The time of migration is in November and December. Old pairs remain year after year at the same breeding-place. They migrate from the one inhabited place to the other in the daytime, generally in the forenoon, and fly at a considerable altitude." The song of the crested lark is sweeter and in some respects more pleasing than that of the skylark. This lark nests upon the ground in any small depression of the soil or behind a clod of earth; the nest being loosely and simply constructed of stems of dry grass and fine roots, sometimes lined with a little horsehair. The eggs are greyish white in ground-colour, marked with dark or light brown and grey. Fresh eggs may be found from the middle of April until the middle of July. The crested lark is a favourite cage-bird in Germany; and it may be seen from time to time exposed in the Paris bird-market. In India the crested lark is frequently caged, and kept in darkness by its cage being wrapped in a cloth. In this state it learns to sing very sweetly, and even to imitate the songs of other birds. The crested lark has the upper-parts brown; the feathers of the neck and back having dark centres fringed with buff; the crest is conspicuous, and consists of nine or ten narrow feathers, blackish brown in colour, edged with buff; the lower-parts are creamy white; while the sides of the throat are spotted with blackish brown; the feathers of the breast and flanks being streaked with dark brown.

The Desert-Lark. In this genus (*Alæmon*) the bill is very long and slender, gently curved on its terminal half, while the nostrils are fully exposed to view; the first of the ten primaries of the wing being small, but exceeding the primary coverts. The toes and claws are very short, and the latter are stout. The plumage is the same in both sexes.

The desert-lark (*A. desertorum*) inhabits the deserts of Arabia and Northern Africa, extending eastwards into Afghanistan and Western India. It is thinly distributed throughout the desolate wastes in which it finds its home, living in pairs, each of which enjoys the run of its own territory. This lark traverses the sandy plains with great celerity. The song of the male is often uttered in the breeding-season, but it is short and unpretentious. Breeding in May and June, when it makes a small nest of dried grass on the sand, the desert-lark lays eggs, which are greyish white, marked with yellowish brown. The plumage of many birds has become modified in order to serve the purposes of concealment from their enemies; and the desert-lark, like other species that haunt sterile wildernesses, has gradually assumed a plumage of an isabelline grey, tinged with ash on the forehead and upper tail-coverts. The first primaries are black, with white bases; the tail-feathers black margined with fulvous, the two central feathers being sandy brown, broadly edged with very bright fulvous; a black streak passes through the lores with a white band above and beneath; a black band passes backward from the eye; the chin and throat are white, as is the abdomen; but the fore-neck and breast are pale fulvous, spotted with black.

The Finch-Larks. Another genus (*Ammomanes*) belonging to the group, with ten primaries to the wings, is formed by the finch-larks, of which the African finch-lark (*A. deserti*) is represented in the left-hand figure below, while other species inhabit India. Having the first primary long, as in the preceding genus, these larks are specially distinguished by the thick beak being much shorter than the head, and the nostrils concealed by plumelets. They inhabit



THE AFRICAN FINCH-LARK AND DESERT-LARK (½ nat. size).

open arid plains, from which they rise singing in the air for a short distance, and then suddenly drop.

There are several other genera of the group, such as the Asiatic bush larks (*Mirafra*), which may be distinguished from the finch-larks by the open nostrils.

The Short-Toed Larks. The short-toed larks, genus *Calandrella*, are inferior in size to most of the family, and have the bill short and stout, with the upper mandible arched; while there are only nine primaries in the wing, of which the first is long and reaches to the tip; the inner secondaries being lengthened and reaching to the end of the primaries, or nearly so; and the tail being rather long and slightly forked; and the claws slightly curved and very short. Five species of short-toed larks inhabit Europe and Northern Asia, and three others are found in India.

The European short-toed lark (*C. brachydactyla*) is a common species in Southern Spain, and is one of the most characteristic of birds of Malta during

the summer months, frequenting the wildest parts of the island, where its song is frequently uttered, as the male thus encourages his mate in the duties of incubation. Its range extends eastwards to Turkestan, and in winter it visits Upper India. Its mode of ascending in the air differs from that of the skylark, consisting of a succession of jerks. The short-toed lark is caught in considerable numbers by the French bird-catchers, to judge from the frequency with which we have found the species for sale in the Paris bird-shops. Its food seems to consist almost exclusively of small seeds, the husk of which it has the faculty of breaking



BLACK LARK, WHITE-WINGED LARK, AND SHORT-TOED LARK (½ nat. size).

in its bill; but we may presume that insects of some sort are supplied to the young. On the ground this lark runs quickly, and it is especially fond of grovelling in sand. When at large, it never perches on shrubs or bushes, though in confinement, like the skylark, it will readily take to a perch. The cock has a lively song, given on the wing both in the morning and evening, but seldom in the middle of the day. The nest is formed of a few bits of grass collected in a depression of the ground, often a horse's footprint; and the eggs, four or five in number, are of a French white, generally minutely freckled with pale hair-brown. The adult has the upper-parts sandy grey, the feathers having dark centres; the wings and tail are blackish brown, some of the feathers being margined with buff;

the sides of the head are marked with blackish brown, a creamy white stripe extending over and behind the eye; on each side of the upper part of the breast is a blackish brown patch; and the under-parts generally are white washed with buff. Individual specimens vary considerably in tint, some being more rufous or grey than others.

The Calandra Larks. This group comprehends a small assemblage of large, stout-billed larks, characterised by black patches of feathers on each side of the breast. The wing has ten primaries, the first being very minute, and is very long,



CALANDRA LARK (⅓ nat. size).

reaching nearly to the tip of the tail; the claw of the first toe being long and straight. This Old World group is chiefly found in Southern Europe, Algeria, Egypt, Nubia, and India; the Eastern representative of the Western bird inhabiting Northern China.

Calandra Lark. The calandra (*Melanocorypha calandra*) is one of the finest of European songsters, which it would be difficult to overpraise, as it would also be difficult to exaggerate the beauty of its glorious song which is full of changes; although individuals vary in the proficiency of their vocal powers. In appearance, it somewhat recalls that of the corn-bunting. It is a heavily-built bird, and somewhat similar to the latter in shape, but it does not dangle its legs in the air when flying. A permanent resident in the south of France and Spain, in

parts of Italy and in Greece, the calandra is common also in Turkey; while many are shot in winter, as they are large, plump birds, and much in request for eating. Mr. G. F. Mathew states that "the male on commencing his song springs from the ground, and with a graceful undulating motion describes a series of large circles until he rises to an immense height; his song is then clear and beautiful, but at close quarters it is piercing and unpleasant. The call-note is loud and harsh, and somewhat similar to that of the corn-bunting. With the Portuguese it is a favourite cage-bird, and in many of the streets of Lisbon may be seen hanging outside every door in cages. At Gibraltar it is frequent, and many are caught on the neutral ground by bird-catchers who use clap-nets with decoy call-birds." The calandra lark makes its nest in a depression of the ground, often at a depth of three or four inches. The nest is a careless structure built of grass stems. The eggs are dull grey in ground-colour, blotched with brown and pale amber, with underlying markings of grey and light brown. The adult is greyish brown above, the feathers having dark centres; the under surface of the body is white tinged with fulvous, and streaked finely with dark brown. The distinguishing character of this species is a large patch of black adorning the sides of the neck.

Black Lark. This species (*M. yeltoniensis*), which is figured on p. 423, inhabits the steppes of Central Asia, migrating westward into Southern Russia in the autumn and winter. After rearing their progeny, these larks congregate, especially in August, and wander over the brackish places of the desert throughout the whole autumn, especially in the region of the salt-lake Yelton. In the middle of winter, when the snow covers the land, they approach the towns and suburbs.

In summer, when on the ground, the black lark emits a feeble piping, generally singing from a hillock, but its song is not powerful. Its nest is merely a slight hollow in the ground, lined with a few vegetable fibres, moss, and dried grass. The female lays four eggs, bluish in colour, and spotted with yellow; these being deposited from the end of April till the end of July. In plumage, the black lark varies at different seasons; in spring, the entire plumage of the male being black, with the feathers of the back, rump, and breast, edged with light sandy, but these markings become almost completely obsolete in the height of summer. The general colour of the female is sandy brown, the lores and superciliary stripe being whitish, the wings and tail dark brown, edged with sandy; the under surface of the body white tinged with buff; the upper part of the breast mottled with brown; and the flanks striated.

White-Winged Lark. This Siberian lark (*M. sibirica*) has only once or twice wandered into Western Europe; its home being in the steppes of Eastern Russia, whence it extends eastward as far as the Yenesei. It has once occurred in Great Britain, a female having been captured near Brighton in 1869, whilst consorting with a flock of snow-buntings; and it has likewise been obtained in Belgium and Western Germany. Arriving on its breeding-grounds in Russia in the spring much later than the skylark, it affects grassy and open districts; and when singing, often soars aloft, but does not ascend so high as the skylark. It pairs about the middle of May, and builds its nest of grass upon the ground. The eggs, four or more in number, are greyish white, closely marked with dull brown. The adult male

in summer-plumage has the upper-parts rich brown, bordered with russet, becoming lighter on the nape; the crown, lesser wing-coverts and upper tail-coverts being a brilliant red-russet, which gives the bird a marked and distinct character; the primaries are dark brown, the first white on the inner web, and becoming almost entirely so in the middle; the tail-feathers are brown edged with white on the inner webs; the throat and sides of the neck are spotted with brown and russet; and the under-parts are white. The female is similar, but duller and less pure in tint.

The Horned Larks.

The horned larks are distinguished in the adult male plumage by a tuft of feathers springing from each side of the crown; the bill being rather short, and slightly arched; the nostrils are densely covered by plumes, the



HORNED, OR SHORE LARK (½ nat. size).

wings are long, and the claw of the first toe is straight and about as long as the toe. These birds are remarkable for the constancy of the pattern of their plumage; yellow and black being usually associated with vinaceous brown. This genus (*Otocorys*) is strongly represented in the New World, the northern parts of which possess several species, one of the number at least being virtually identical with the common horned lark of Europe. The latter bird (*O. alpestris*) appears to inhabit the whole of the northern parts of Europe and Siberia; and other species are

found in the Himalaya and adjoining plateaus, two of the number being peculiar to very high altitudes; Mr. Blanford having met with Elwes' horned lark in Sikhim at nearly eighteen thousand feet elevation.

The horned lark breeds on the fjelds and tundras of Northern Europe, extending southwards into Central Norway. Formerly it was regarded as a rare straggler to the coast of Great Britain, but it is now known that considerable numbers of these birds annually cross the North Sea to winter upon the eastern shores of England. Certain spots are frequented by these birds year after year, where they feed chiefly on the seeds of marine plants. For many years the horned shore-larks that visited Britain proved to be males almost exclusively; but females have latterly been taken in considerable numbers, although not in the same proportion as the males. The shore-larks, which winter on the British coast, rarely wander inland, although they sometimes migrate across England from the Yorkshire coast to that of Lancashire. They arrive during the last months of the year, and remain until the end of February, or even the middle of March. Mr. Seebohm writes that "the shore-lark is as much a bird of the tundra as the snow-bunting and the Lapland bunting, but it breeds at a lower latitude than the former species, and is almost as abundant as the latter is more local. It avoids the marshy districts, and confines itself to dry sandy plains or rocky hills, though it comes down to the mud-shores of the rivers to drink. It is one of the earliest of the small birds to arrive at its breeding-grounds. The snow-bunting and the mealy redpoll arrive first, and may be seen running about on the snow some weeks before the ice breaks up; but as soon as the thaw begins in earnest a batch of small birds arrives, among which is sure to be the shore-lark . . . During migration the shore-lark is a gregarious bird, and though the first flocks consisted of shore-larks only, as soon as the Lapland buntings began to arrive, they seemed to be on the best of terms together, and the later flocks usually consisted of both species. Flocks of pipits were migrating about the same time, and it was very striking to contrast the wildness of these birds with the tameness of the shore-larks. The shore-lark often sings on the ground, and when apparently too busy feeding to mount in the air for the purpose, will occasionally utter snatches of song. At their breeding-places they sing continually, mounting up into the air like a skylark, and singing their charming song as they sail about with wings and tail expanded. The song is very melodious though short; and among its few variations a long drawn-out note often occurs, which resembles much the song of the corn-bunting. It often remains some time in the air and sings its little song several times over before it descends. It will also sing from the roof of the wooden houses. Its call-note is loud and clear, but scarcely capable of being expressed by a word. In Lapland, the shore-lark lays its eggs from the middle of May to the middle of June, but in Siberia not before the latter date. The nest is always built on the ground, generally in some slight hollow. I found one in Finmark in the middle of a mountain-pass, in the hollow formed by the foot of a horse in the soft mud which the sun had afterwards hardened. Others were amongst stones on the bare ground, and one under the shelter of some rushes in the grass. The nest is loosely made of dry grass and stalks; and the inside, which is rather deep, is lined with willow down or reindeer hair. Four is the usual

number of eggs, but very often only three are laid, and sometimes as many as five. They may be said to be characteristic larks' eggs, and only differ from those of the skylark by their more olive shade of colour. The ground-colour is a pale greenish or pale brownish white, often so coloured by the profusion of markings as to be scarcely visible. The overlying spots are small and irregular in shape, of an almost neutral brown colour, and nearly conceal the paler and greyer underlying spots." The adult male shore-lark in breeding-plumage has the forehead, and a stripe over each eye, the chin, and upper throat pale yellow; the crown, and tufts of the head, the lores, and a band across the lower neck are black; the upper-parts are vinaceous brown, and the under-parts dirty white. The female is similar, but all her colours are duller, a remark which applies to the bird of the year. In winter-plumage the shore-lark lacks the ruddy vinaceous tinting characterising the breeding-plumage. The intensity of the latter is obtained by a change in the actual colour of the feather itself, and is not produced by a moult. The young have the whole of the upper plumage dark brown spotted with dull yellow; the throat being pale yellow streaked with black; the lower-parts are dull white.

Wagtails and Pipits.

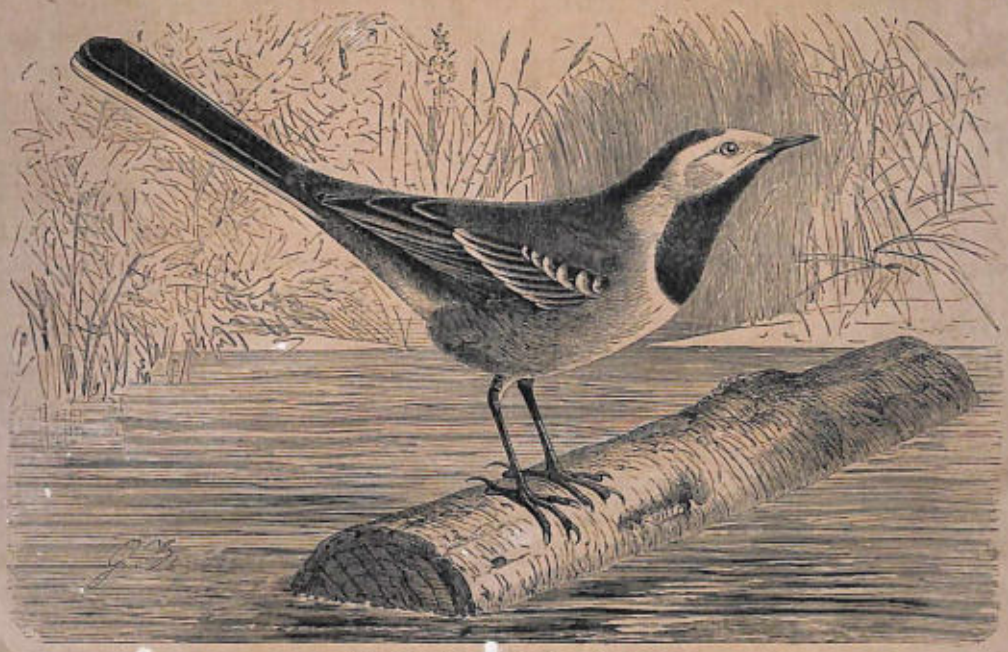
Family *Motacillidæ*.

The members of this family are a group of slender-bodied birds, possessing among their common features a slender bill adapted to an insectivorous diet, a wing composed of nine primaries, long slender feet, and a long tail generally about equal in length to the wing. The wagtails are distinguished from the pipits by their proportionate longer tails; and also by their gay colours, in which yellow usually predominates; they are migratory, and perform long and arduous journeys to and from their breeding-grounds. The wagtails and pipits are chiefly inhabitants of the Old World, especially the northern portions of Europe and Asia, being represented in North America by two species found in Alaska, but not in the eastern portions of that Continent.

The Wagtails. The white wagtail and its congeners are small, elegantly-shaped birds; all in the habit of running over grass in pursuit of insects. The bill is slender, nearly straight, and very slightly notched at the tip; while the wings are moderate, the first three primaries being about equal and longest, and the inner secondaries very long; the tail consists of twelve long narrow feathers; and the metatarsus is long and slender. The white wagtail is found throughout Northern Europe, extending as far East as the Yenesei, and wintering in North Africa; while an allied species is found in Persia; a third breeding in Northern China, and wintering in Burma. Seven species of the genus *Motacilla* are found in South Africa; while no fewer than thirteen visit India during the winter season, at least one of these being a permanent resident in that country.

The White Wagtail. The white wagtail (*M. alba*) is a common summer visitor to the northern and central portions of Europe, delighting in public parks and gardens, where it may be seen running at the roadside in pursuit of its insect prey. In Portugal its provincial name signifies "washerwoman," the

analogy having been suggested by the habits of the rural laundresses, who, wading into the streams, cleanse the clothes on a stone. It is partial to the neighbourhood of old buildings and outhouses, and often nests in such situations; and in Switzerland it seeks the mountain-chalets and cow-sheds, in search of the insects to be found in the neighbourhood of domestic animals. The nest of this wagtail may be either among the roots of a tree, or in a bank by the riverside, or occasionally on a shelf in some outbuildings. Mr. Seebohm says that, in Siberia, the white wagtail is one of the first of the soft-billed birds to arrive on the Arctic Circle in any numbers. This wagtail nests two or three times in the season, rearing four or five young ones in a brood; the nest being built of dry stems of grass, moss, and fibres, closely worked together and neatly lined with wool, hair, and often feathers. The eggs



THE WHITE WAGTAIL (⅔ nat. size).

are white in ground-colour, spotted and speckled with greyish brown. When the young leave the nest, they live for some weeks with their parents, haunting garden-lawns and meadow-lands in search of food. The flight of the white wagtail is rapid and undulating. The call-note is loud and sibilant, and the song somewhat pleasing, although far from powerful. The white wagtail sometimes migrates in large parties, and is fond of roosting in the cover supplied by aquatic reeds. All the movements of this bird are elegant and rapid, perhaps even more so than those of the closely-allied pied wagtail (*M. lugubris*), so well-known in the British Islands as a summer visitor. White varieties of this wagtail are occasionally seen, in which the characteristic pattern of plumage had become almost obsolete. The adult male in the breeding-season has the forehead and sides of the head pure white, the crown, back of the head, and nape jetty black; the back, rump, and upper tail-coverts pure pearl grey; the primaries and wing-coverts

dusky black, edged with greyish white; the tail black and white; the chin and throat black; and the lower-parts pure white.

Yellow-Headed Wagtails. The yellow-headed wagtail (*M. citreola*) is a native of Siberia and Eastern Russia, wintering in most parts of the Indian Empire, and apparently finding its westward summer limits in the valleys of the Petchora and Volga. It breeds in Kashmir, where the nests are placed under clods in the ploughed fields. The proper home of this beautiful bird is, however, amongst the dreary tundras of the far north; Mr. Seebohm having observed it perching on alder-bushes in the neighbourhood of flooded land on the banks of the Petchora. There it breeds in June, and its habits resemble those of other yellow wagtails, its light dainty form assimilating closely to that of the blue-headed and yellow wagtails. The adult male in summer has the entire head and neck deep yellow, as are the under-parts; the upper plumage being ashy grey tinged with bluish.

Grey Wagtail. The species which haunts the streams and mountain torrents of Central Europe is the grey wagtail (*M. melanope*). A common summer visitant and partial resident in the British Isles, shunning the neighbourhood of sluggish, turbid rivers, and delighting in tiny cascades and rippling waterfalls, the grey wagtail is fond of wading daintily in the shallows of a stream, and running over the rocks rising out of the bed. Never found at any distance from water, the nest is placed in a variety of situations, often in the recesses of some loose stone wall, or mossy shelf of rock overhanging running water; while a hole in a wooden bridge is occasionally selected. Nesting year after year in the same place, the grey wagtail is a very early breeder, full complements of eggs being laid early in April; and it breeds twice in a season, the second brood being generally fully fledged about the middle of July. The nest is built of dry stems of grass and a few roots, usually lined with horsehair; six eggs being laid in a clutch, which are white in ground-colour, suffused with pale brown or olive. The grey wagtail has a pretty little song, often uttered from the top of some willow or other riverside tree; the males are very jealous, each choosing his own territory from which every intruder is ousted. Even when the first broods of young are already fledged, and actively searching for food in company with their parents, the old cocks are always on their guard against the possible intrusion of a stranger, whose approach is invariably heralded with a challenge to combat. During its migrations the grey wagtail visits many low-lying districts far remote from its haunts by rocky rivers, occurring near London every winter. This wagtail bears confinement well, and has been known to pair with the pied wagtail in captivity and produce hybrid young. The adult male in summer has the crown and upper-parts slaty grey, the upper tail-coverts greenish yellow, a white stripe passing above the eye and another beneath the lore; the chin and throat are black, and the lower-parts bright yellow. In winter the chin and throat are dirty white, the breast dull buff, and the under-parts greyish white tinged with yellow.

Blue-Headed Wagtails. One of the prettiest of all the wagtails is the blue-headed species (*M. flava*), well known in most parts of Europe, though but a chance summer visitor to the British Islands. In Holland, on the other hand, the present species is of general distribution, though most numerous on the banks of streams and in the neighbourhood of morasses. Its flight is swift, graceful, and undulating,

often accompanied by a cheery call-note which can be heard at a considerable distance. Sometimes it frequents gravelly islets like the grey wagtail, but this is rather the exception than the rule, since the bird prefers the environs of sluggish rivers and the banks of canals to more rapid streams. The blue-headed wagtail nests in meadow-lands, generally in a tuft of grass or a tussock of rushes, but sometimes a number of pairs nest together in a single field. The nest is built of



YELLOW-HEADED WAGTAIL, BLUE-HEADED WAGTAIL, AND MEADOW-PIPIT (½ nat. size).

dry stems of grass and scraps of moss, lined with fine bents and hair; the eggs being yellowish white in ground-colour, mottled and clouded with pale brown. When the eggs are hatched, the old birds wait eagerly upon their offspring, continuing to watch over their safety long after they are fledged. These birds are exceedingly fond of the neighbourhood of horses, running in and out between the feet of the animals with singular unconcern. The adult male has the upper-parts yellowish green; the forehead, crown and lores, a beautiful slaty blue, set

off to great advantage by the white eyestripe, the under-parts being pure yellow. The female has the crown of the head greenish brown instead of blue, and the eyestripe is less pure; the under-parts being of a duller yellow. A figure of this bird is given on the left side of the woodcut on p. 431.

Cape Wagtail. The European wagtails are replaced as familiar birds in South Africa by several allied species, of which the best known is the Cape wagtail (*M. capensis*). Frequenting the crowded cities no less than the outlying farmhouses, this wagtail is everywhere protected, in recognition of its charming ways. Like their European cousins, these birds consort much with cattle, for the sake of the small flies found about those animals; and they also frequent the sea-beach to procure the flies bred in the putrefying seaweed. The nest is generally constructed in the side of a bank, or a crevice of a stone wall; it is cup-shaped and constructed of dry grass lined with cows' hair and fur. Sometimes it is built under some projecting stone or overhanging root on the bank of a stream. The eggs are brownish cream-colour, freckled with brown. The Cape wagtail has the dipping flight peculiar to the genus, and like other wagtails is fond of seeking its food on the margins of muddy streams; and it has a pretty song, which however is seldom uttered. Sometimes it is seen in flocks, especially when the birds are gathering to roost in some favourite tree; at other times it lives chiefly in pairs, preying upon insects, which it takes both upon the ground and on the wing. The adult male has the head and hind-neck ashy grey, the eyestripe, cheeks, and throat white, the upper-parts brown, washed with olive, the tail-feathers blackish brown, with the exception of the outer feathers which are chiefly white; a black crescentic band crosses the neck, and the breast and under-parts are yellowish white, and the sides of the body brown.

Pipits. The pipits of the genus *Anthus* form a large group of plain-coloured birds, characterised by the possession of a slender bill very slightly notched at the tip. The legs are proportionately slender and generally adapted for terrestrial progression; the wings are moderate in length, but the tail is comparatively short, and often slightly forked. Unlike the larks, the pipits have the nostrils unprotected by feathers; but in certain species the first toe is much elongated. Practically cosmopolitan in their distribution, pipits are represented in all parts of the world except the islands of the South Pacific; they are, however, really an Old World race, since only two, out of a total of some forty known species, are inhabitants of North America.

Tree-Pipit. Even in Northern Europe, the tree-pipit (*A. arboreus*) is a fairly well-known bird, but its favourite haunts are the mild climate of the British Isles and Central Europe; and it shuns high and barren regions, preferring the shelter of well-timbered valleys and the undulating hollows of English parks. All the pipits are quarrelsome and fond of fighting individuals of their own kind; and on one occasion we observed a tree-pipit chase another of the same species against the side of an hotel in Switzerland, the pursuer following up the chase with such energy that he was unable to check his course, and, dashing against the window, dropped stunned on the ground. Another time a tree-pipit chose to take up his abode in a small garden which was also a favourite hunting-ground of a robin, and although the fight was sharp the robin was eventually vanquished.

The tree-pipits migrate in flocks, and in the spring the birds soon pair, when each couple selects its own area of breeding-ground. The song is melodious, its notes bearing a strong resemblance to those of the canary. Sometimes this pipit sings upon the ground, threading its way furtively through the stems of the hay crop, pouring forth in snatches a volume of melody. Oftener the song is uttered while the bird is perching on one of the larger branches of a tall tree by the roadside, or when on the wing. Mr. Seebohm writes, that it is a pretty sight in early spring to watch the tree-pipit essaying his short flights, as he "springs up from the topmost twig of some branch, and mounts nearly perpendicularly into the air warbling his pretty song. He soon begins to hover in the air, and, as if fatigued by his recent journey, almost immediately descends with tail and wings extended like a parachute, and at last finishes his song on the ground, in a tree, or on a wall. His downward course is in a semi-spiral curve, and he alights where the curve of his flight would make a tangent to the surface of the ground. All this time he has been singing melodiously, the clear, rich, joyous notes following each other in rapid succession, until, as he reaches his perch, he concludes his song with several long-drawn notes expressive of almost impatient anxiety." The tree-pipit nests upon the ground, often upon a bank skirting the edge of a wood; the nest being always well concealed, and built of dry stems of grass and moss, lined with fine bents and hair. At times several pairs nest on a single strip of moorland, although this is unusual. The eggs vary greatly in colour, but the most usual type has the ground-colour white, so closely suffused with deep brown as to be almost entirely of the latter colour. The young birds leave the nest early and soon become independent of their parents. In autumn these birds flock together, and many are captured by the bird-catchers. The upper-parts of the tree-pipit are brown, the feathers having dark centres, and the lower parts buffish white, profusely spotted with dark brown.

Meadow-Pipit. Upon the waste moorlands of Western Europe the meadow-pipit (*A. pratensis*), figured in the illustration on p. 431, generally replaces the tree-pipit, and finds a congenial abode among peat-bogs and dreary wastes only redeemed from ugliness by large strips of cotton-grass. A partial resident in most of its haunts, many individuals, merely shifting from the higher grounds to the plains before the arrival of winter, the meadow-pipit loves rough marshy ground and treeless wastes of heather, rearing its young in the most remote and forbidding solitudes. Although its song is inferior in compass to that of the tree-pipit, it is chanted on the wing. The meadow-pipit nests on rough ground and undrained meadows, building a slight nest of dried stems of grass, often in a tussock of herbage, sometimes a very little above the tide-mark on the sea-beach. The eggs are white in ground-colour, closely mottled with brown or brownish grey. The cuckoo is exceedingly fond of depositing her eggs in the meadow-pipit's nest; and it is diverting to watch a pair of these birds endeavouring to oust one of these undesirable neighbours from their vicinity. It is often assumed that the cuckoo finds a willing dupe in the meadow-pipit, but such is not the case in actual fact. When the cuckoos first arrive in England, and commence to pair and lay, the meadow-pipits assail the strangers with persistency, not only mobbing them with angry cries, but also using physical means to enforce their opinions;

the small birds not hesitating to alight upon the back of the cuckoo. As soon, however, as the young cuckoo has become the sole object of the charge of the pipits, the latter accept the situation with admirable fortitude, working early and late to satisfy the hungry maw of their foster-child. The meadow-pipit is very subject to a variation of plumage, especially when young; one of the prettiest varieties being of a buff canary-yellow throughout, and we have seen others



RICHARD'S PIPIT, WATER-PIPIT, AND TAWNY PIPIT (⅔ nat. size).

pied with white. A small pale race is found in Madeira. The meadow-pipit is olive-brown above, with dark centres to the feathers, often tinged with olive green; the under-parts being buffish white, thickly streaked with dark brown.

Richard's Pipit. A large species of pipit, known as Richard's pipit (*A. richardi*), breeds in North Siberia, whence stragglers often wander to Britain during the autumn and winter. Mr. Seebohm states that he found this pipit "exceedingly abundant in the meadows on the banks of the Yenesei near Yenesaisk. The country is almost a dead flat for miles, and is intersected with half dried-up

river-beds, and chains of swampy lakes, full of tall sedges and reeds and water-plants of various kinds, and half-concealed by willow-bushes and alders, whilst far away in the distance the horizon is bounded on every side by the forest. These oases of grass in the boundless forest are the paradise of Richard's pipit. As I wandered away from the town this bird became more common. I found it difficult to shoot them on the ground, as they ran about on the grass; but I soon obtained as many examples as I wanted, as they hovered in the air almost like the kestrel. . . . Dybowski found them equally common on the plateaus near Lake Baikal, at an elevation of five thousand feet above the level of the sea. They arrive about the middle of May, and build their nests upon the ground in the grass. They usually choose a hollow in the meadows, such as the footprint in the soft earth of a cow or a horse. The first nest is made in the first half of June, and frequently a second brood is reared, the eggs being laid in the second half of July. The nests are said to be very difficult to find. The male keeps watch, and, on the approach of danger, he gives the alarm to the female, who leaves the nest and runs along the ground for some distance, when she rises and joins the male in endeavouring to entice the intruder from the nest with anxious cries. If their little manœuvres are successful, the female drops to the ground and runs back to the nest through the grass. In this district the nest of Richard's pipit is the one usually selected by the cuckoo in which to deposit her eggs. They leave for their winter quarters late in September." The eggs vary in number, from four to six; some are profusely spotted all over with minute specks and blotches of greenish brown upon a pale greenish white ground-colour, whilst in others the spots are reddish brown upon a pinkish white ground-colour. The adult male has the upper-parts nearly uniform brown, beneath buffish white darkest on the breast, which is streaked with dark brown. The sexes are identical. Richard's pipit may always be known by the long metatarsus and greatly developed claw of the first toe. A figure of this bird, as well as of the tawny pipit, is given in the woodcut on p. 434.

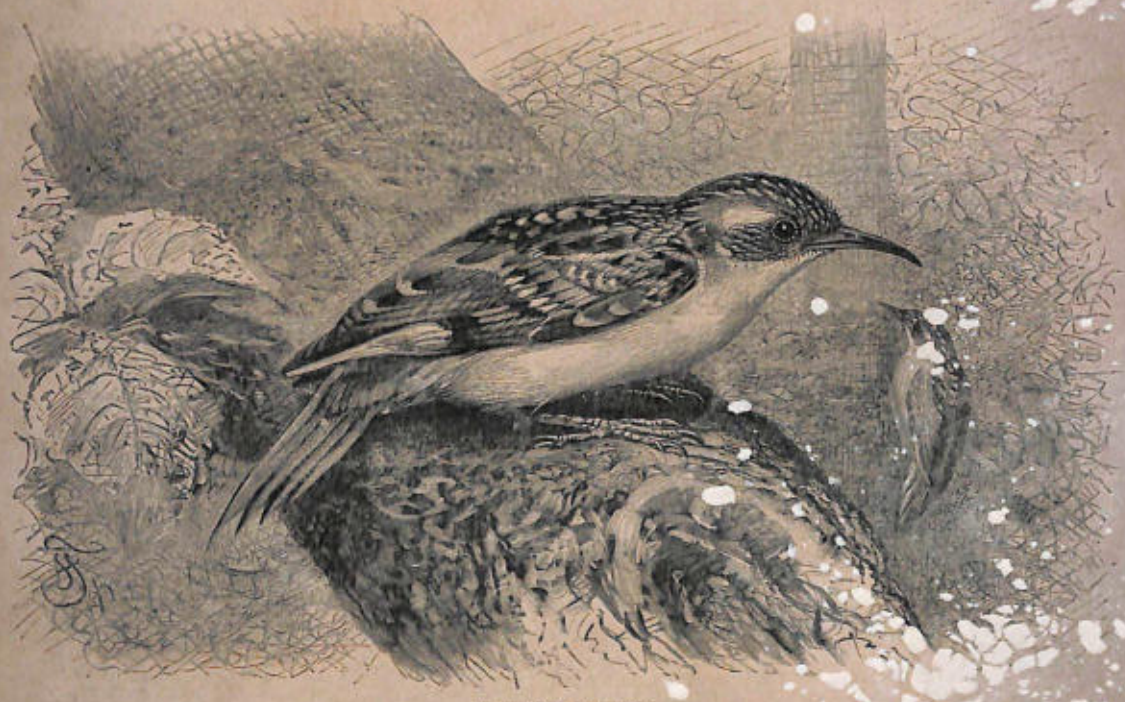
Tawny Pipit. The haunts of the tawny pipit (*A. campestris*) are chiefly in desert-regions at least through a large portion of its range. In Europe it is chiefly known as a summer visitor to certain favoured districts, such as the sierras of Spain and Portugal, the sand-dunes of the Baltic coast-line, and sparingly on high ground in Central France. It is a shy and wary species, even on the breeding-ground. Mr. Seebohm found it very common in Greece, where it is the only pipit that nests. It there prefers the open plains, being especially common on the undulating prairie country, half rock and half grass and heath, between Athens and Marathon. It runs on the ground with great agility, and has a restless zigzag flight, which appears less undulating than that of the meadow-pipit. The nest, according to Mr. Seebohm, "is sometimes under a bush, sometimes beneath a tuft of dense herbage, or under the shelter of a clod of earth; at others in the open plain amongst the growing crops, and often near a dried-up streamlet on a bank beside a convenient stone. It is made of dry grass, often intermixed with a few stems of coarse herbage or straws, together with roots, and lined with horsehair." The eggs are white in ground-colour, profusely spotted with reddish brown and underlying spots of grey. The tawny pipit migrates from its breeding-ground in August, at which season it has occa-

sionally been captured in the British Isles and on Heligoland. The adult male is nearly uniform brown above; the wings and tail being conspicuously edged with buff, while the chin is buffy white, and the lower-parts buffish, slightly streaked with brown upon the breast.

The Creepers.

Family *Certhiidæ*.

The creepers bring us to a small group of birds modified to pursue their prey (comprising spiders and insects) upon the surface of cliffs or the trunks of trees; the best known forms being small and plain-coloured birds, typified by the common



THE TREE-CREEPER.

European tree-creeper (*Certhia familiaris*). All have the beak relatively long, slender, sharp, and curving downwards; the wings including ten primaries, and the tail consisting of twelve stout and pointed feathers, which are often stiffened to aid climbing. The claws are long and curved, and the metatarsus is scutellated.

Some divergence of view obtains among ornithologists as to the limits and serial position of the family. Dr. Sharpe, for instance, who places it near the wagtails and pipits, would include in this family the nuthatches; while, on the other hand, Mr. Oates excludes the latter and includes the wrens within its limits, placing the family between the drongos and the warblers. Employing the term in the original more restricted sense, the *Certhiidæ* are widely spread over the northern regions of both the Eastern and Western Hemispheres; several species also inhabiting the Indian region, while others are peculiar to Australia.

Passing by the tree-creepers (*Certhia*), in which the tail is composed of stiff feathers, and also the Indian spotted-grey creeper (*Salpornis*), remarkable for building an open cup-shaped nest upon a branch, and in which the tail-feathers are soft, we select for special notice the wall-creeper.

Wall-Creeper.

The beautiful creeper (*Tichodroma muraria*), which alone represents the genus, passes its entire existence in traversing the surfaces of precipices in pursuit of the spiders and flies constituting its food.



THE WALL-CREEPER (½ nat. size).

Hence the bill is long, slender, and almost straight, adapted for probing interstices and cracks, such as usually constitute the haunts of its prey. The wing is large and rounded, like that of a butterfly, thus affording an easy support as the bird half flies, half flits about the mural precipices in which it makes its home; the tail is slightly rounded, and composed of twelve feathers; the metatarsus is smooth, and the claws are sharp and curved. Residing in the mountain-ranges of Europe, and ranging eastwards into Central Asia, the wall-creeper is found throughout the

Himalaya, although only as a winter visitor. During the summer months it makes its home among precipitous rocks, either in rugged ravines or upon the faces of cliffs. The flight of this bird almost recalls that of a large butterfly, as it makes its way from one crevice to another, hanging momentarily with expanded wings in one spot, thence shuffling upwards for a foot or two, and then suddenly darting off to explore another corner of the rocks, ever in restless motion, save when it creeps to roost in some secure fissure. The wall-creeper nests from April till June, depositing four or five pure white eggs, sparsely speckled with red, in a nest built of straw, grass, and moss, intermingled with wool and feathers.

The Australian Straight-Claws.

Certain somewhat remarkable Australian birds, placed by Gould among the present family, may be conveniently noticed here, although their serial position is open to considerable doubt, and they are placed by Dr. Sharpe with the *Crateropodidæ*. The genus, of which there are several species, such as the spiny-tailed (*Orthonyx spinicauda*), and yellow-headed straight-claw (*O. ochrocephalus*), is characterised by the short and straight beak, in which the culmen is arched, the moderate and rounded wings, with the first four quills graduated and shorter than the fifth, and the long tail, in which the feathers are broad, and furnished with soft webs, but with stiff, rigid shafts, terminating in naked points. The feet are very large and strong. Inhabiting South and Eastern Australia, the common species frequents remote situations in the bush, rapidly traversing the surface of moss-covered stones and the fallen trunks of trees in search of food. It never climbs, and is solitary in its habits, seldom more than two being seen together. Its oft-repeated cry of *cri, cri, cri, crite*, betrays its presence, when its native haunts, the most retired forests, are visited. Its food consists of insects and wood-bugs. The eggs are white and large in proportion to the size of the bird. The situation of the nest is the side of a slanting rock, the entrance being level with the surface. The adult male has the head and upper-parts reddish brown; the wings are brown, the coverts largely tipped with grey; the primaries are crossed with grey at the base; the tips of the secondaries are tipped with dark brownish grey; the tail is dark brown; the sides of the head and neck are dark grey; the throat and chest white, separated from the grey of the sides of the neck by a lunar-shaped mark of deep black; and the flanks and under tail-coverts grey, stained with reddish brown. The female differs from her mate, in having the throat rich rusty red instead of white.

The Nuthatches.

Family *Sittidæ*.

Regarded by Dr. Sharpe as inseparable from the creepers, the nuthatches are retained as a distinct family by Mr. Oates, who considers them to be most nearly related to the *Crateropodidæ*. These birds have the edges of both mandibles smooth, or the upper one slightly notched; the hinder surface of the metatarsus is smooth, and covered with two entire longitudinal plates; the wing has ten primaries; the nostrils are clear of the line of the forehead, and overhung by some

hairs; bristles are present at the rictus of the gape; there are twelve tail-feathers; and the first and second toes are of very unequal lengths. In all the group there is but one annual moult, and the plumage of the nestling resembles that of the female; while in most cases the coloration of the plumage is different in the two sexes. With the exception of South America and Africa south of the Sahara, nuthatches are pretty generally distributed, extending to Australasia. They are small climbing birds, with the first toe greatly developed, and the second proportionately shortened; and feed both on insects and nuts. Resident in their habits, they nest in the holes of trees or the crevices of rocks, very generally reducing the size of the aperture of the hole by building it up with mud. In addition to the type genus, the family is represented by the Australian genus *Sitella*, and likewise by a third known as *Hypositta*.

Common Nuthatch.

Abundant in many parts of Central and Southern Europe, as it is in England, in the spring of the year the common nuthatch (*Sitta cæsia*) invariably indicates its whereabouts by its merry call-note, which rings far and wide through the beech woods, which the bird chiefly frequents. The nuthatch pairs at the close of winter, and chooses for its nesting-site a hole in some hollow tree, plastering up the entrance with clay, and only leaving a small orifice through which the birds pass into the nest; the interior of the nest being lined with dry beech leaves. The eggs are white, spotted with bright red; and, when the young are fledged, they live for a time with their parents, but soon become independent, and rove through the woods in company with tits and other small birds. If a nuthatch be watched, it will be found that it sometimes perches across a bough like any little singing bird; but when feeding it generally runs up and down the trunk of old trees something like a woodpecker. The call-note of the nuthatch is a loud *twet twet*, which may be compared to the words *fetch it, fetch it*, but this cry must not be confused with the spring whistle of the male. If encouraged, it becomes a tame and confiding bird, laying aside much of its fear of man, and readily learning to avail itself of the resources of civilisation. In winter, especially, the nuthatch approaches dwelling-houses, and willingly partakes of scraps of food with tits. During the summer it feeds chiefly upon insects, but in autumn subsists more upon nuts and beech-mast. Few sights are prettier than to watch a nuthatch opening nuts; the bird swinging its body freely forward as it brings down its long bill with accuracy on the right part of the shell.



NUTHATCH.

Nuthatches have rather a habit of entering houses through open windows, probably out of curiosity; and we owed to this habit a pet nuthatch, which became extremely tame, and used to take flies from our finger. They are decidedly pugnacious, and if two males are placed in the same cage in the breeding-season, the probability is that the stronger bird will kill his rival. The devotion which paired birds show to one another is a marked trait in the character of the nuthatch. Once we saw a great deal of a pair of nuthatches which used to flit about the apple-trees in a garden at Montreux; and we noticed the fearless way in which they foraged for food amongst the dead leaves, often approaching close to us with imperturbable confidence. The adult male has the upper-parts slaty blue; a black line passes from the base of the bill through the eye to the nape; the wings and tail are slaty blue, the outer tail-feathers showing, when open, white edges; the flanks are bright chestnut-red; and the lower-parts buffy white. A variety with a black throat and crown has been recorded.

Syrian Nuthatch. The Syrian nuthatch (*S. neumayeri*) might more properly be called the rock-nuthatch, for its habits in Southern Europe differ in a very remarkable way from those of its congeners; this nuthatch building its nest of earth, small stones, etc., and placing it upon the face of a rock, and constructing a round, funnel-shaped entrance, an inch or more in length. Mr. Seebohm, who found this nuthatch building in the crags near Smyrna, gives the following account of its nidification:—"The nest of this bird is a very curious structure. A recess in the rock is selected, and a funnel made of mud and little bits of dry grass is built in front of it. It is quite an important affair; the base is frequently twenty-four inches in circumference, and the walls vary in thickness from half an inch to an inch and a half. The tube of the funnel, which, of course, serves for the ingress and egress of the bird, is about four inches long, with an internal diameter of an inch and a quarter at the entrance. The outside of the nest is carefully made to resemble the appearance of the rock against which it is built. One which I brought home with me is curiously corrugated or granulated, to imitate the calcareous deposits on the inside of the cave where I found it. The nest is warmly lined with goats' wool, thistledown, and all sorts of soft materials. As might be expected in a bird which remains in its summer home during the winter, it is an early breeder, laying its eggs about the middle of April; and it would not appear to breed a second time in the year, as all the nests I found in June were empty. The number of eggs varies from six to ten. They are very beautiful, well marked, and unlike any other egg with which I am acquainted. The typical egg is about the size of that of the wryneck, but rather wider and flatter at the top and straighter at the sides. It has the same pearly-white ground colour, spotted with large rust-coloured blotches." This nuthatch seems to confine itself entirely to rocks, and never alights on the trunk of a tree. The adult male has the entire upper-parts leaden blue; a black stripe passes through the eye; the quills are bluish brown, edged with russet; the tail is blackish brown, with the outer feathers tipped with russet; and the throat and lower-parts are white, tinged with russet on the flanks and abdomen.

Pigmy Nuthatch. One of the most abundant of the nuthatches of North America is the widely distributed pigmy nuthatch (*S. pygmæa*), which roams

through the woods in flocks composed of its own kind, occasionally joining company with tits and warblers. As many as twenty or thirty may sometimes be seen together, calling incessantly to one another. They feed partly upon the tiny insects which they find lurking in the crevices of the tree-bark, partly upon the seeds of fir-trees. Their notes are very varied. The eggs of this nuthatch are deposited in the hole of a tree, which is sometimes lined and sometimes left bare; the eggs being pinkish white dotted with reddish. The young birds leave the nest in the month of June. Mr. Trippe furnishes the following notice of this bird, which he found breeding up to an elevation of eight thousand five hundred feet in Colorado:—"The pigmy nuthatch is a delicate little fellow, with more of the habits and voice of *S. canadensis* than of the white-breasted species; a similarity carried out by the coloration of the tail, and their half warbler-like movements at times. They are very active and incessantly on the move, creeping over the trunks and limbs of the pines, and tapping vigorously here and there like a woodpecker, and far louder than the other nuthatches do." The adult bird has the upper-parts ashy blue; the top of the head and sides to below the eyes olive-brown bordered with black; the tail-feathers are blackish spotted with white, except the two central ones, which are blue; and the under-parts vary from buffish white to a rich rusty colour.

The Honey-Eaters.

Family *Meliphagidæ*.

Distinguished from all the families hitherto noticed by their long extensile tongue, adapted for extracting the honey upon which they subsist from the flowers of gum-trees and other trees of the Australasian forests, the honey-eaters form a large and interesting group. In all, the beak is long and slender, with the upper mandible curved, but there are no bristles at the rictus of the gape; the feet are generally large, and the wings of moderate length. The group is confined to Australasia and the islands of the South Pacific; and although comprising many genera, our space allows of mention of only a few.

Parson Bird.

The Poë honey-eater (*Prosthemadera nova-zealandiæ*), commonly known as the parson-bird, has the long, slender, and considerably curved beak, broad at the base, while the tail is long and broad. The sole representative of its genus, this bird is found on both the main islands of New Zealand, where it is one of the most abundant of the indigenous species. Sir Walter Buller writes, that in a state of nature, the tui, or parson-bird, is even more lively and active than in captivity. "It is incessantly on the move, pausing only to utter its joyous notes. The early morning is the period devoted to melody, and the tuis then perform in concert, gladdening the woods with their wild ecstasy. . . . When engaged in song the tui puffs out the feathers of his body, distends his throat, opens wide his beak, with the tongue raised and slightly protruded, and gesticulates with his head, as he pours forth the wild harmony of his soul. A pair may often be observed scarcely a foot apart on the same branch performing in concert, for both sexes sing. The notes are rich and varied, now resembling the striking together of metallic rods, then a long-drawn sigh, a warble, and a sob,

followed by a note of great sweetness like the touch on the high stop of an organ. . . . One of its finest notes is a clear silvery toll followed by a pause, and then another toll; the performance lasting sometimes an hour or more. This is generally heard at the close of the day, or just before the bird betakes itself to roost for the night. I have, however, on one or two occasions heard a sweet *tui* toll long after the shadows of darkness had settled down upon the forests, and all other sounds were hushed. At other times it may be heard uttering a sweet warbling note, followed by a sneeze, after that a pause, then a sharp cry of *tu-whit, tu-whit, ooo*, a pause again, and then its warbling note with variations, very soft and liquid, but



POË HONEY-EATER, OR PARSON-BIRD.

ending abruptly in a sound like the breaking of glass." In confinement the parson-bird readily reproduces the cries of other species. It feeds upon ripe berries, flies, and other insects, and the honey of certain wild blossoms; it builds its nest in the fork of a bushy shrub, generally only a few feet from the ground; it is a large structure, composed chiefly of sprays or dried twigs, intermixed with coarse moss, and lined with fine grasses. The eggs are generally white, finely spotted with red or brown. The parson-bird builds twice in the year, the first nest being found in August. The newly-hatched bird is almost entirely bare, but the feathers soon appear, and the growth of the nestling is rapid. The adult male has the general plumage shining metallic green, with bluish purple reflections on the shoulders, rump, and upper tail-coverts; the middle of the back and the scapulars are bronze-

brown; the primaries and tail-feathers are metallic green; the hind-neck is ornamented with a collar of soft plumes, having a white line down the centre; and the lower part of the breast is metallic green, changing into purplish blue. The sides and abdomen are blackish brown, and the throat is ornamented with two tufts of white filamentous feathers.

Stitch-Bird. This honey-eater (*Pogonornis cincta*) has a moderate bill, much compressed and slender, and the gape furnished with slender bristles; the wings are moderate, with the fourth quill the longest; the tail is moderate and forked; and the metatarsus long, robust, and covered in front with transverse scales. Formerly abundant in the southern parts of the North Island of New Zealand, it was never found in the South Island. The stitch-bird is remarkable for the bright plumage of the male, on which account it has been almost completely exterminated by the natives, in order that the chiefs might wear the canary-yellow feathers from the wings in their gorgeous feather robes. Always a shy and retiring species, and difficult to shoot, the Maoris used to take this bird in snares baited with flowers. Sir W. Buller observes that when disturbed by the report of a gun, this bird will fly off to a neighbouring tree with a light and graceful movement of the wing; but when descending to a lower station it adopts a different manner of flight, elevating the tail almost to a right angle with the body, and scarcely moving the wings at all. The male bird erects the tail and spreads the ear-tufts when excited or alarmed; but the female habitually carries the tail perfectly erect, and the wings drooping. The male utters at short intervals, and with startling energy, a melodious whistling call of three notes; but at other times he produces a sharp, clicking sound, like the striking of two quartz stones together, the sound having a fancied resemblance to the word "stitch." The nest is a slight, shallow structure, built of sprays and fibres, lined with fine grass and cow-hair. The egg is yellowish white, thickly spotted with pale rufous. The adult male has the head, neck, and upper back velvety black; a tuft of snow-white feathers is present on both sides of the head; the wings and tail are black; a band of rich canary-yellow encircles the back neck; and the under-parts are light greyish brown. The female is plain brown.

White-Eyes. The group of honey-sucking birds known as white-eyes (genus *Zosterops*) have long been a bone of contention among ornithologists, Dr. Gadow placing them among the honey-eaters, Dr. Sclater with the sun-birds, Mr. Wallace among the flower-peckers, and Mr. Oates in the *Crateropodidæ*, while Professor Mivart makes them the type of a family by themselves. Under these circumstances we have placed them here, preferring to leave their family position open. They are characterised by having the beak curved, slender, and pointed, and the nostrils covered by a large membrane, while the eye is surrounded by a characteristic circle of small white feathers. The tongue, according to Dr. Gadow, is protractile and bifid, with each half broken up into numerous stiff horny fibres, so as to form a brush. The wing has ten primaries, but the first is very minute; and the tail is short and quite square. Twelve species of white-eye are found in Madagascar and the Mascarene Islands, which Canon Tristram divides into the green-backed and grey-backed groups; while five inhabit India, and several Australia. Japan also possesses a species; and several others occur in Africa.

Taking as an example the green-backed white-eye (*Z. gouldi*) of Australia, we find this bird is well known to settlers as being exceedingly partial to garden-fruit. Being particularly fond of figs and grapes, it consequently abounds in all the gardens where those plants are cultivated, and it is as often to be seen and as numerous as sparrows in England; besides feeding upon fruits, it catches flies while on the wing, after the manner of the true flycatchers. Its note is a single plaintive one, several times repeated; and its flight is irregular and of short duration. The breeding-season commences in August and ends in November; the nests during the earlier part of the season invariably contain two eggs, but in those found in October and November the number is increased to three, and rarely to four. The nest is small, compact, and formed of dried wiry grasses, bound together with the hairy tendrils of small plants and wool, the inside being lined with very minute fibrous roots. The eggs are greenish blue, without spots or markings. In South Australia the white-eye just described is replaced by a grey-backed species which frequents gardens, building its nest and rearing its young in shrubs and rose-trees bordering the walks. This species make a very neat nest, and its eggs are of a beautiful pale blue. The green-backed white-eye has the crown and upper-parts olive-green; the wings and tail are brown edged with olive-green; the throat and under tail-coverts light greenish yellow; and the breast and under-parts grey, tinged with brown.

The Sun-Birds.

Family *Nectariniidæ*.

The sun-birds are a tropical family corresponding in the Old World to the humming-birds of the New; and are characterised by the long, slender, curved bill, with the sides compressed along to the tip, which is acute, and in which both mandibles are finely serrated for the terminal third of their edges, the wings being of moderate size, and consisting of ten primaries, the tail being more or less elongated, with the middle feathers sometimes prolonged beyond the rest, the metatarsus being usually short, and the toes of moderate size, the claws being curved and sharp. The sexes are very different; the males having bright metallic tints in the plumage, while the females are dull in colour. Most numerously represented in the African continent, the sun-birds are fairly plentiful in the Indian region, and likewise occur in Australasia.

Typical Sun-Birds. The birds of the genus *Nectarinia* have the bill long, curved, and acute, while the wings are moderate and rounded, the tail broad and slightly rounded, with the central feathers lengthened and narrowed, the metatarsus short, and covered in front with very broad scales. The majority of these sun-birds are found in Africa, but the Australian sun-bird represents the genus in Australasia.

Malachite Sun-Bird. One of the best known of the South African sun-birds is the malachite sun-bird (*N. famosa*). According to Captain Shelley, this species is partial to the blossoms of the aloe, among which it finds an abundance of its insect food; but it feeds also upon saccharine juice, extracted from

blossoms by means of its long, brush-tipped tongue. It has a shrill, not unpleasing, but short song. When pursuing a rival uttering a piercing scream, it is very combative, and if two males meet about the same bush, a fight is sure to ensue, to the great detriment of the beautiful tail-feathers. The males lose their beauty in the winter season; and the young birds are just like the females. The domed nest is built of cobwebs, lichens, and dry leaves, and usually suspended on the outside of a bush, or the branch of a tree; the eggs, two in number, are of a dull greyish



MALE AND FEMALE OF THE METALLIC SUN-BIRD (⅔ nat. size).

brown colour, minutely mottled all over. In Natal this sun-bird frequents the open country, feeding upon the nectar of the various kinds of aloes, and also on that of some species of lilies, which are numerous in many of the valleys. Mr. Andersson observes that "this sun-bird is permanently established where it has once taken up its abode. Its food consists of insects and the saccharine juices of flowers, in search of which it flits incessantly from one flowering tree to another, now settling and now hovering, but glittering all the while in the sunshine like some brilliant insect or precious gem. The male, in addition to the beauty of its plumage, possesses a very pleasant warble." The adult male has the general

plumage, a shining malachite-green with the tufts of the breast brilliant yellow; the two central tail-feathers are prolonged three inches beyond the rest; and the wings and tail are blackish. The female is dull brown above, tinged with green, and beneath is greenish yellow.

Metallic Sun-Bird.

The sun-bird (*N. metallica*), represented in our illustration on p. 445, inhabits Equatorial Africa, living in pairs wherever the mimosa is abundant. During the heat of the day its actions become most animated; and at noon, when all the other birds seek rest and shelter from the parching heat, this sun-bird flies from blossom to blossom, accompanied by its faithful little mate. Standing beneath a mimosa tree in full flower, an observer may hear its quick whirring flight as it alights upon the branches of the thorn-bushes, and begins to probe the blossoms in search of honey and the insects which enter the interior of the flowers in search of sweets. It feeds also upon flies and other winged insects which it takes in flight; and as soon as a male has exhausted the contents of the blossoms of one tree, he darts off to another, always followed by his mate. The male bird is much devoted to his companion, whom he frequently entertains with a lively song; and he is jealous of any intruder, darting angrily against any stray male that may happen to invade his territory, and promptly expelling him from the neighbourhood. The nest is suspended in the centre of some mimosa-tree, and is built of the down of plants and cobwebs; the eggs being reddish white in ground-colour, variegated with dark grey and violet. The adult male is brilliant green above, with the addition of a violet gorget; the wings and tail being bluish black, and the under-parts bright yellow. The female is olive-brown above, and sulphur-yellow beneath.

The Indian genera of the family are five in number, four of which are included in one subfamily and the fifth in another.

The Honey-Peckers.

Family *Dicæidæ*.

If we exclude from this family the white-eyes, the birds to which the above name is applied comprise a group of small and mostly gaily-coloured species, distributed over the whole of the Oriental and a part of the Australian region, and nearly allied to the sun-birds, from which they may be distinguished by the beak being short and triangular, instead of long, slender, and cylindrical. Moreover, while all the sun-birds have ten primary quills to the wing, in the honey-peckers the number of these feathers may be either ten or nine; in all cases the tail is short, and the metatarsus is never elongated. In the majority of the species the two sexes differ markedly in plumage, although in a few they are alike; and in all instances the young resemble the females. None of them migrate, not even locally; while all are remarkable for the beauty of their nests, which are frequently suspended from branches, and pear-like in form. In India the family is represented by four genera, of which three, and among them the typical *Dicæum*, have nine primaries, while in the other three a small tenth primary is retained. A well-known representative of the typical genus is the scarlet-backed flower-pecker



1, GREAT TIT; 2, BLUE TIT; 3, CRESTED TIT; 4, MARSH-TIT; 5 COAL-TIT.

(*Dicæum cruentatum*), ranging from India to Sumatra and China. Still more beautiful is the Australian diamond-bird (*Pardalotus affinis*), a small short-tailed species, the loveliness of whose plumage it is almost impossible to describe. The general colour is, however, ashy grey, spotted and spangled all over with red, yellow, orange, and black, with the tail-coverts rich dark red. Common in some places among the large gum-trees of the deep forest, this bird has a remarkably loud call-note, which can be heard from long distances. Generally only a summer visitor to Victoria, although occasionally seen there during the winter, it nests in hollow logs, or more rarely in a hole in the ground.

The Tits.

Family *Paridæ*.

Included, as we have already had occasion to remark, by Mr. Oates among the Crows (from which they may be distinguished by the first primary quill never exceeding half the length of the second, and being generally still shorter), the tits are by most ornithologists regarded as constituting a distinct family, which is placed by Dr. Sharpe near the honey-eaters. They constitute a considerable group of small, agile birds, obtaining their food on trees, and living principally upon insects, although they will also eat seeds and blossoms. They are all very much alike, and have a short, conical, and entire beak, about one-third the length of the head, the bristles at the rictus of the gape short, while those covering the nostrils, although likewise short, are straight and very thick. The wing, which contains ten primaries, is weak and rounded; and the metatarsus is scutellated. Thoroughly arboreal in their mode of life, seldom descending to the ground, and often going about in parties of three or four, the tits are chiefly denizens of the Old World, some inhabiting the forest-regions of Northern Europe and Asia, while others are indigenous to the Himalaya, and others peculiar to North America, there being one genus in New Zealand.

The True Tits. The true tits are specially characterised by the absence of a crest on the head; and by the rounded tail, in which the outer pair of feathers fall short of the tip by the length of the claw of the first toe. Distributed over a large portion of the world, these birds are numerously represented in Europe, while four are denizens of the Indian region; and they are also common in North America. The beak is generally strong and conical, and thus well adapted to extract insects from their hiding-places in the bark of trees; while the wings are somewhat rounded, and the tail comparatively short.

Great Tit. The great tit (*Parus major*) is a common bird in the northern parts of the Old World, living in companies which haunt woods and gardens during the greater part of the year. In England, writes Mr. Dresser, it "is a resident, frequenting during the summer season woods and large gardens, where its food, which at that season of the year consists almost exclusively of insects, is best to be found. They are excellent destroyers of the latter, and for that reason are welcomed in any garden where the owners are sufficiently enlightened to know and esteem their value. During the winter season they flock together in families, and

either roam about wherever there are trees, in company with creepers and other small birds, diligently seeking after insects and their eggs in the bark of trees, or else remaining in the neighbourhood of inhabited places, picking up what refuse they can find. They are remarkably fond of picking a bone, and may often be seen near the kitchen door, watching for any stray scraps which may be thrown out. Some friends of ours, who are fond of enticing them to remain about their gardens, feed them during the winter by hanging lumps of suet in a small net on a piece of wire fixed across a high stick, in order that they may be out of reach of the cats; and I have often been astonished to see how soon a large piece of suet is demolished by these little birds. Often two or three may be seen clinging to the same piece, pecking at it vigorously, evidently enjoying the good fare prepared for them. . . . When hunting after insects, etc., in trees, they appear to examine every part most carefully, moving along and round the branches, now clinging head downwards, now moving along the limbs of the tree almost like a creeper, or clinging to the end of a small branch, examining carefully a bud to see if any insect is harboured therein. This is done in a most business-like, quiet manner, and only now and then a low call, *ze*, is uttered; but when taking a short flight from tree to tree or bush to bush, they utter their cheerful loud note." The great tit has a variety of notes, some of which are harsh and unmelodious; its song being inconsiderable but characteristic. Building early in spring, it places its nest in a variety of situations, one having been found in the roots of an elm-tree, quite a foot below the ground. Most nests are, however, placed in holes in trees, sometimes in the deserted nest of a hornet, and some have been found in garden-pumps, flower-pots, and other unlikely situations. Probably one of the most extraordinary nests ever discovered was found in a rough corner-cupboard, fixed at one end of an old shepherd's house, erected in a plantation for the use of the gamekeeper. In the centre of the cupboard was a single shelf, and the door being kept shut, the pair of tits could only obtain access through a small hole in the woodwork above; but through this opening the large amount of material employed in the construction of the nest must have been introduced. The eggs of the great tit are pure white, blotched with bright red; the bird frequently rearing two broods in the same nesting-hole in the course of the summer. The adult male has the crown of the head and the sides of the neck and throat glossy black, and the sides of the face white; the back is yellowish green; the lower part of the back and upper tail-coverts is slaty grey, as are the wings and tail; while the under-parts are bright yellow, with a black median stripe.

Coal-Tit.

An inhabitant of the fir-woods of Central and Northern Europe, the coal-tit (*P. ater*) breeds early in the year, generally in a hole in the wall or chink in some rotten tree-stump; the nest being lined with fine roots, moss, hair, and feathers. The eggs are white, spotted and blotched with red; and a nest of this species was once found in the burrow of a sand-martin. The British form of the coal-tit is regarded by some ornithologists as distinct from the Continental race, inasmuch as it has the back of an olive-brown, whereas the back of the Continental bird is slaty blue. Nevertheless some specimens of coal-tit obtained in the north of Scotland are intermediate between the British and Continental forms; while the habits of both appear to be precisely identical. The

coal-tit is an inquisitive bird; and we have known one voluntarily enter an empty mouse-trap, apparently tempted only by curiosity. The adult male has the crown black; a distinct white patch adorns the nape; the sides of the head are pure white, the upper-parts slaty blue, the throat black, the centre of the body whitish, and the flanks buff.

Marsh-Tit. Generally frequenting gardens, orchards, and woods near swampy ground, the marsh-tit (*P. palustris*) displays a marked partiality for rabbits' fur as a nesting material; some nests being almost entirely composed of it. One taken from a hole in a birch-tree was compact, cup-shaped, smooth both externally and internally, and mainly composed of rabbits' fur, interwoven on the inner side with minute chips of dried grasses, and on the outer side with fine moss; while another from Berkshire was a thick matted structure of moss and dogs' hair, the moss predominating on the outside and the hair inside. The eggs are pure white, dotted all over with red. The adult male has the crown glossy black, the sides of the neck white, the back greyish brown, the throat black, the wings and tail greyish brown, and the breast white tinged with buff.

Blue-Tit. Common in most parts of Europe, where it frequents gardens, orchards, and the neighbourhood of houses, the blue-tit (*P. cæruleus*), is a familiar bird, and often exhibits its antics in full view of any passer-by. Its laughing call-note is well known to every schoolboy, and scarcely less so are its nest and eggs. Rearing its young in a great variety of situations, the same site being resorted to for many generations, the blue tit often nests in a hole upon the ground, while a pair have been known to rear their brood in the steeple of a church. The blue tit sits very close upon its eggs, which, like those of other tits, are white spotted with pale red. Both the present species and the great tit are migratory in their habits, not only crossing the North Sea upon their journeys, but sometimes venturing into the heart of London. The forehead is white; the crown, back of the neck, and collar are bright blue; the back is yellowish green; the wings and tail are blue; the throat is dusky black and the under-parts are pure yellow.

Azure Tit. Another member of the family that calls for notice, on account of the beauty of its plumage, is the azure tit (*P. cyaneus*) of Siberia, which occasionally wanders into Europe, having been captured more than once in the neighbourhood of the Russian capital. According to an account of its habits, published by Dr. Dybowski, it appears that this tit breeds in holes in old trees, especially willows, sometimes making use of a deserted woodpecker's nest. The nest is composed of the fur of the white hare and squirrel, with a few pieces of slender grass. The azure tit lays ten or eleven eggs; and one nest is on record composed of dried green moss intermixed with fine cow-hair. The eggs are white, spotted with dull red at the larger end. The adult male has the head snowy white, appearing in life as if powdered over with blue; the back is pale bluish grey; the upper tail-coverts are Prussian blue tipped with white; the wings are greyish brown, white at the base of the inner web, and the outer web Prussian blue; while the tail is very long and bright Prussian blue, with the exception of the outer feathers, which are white, as are the lower-parts.

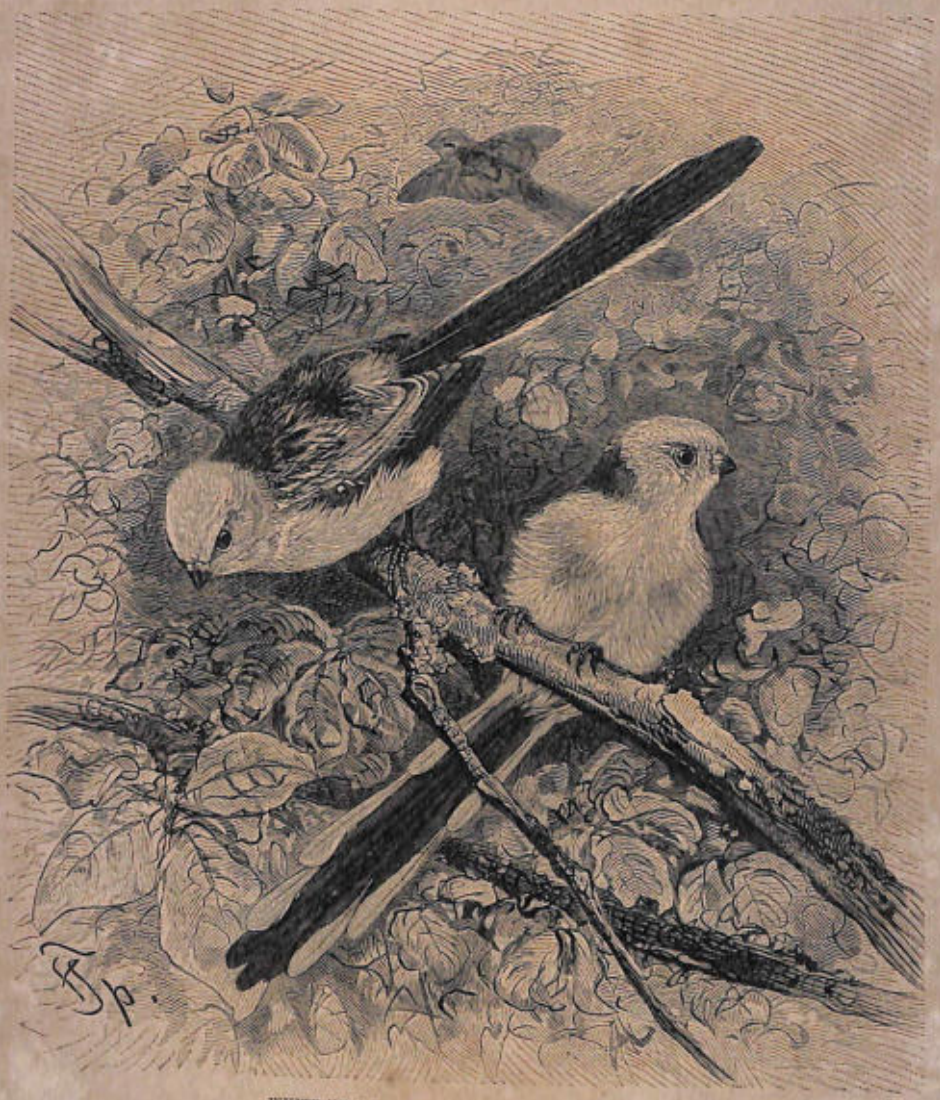
The Crested Tits. Originally included in the typical genus, the crested tit (*Lophophanes cristatus*) of Northern Europe, is now generally considered

by ornithologists to represent the type of a genus including several other species. Distinguished from the true tits by the presence of a crest on the head, the members of the genus differ from an allied group of crested tits (*Macrolophus*) by the tail being square or slightly forked, whereas in the latter it is rounded. Moreover, the black abdominal band, found in the last-named genus, is wanting in the present one. The home of the crested tit must be sought in large pine-forests, or extensive stretches of beech-wood and mixed timber. It is a shy and retiring species, not courting observation like many of its cousins, but shunning the haunts of men even in winter. In the spring we have met with it in small droves, in pairs, and even singly. Though shy and timid, if conscious of being pursued, the crested tit when left alone often allows a quiet observer to enjoy a close inspection of its plumage, and the pale grey crest, jet-black throat, and buffish under-parts form a pleasing harmony of colour. It has rather a knack of perching overhead, especially if the observer be riding, probably impelled to the survey by curiosity. Anyone who has trained his ear to recognise the cries of birds, will soon become familiar with the liquid call-note, *prrit* or *chrrit*, which may often be heard before the tiny musician has revealed its whereabouts. The crested tit has a pretty little song, generally uttered when a male bird is playfully pursuing one of his companions in mock anger. Mr. C. Thusnall says: "I have generally seen them in the top boughs of the firs, but they frequently come on to the ground, apparently to pick up a seed that may drop from the fir-cones; at anyrate, you see them fly down, look in the grass, and fly up again immediately. They appear to remain in families, as you seldom see a single one. As a rule, they prefer the rotten stem of a fir, about twelve or fourteen feet high, and bore a hole in the tree from two feet to eight feet above the ground. I have also found the nest in old stumps of very large trees within six inches of the ground. Their nidification is therefore more like that of the coal-tit in that respect." In Rhenish Prussia, the crested tit lays in the deserted nests of the crow, magpie, or squirrel, as well as in hollow trees; the nest being made of moss, wool and feathers. The eggs are white, spotted all over with bright red. When the pairing-season is over, the crested tits band together with tree-creepers, goldcrests and other tits, and scour the woods in search of food; the crested tits leading the van. They do not work the branches as minutely as other tits, preferring to range more widely.

The crested tit possesses an elongated crest, often raised; the forehead and sides of the head are white, mottled slightly with grey, the feathers of the crown black, edged with white, the cheeks and sides of the head white, the throat deep black. The upper-parts are greyish brown, so that the bird appears sombre upon the wing; the lower-parts are fulvous.

Long-Tailed Tits. Agreeing with the true tits in the absence of a head-crest, the long-tailed tits, as represented by the European species, are sufficiently distinguished by the elongation of the appendage from which they take their name. We select for illustration the white-headed long-tailed tit (*Acredula caudata*), as being the type of the genus. Inhabiting the northern districts of Europe, and occurring also in many parts of Germany, its range somewhat overlaps that of the form termed the British long-tailed tit. The species under consideration is a tolerably common and well-known bird throughout the whole of Switzerland,

ranging up into the mountains to an elevation of five thousand feet. It would be difficult to name a more sociable or confiding species, for this tit lives in flocks during the greater part of the year, and roves about with its fellows in quest of the small insects, especially certain grubs found in the catkins of willows, which form its subsistence. Flying in an undulating fashion, and exhibiting a rather peculiar



WHITE-HEADED LONG-TAILED TIT (⅔ nat. size).

appearance on the wing, as it flits gaily from one tree to another, uttering its loud and shrill call-note almost without cessation, this tit builds a beautiful nest composed of mosses, interwoven with wool and feathers, and exquisitely trimmed on the exterior with grey and white lichens; the interior of the structure being copiously lined with a variety of soft feathers. A peculiarly shaped nest of this tit taken in Denmark, resembled in shape a plain honey-jar, placed horizontally on

the upper part of a long cleft between two large branches, to the base of which a pouch twice or three times as long as the jar itself was attached perpendicularly, filling up the face of the fork between the branches; the entrance hole being the mouth of the jar. This nest was built of moss closely covered with pieces of lichen. An early breeder, this tit lays from ten to fourteen white eggs, spotted with red; the young being sometimes hatched as early as the month of April. Both the old birds participate in the labours of incubation, and we have known the young of this species reared from the nest by hand. Indeed, long-tailed tits have been kept in confinement for no less a period than two years. The method of treatment was to confine these birds between large double windows where ivy was growing, on the leaves of which numbers of plant-lice were found, and upon these the freshly caught tits fed, and by degrees got accustomed to confinement, and would take ants' eggs and other food. About a dozen species of the genus are now known; the most recently discovered being the Macedonian long-tailed tit. Possessing a black chin, this tit otherwise resembles the British long-tailed tit with black instead of white lores. Irby's long-tailed tit inhabits Spain and Italy, while the Turkish long-tailed tit resembles the last-named in having the centre of the back grey and not black, but differs in the presence of a large blackish patch on the centre of the throat. A sixth species inhabits the northern slopes of the Caucasus, and has the forehead pale brownish, and the sides of the crown brown instead of black. The adult has the whole of the head snowy white, the hind-part of the neck deep black, the sides of the back and scapulars vinous red, the wings and tail black and white, and the under-parts whitish tinged with pink.

The Bearded Tit.

The single representative of this genus, *Panurus*, possesses a short, subconical bill; the wing has the first primary very minute, the tail is long and graduated, the metatarsus is also long, and the feet are comparatively stout; but the distinctive character is the elongation of the feathers of the sides of the throat into a moustache. The bearded tit (*P. biarmicus*) is peculiar to Central and North Europe in its typical form, being replaced in Central Asia by a paler variety. Throughout its range it haunts large reed-beds and marshes. Norfolk was formerly its home, and a few pairs still breed in some of the more favoured parts of the broads; Mr. Stevenson writing that "when shooting at Surlingham, in the winter months, I have more than once observed the arrival of a flock from some neighbouring broad, their presence overhead being indicated by the clear ringing of their silvery notes uttered preparatory to their pitching into the nearest reed-bed; and in autumn, after roosting in small parties on the reeds, they will fly up simultaneously soon after sunrise, swarming for a while like a flock of bees, and uttering in full chorus their pretty song, disperse themselves over the reed-beds for their morning meal. Delicate as these little creatures appear, I have found them during the sharpest frosts, when the snipe had left the half-frozen waters for upland springs and drains, still busy among the reed-stems as lively and musical as ever." The writer also says that he has often found the nests completed by the end of the first week of April. These are generally placed amongst the reed-stems close to the edge of the water, supported on the loose herbage forming the foundation of the reed-beds, but never in any way suspended; they are constructed of the

dead stems of sedges and reeds, intermixed with a few pieces of grass, and invariably lined with the tops of reeds. The eggs are pure white, sprinkled all over with small purplish red spots. The food of these tits during the winter is principally the seed of the reed, and so intent are they in searching for it that they have been taken with a bird-limed twig attached to the end of a fishing-rod. When alarmed by a sudden noise or the passing of a hawk, they utter their shrill notes and hide among the thick bottom of the reeds, but soon resume their station, climbing the upright stems with the greatest facility. In feeding they approach near to the long-tailed tit, often hanging with the head downwards and turning themselves into curious attitudes. Their food is not entirely the reed seed, but insects and their larvæ, and the very young shell-nails of different kinds which are numerous at the bottom of the reeds. Mr. Keulemans, describing the finding of a nest near Rotterdam, states that "both old birds made a great noise when I captured their little home; both incessantly uttered their anxious note, *churr churr*, flying about me and performing a series of rapid movements . . . Bearded tits have no real song, their vocal powers being rather limited; nevertheless, they produce peculiar notes for expressing their different feelings. When rejoicing in each other's presence, or when one perceives the arrival of its mate, they utter repeatedly their note *ptjink, tjinck*. When disturbed, frightened, or caught, both sexes utter a very peculiar sound, like *tsjirrr-irr irr rrrr*. Distress or anxiety is expressed by *er-arrh ee arr-chieur*. When uttering the latter, they erect the body, bow the head downwards, and puff the feathers of the head and neck." In Holland many bearded tits are captured, chiefly during the early part of October, when the old birds go on foraging expeditions, accompanied by the young ones, to the number of six or seven in a flock. They are then caught by means of nets, which are laid down among the reeds, while decoy birds are placed at a short distance. The adult male has the head clear bluish grey; the lores and moustache stripe are black; the back is rich fawn-colour; the primaries are brown, edged with white; the tail-feathers deep rusty red; the throat and upper breast greyish white; and the sides of the body rich fawn-colour. The female is greyish fawn above, and greyish white beneath.

New Zealand Creepers.

The tits of this genus (*Certhiparus*) have a bill of moderate size, curved and compressed, the wings are moderate and rounded, the tail is also long and rounded, and the metatarsus comparatively long and broadly scutellated in front. Its representatives are peculiar to New Zealand, the common form, *C. novæ-zealandiæ*, being confined to the wooded portions of the South Island; where it frequents low undergrowth and the outskirts of the bush where insect life is abundant. During severe seasons it has been known to leave the shelter of the bush to frequent the sheep stations, flitting about the meat stores, and picking off morsels of fat from the bones and skins of the butchered animals. Its ordinary food consists of minute beetles and other insects. The New Zealand creeper breeds late in the summer, the young being sometimes found in the nest in December. The eggs are white, spotted with brown and purple. Sir W. Buller says that the nest is of a rounded form, and not unlike a large pear in shape. In structure it is composed of dry vegetable fibres, fragments of wool, moss, spiders'

webs, and other soft materials closely felted together. The entrance is placed on the side about one-third the distance from the top, and is perfectly round with smoothened edges; the interior being lined with soft white feathers. The adult male of this tit has the upper-parts bright cinereous brown, inclining to rufous; the quills of the wing are light brown; the tail is pale rufous; the sides of the head and nape are grey; and the throat, breast, and under-parts rufous white.

Allied Types. There are several other genera of tits, such as the Oriental *Ægithaliscus*, which comprises some small species differing from the true tits in the more graduated form of the tail, the longer and more copious feathers on the crown of the head, and the absence of a dark band on the under-parts. The yellow-browed tit (*Sylviparus modestus*) of the Himalaya represents a second genus, distinguished from the preceding by the squared or slightly forked tail.

In the neighbourhood of the tits Mr. Oates would place the so-called crow-tits (*Conostoma, Paradoxornis, Suthora*, etc.), which are restricted to the mountains of North-Eastern India and parts of China, and are referred by some ornithologists to the *Crateropodidæ*. Mr. Oates writes that "the position of these birds has been much disputed, but looking to the facts that they have ten primaries, that the young are identical in plumage with the adult, and that the nostrils are completely hidden by stiff bristles, their location with the crows and tits seems the proper course to adopt." Those species of which the nesting is known, build cup-shaped nests in trees, and lay eggs marked with yellowish brown and purple.

The Shrikes.

Family *Laniidæ*.

A somewhat variable group, including such different forms as the gay-coloured minivets, the cuckoo-shrikes, the crested jay-shrikes, the plainer wood-shrikes, and the Indian pied shrikes, the members of this family have the edges of both mandibles either smooth, or the upper one simply notched or toothed, or both together; the hinder surface of the metatarsus is smooth and covered with two longitudinal plates; the wing has ten primaries; the tongue is of ordinary form: the nostrils are clear of the line of the forehead, and more or less overhung with bristles; and there are twelve tail-feathers. The plumage of the nestling is cross-barred, and there appears to be only an autumnal moult. The family comprises a large number of genera, and, with the exception of South America, has a cosmopolitan distribution, although most numerous in Africa.

The Shrike-Tits. The species composing the genus *Falcunculus* have been described as uniting the form of a shrike with the habits of a woodpecker; they possess a strong toothed bill, with which they are able to tear off pieces of rotten wood, and even the bark of gum-trees in search of food, and they have a crest of feathers. Inhabiting the larger branches of trees, and resembling the tits in many of their habits, when attacked by an enemy they defend themselves with ferocity. All being exclusively Australian, the white-bellied shrike-tit (*F. leucogaster*) is a native of Western Australia, while the frontal shrike-tit (*F. frontatus*) inhabits South Australia and New South Wales.

Frontal Shrike Tit.

This shrike-tit is a bird of great animation and sprightliness; its chief food consisting of insects, which are obtained either among the foliage of trees or under the bark of the larger branches and trunks. In procuring them, the bird exhibits great dexterity, stripping off the bark in the most determined manner, for which purpose its powerful bill is admirably adapted. Whilst searching the branches for food, it frequently erects its crest and assumes many pert and lively positions; and no bird of its size possesses greater strength in its mandibles, or is capable of inflicting more severe wounds. Its song consists only of a few piping notes. The male has the crest pure black, the sides



FRONTAL SHRIKE-TIT (⅔ nat. size).

of the head white, divided by a black line, the back, shoulders, and wing-coverts olive, the primaries, secondaries, and tail blackish brown margined with grey, the two outer tail-feathers and the tips of the remainder being white; while the throat is black, and the under-parts are bright yellow.

True Shrikes.

The true shrikes (*Lanius*) have the large compressed bill, hooked and toothed, and thus adapted to enable them to tear the flesh of the small mammals and birds upon which they often prey. The wings are moderate in length but comparatively powerful, the tail is generally much longer

than the wings, and graduated, the central feathers being the longest. The relatively strong metatarsus and toes are of assistance in enabling the shrikes to retain hold of beetles and other insects. The great grey shrike inhabits Western and Central Europe, being replaced to the eastward chiefly by a single-barred species, which extends through Asia, merging into the great northern shrike of North America. The brightly-coloured shrikes belong chiefly to Africa.



GREAT GREY SHRIKE AND RED-BACKED SHRIKE (½ nat. size).

Great Grey Shrike. The great grey shrike (*Lanius excubitor*) is a common bird in the northern and central parts of Europe, frequenting the skirts of forests in the summer. It is a shy and retiring species when unmolested, but when it has lost its nest or young becomes most vociferous. Willughby was perhaps the first English naturalist to describe the employment of this shrike in the capture of passage-falcons. On the Rhine they are persecuted by the game-keepers, and the shrike that has lost his mate will often fly to the top of a very tall poplar tree and thence pour forth his woes. The plan adopted for

destroying these birds is to mark down their nests and kill the young birds and one or both parents, before the former can fly. The great grey shrike builds in a variety of situations; Mr. Seebohm found a nest of this species in the top of a Scotch fir, and Mr. Collett observed another in Finmark, containing six young ones, in a birch-tree on a sterile terrace. The nest was easily seen, and constructed of dry twigs together with straw, thickly lined with white feathers of the willow-grouse, and a little wool. In Central Europe large forest-oaks are most frequently chosen by this species to contain its nest, the tree selected being always on the edge of a belt of timber, never in the centre of a big wood; such nests being generally placed at the apex of a forked bough a long way out from the main trunk, built on a knot in the fork, at an elevation of some thirty-five or forty feet. The nest itself is a bulky structure composed of fine twigs interlaced with a few stout straws, bents, and fibres. Within, it is quilted with a profusion of soft substances, feathers of the pheasant and buzzard, a little of the white fur from the belly of a hare, and some of the shed coat of the roe deer, sheep's wool, or any convenient substitute. The eggs of this shrike are greenish white in ground-colour, blotched with olive-green, wood-brown, and dull lilac. The great grey shrike is most assiduous in the care which it bestows upon its young, and it is touching to see the distress and consternation which it exhibits if it imagines that the safety of its charge is endangered.

To a large extent migratory in its habits, this bird does not breed in the British Isles, although a considerable number visit England and Scotland in the fall of the year. They have occurred on Heligoland as early as the middle of August; and whilst a few individuals yearly pass along favourite "fly-lines" in certain years their numbers have increased tenfold. Those which winter in England for the most part lead lives of solitude, frequenting a particular beat of country for a week or two at a time, during which the familiar outline of the butcher-bird may at any moment be detected perching upon the top of some leafless tree, watching incessantly for field-voles, shrews, and small hedgerow birds. The flight of the shrike is sometimes high and sometimes low, but constantly undulating. With the arrival of spring the great grey shrike in England moves eastward to the coast, from which it takes its departure in March and April, though an occasional straggler is sometimes reported as having been seen during the summer. In common with other butcher-birds, the great grey shrike is in the habit of impaling the carcase of its prey upon some convenient thorn, in order both to facilitate the flaying of the bird or small mammal, and also to provide a larder. The great grey shrike has the upper-parts nearly uniform slaty grey; the lores, cheeks, and ear-coverts are black; the wings are black with white bases to the quills; the graduated tail is black and white; and the under-parts are pure white, often finely barred with crescentic grey markings.

Lesser Grey Shrike.

The lesser grey shrike (*L. minor*) is a migratory species, winter-ing in Africa, and passing the summer months in Central and Southern Europe, Asia Minor, and Persia. Mr. Seebohm says that in Eastern Europe this shrike frequents the outskirts of cultivation, where trees and bushes of various kinds struggle for existence amongst the broken rocks. This species breeds early in June, and the nests found in Slavonia are built in acacia trees; in

size they are as large as those of the blackbird, and chiefly composed of chickweed, freshly plucked feathers, and wool. Some contained as many as six eggs, these being bluish green in ground-colour, spotted and blotched with greenish brown. This shrike feeds principally upon beetles, butterflies, grasshoppers, and other insects. Its flight, like that of its congeners, is undulating, but easy and comparatively noiseless; the bird skimming through the air like a partridge for a moment or two before it alights on some perch, on to which it drops with a scuffle of the wings. The song is a not unmusical chatter, something like the twitter of the swallow or



LESSER GREY SHRIKE (⅓ nat. size).

starling, but louder and mixed with some harsher notes. The bird has a variety of notes, some very harsh, which are probably alarm notes, and others somewhat plaintive. In the adult the forehead, lores, and ear-coverts are deep black; the crown of the head and all the upper-parts pearl-grey; the wings black, the primaries having white bases which form a single white wing-bar; the tail is black and white; and the under-parts are white tinged with reddish-buff.

Red Backed Shrike.

The red-backed shrike (*L. collurio*), which is represented in the lower figure of the illustration on p. 458, is another migratory bird, spending many months of the year beneath the burning rays of an African sun, and returning northwards in the spring of the year in order to rear a fresh family in its haunts in Central Europe and the British Isles. Those individuals that

visit England (for in Scotland the bird is very rare), apparently journey to their summer quarters by way of the valley of the Rhine. The red-backed shrike arrives somewhat later than the majority of summer migrants. Each pair becomes established in a certain area which it rarely if ever leaves; the male bird being conspicuous as he perches on some tall spray of hawthorn. We have never seen this shrike build in a tree of any kind, and it seems invariably to build in a hedge or low bush; the nest, although this circumstance is exceptional, being at times placed in a tiny bush barely eighteen inches from the ground. The nest is built of dry stalks and moss, lined with fibrous roots and a little hair; the eggs vary, being sometimes yellowish white with markings of olive and lilac, and sometimes salmon-coloured marked with light red. No sooner has this shrike reared its young than it prepares to leave Britain, hurrying south in advance of many other summer birds, in order that it may perform the operation of moult in the heat of a tropical winter. So long as it remains in England, it always exhibits the same alert character—vigilant, resourceful, always ready to anticipate danger. It is a bird of rapid flight and considerable agility; and when in the act of seizing some winged prey, shoots forward like an arrow released from the bow, and rarely misses the quarry. It will swoop upon a humble-bee, impaling the unfortunate insect with perfect deftness upon the sharpest thorn available. Although the red-backed shrike is generally content to feed upon insects, it has been known to attack a lizard, and is partial to small birds, field-mice and frogs, and sometimes attacks the decoys of bird-catchers like the great grey shrike. The adult male has the head, back, and sides of the neck bluish grey; the middle of the back and scapulars dull brick-red; the wings dull black edged with rufous; the tail black-and-white; the forehead, lores, and ear-coverts black; the chin white; and the under-parts rose-colour. The female is brownish grey above with a reddish brown tail; the under-parts being dull white closely barred with transverse brown markings.

Woodchat Shrike.

The woodchat shrike (*L. pomeranus*) is rather a rare bird in many parts of its summer quarters in Central Europe, although it is the commonest of all the shrikes in Portugal. Preferring to nest amid extensive orchards, it is absent from forest-land, and frequents sunny valleys and the gentle slopes of low hills commanding a southern aspect, rather than more elevated and exposed situations. A trained eye soon learns to recognise the woodchat at a considerable distance, and we have often pointed out to our companions a woodchat when the bird appeared to the naked eye, or even to the binoculars, to be merely a small white patch on the side of a bush. This is easily explained by the fact that the woodchat, true to the watchful character of its congeners, invariably perches (at least during migration, to which alone these remarks apply) upon the outside of a bush, its white breast facing outwards towards the quarter from which it apprehends the approach of danger. The flight is strong and undulating. During migration these birds travel constantly in the wake of their fellows, and although two days may often interrupt the migration, when it is resumed, it will be found that shrikes adhered to the line taken by the advance-guard. In Eastern Algeria this shrike breeds in numbers on the hillsides, constructing its nest almost entirely of the stalks of a small grey flower. As a rule, the eggs

are bluish grey in ground-colour, spotted and blotched with dark grey and brown. Captive specimens will eat not only insects, but likewise small frogs; and, in default of thorns, will hang their prey on the crossbars of their cage. The adult male has the crown of the head and lower neck bright chestnut; the forehead and ear-coverts jet black; the scapulars and rump pure white; the wings and tail black-and-white; and the lower-parts white, slightly tinged with buffish red.

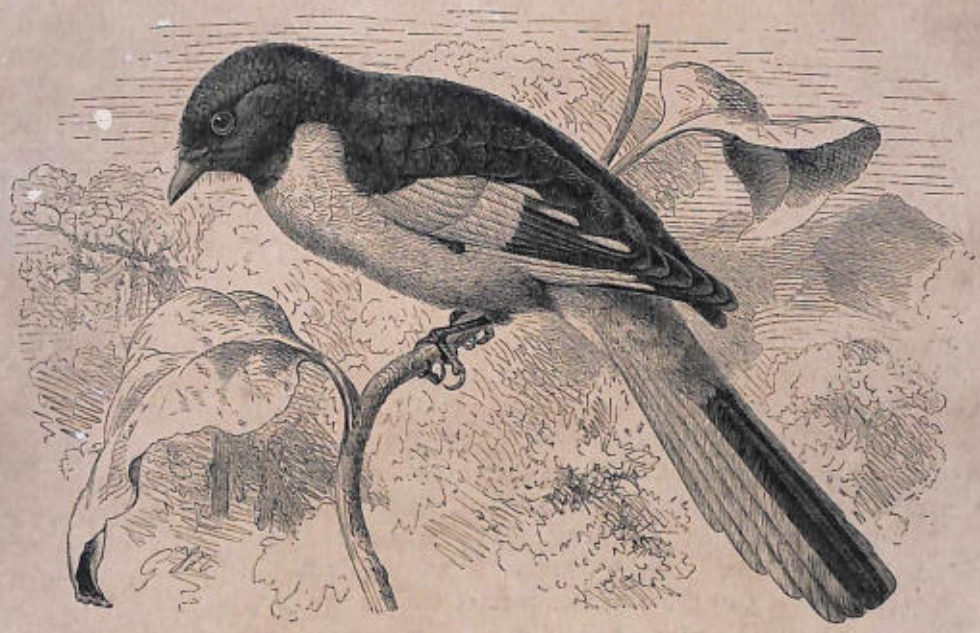


WOODCHAT, MASKED, AND HOODED SHRIKES (½ nat. size).

Masked Shrike. The masked shrike (*L. nubicus*), represented in the left-hand figure of the illustration above, is a Nubian species, which passes the summer in Greece as well as the northern parts of Africa. It arrives in the Morea at the commencement of May, and proceeds to take up its quarters in cultivated valleys, generally nesting in the vicinity of pasture-land. This shrike builds its nest in olive-trees and bushes, the nesting materials consisting of leaves of plants, grass-stems, and fibres. It lays a pale greenish grey egg, clouded with yellow and

irregularly spotted with black. It feeds principally upon beetles and other insects, like the woodchat, and possesses a pleasant song. The adult male has the forehead white, this colour extending behind the eye, the scapulars being also of the same hue; the crown and entire upper-parts are bluish black, the wing-coverts being edged with whitish; the tail-feathers are black-and-white, and the lower-parts white tinged with reddish yellow.

Hooded Shrike. The hooded shrike (*L. erythropterus*), is an Algerian bird, breeding in well bushed situations, where it runs about with great rapidity in search of its food. It is a skulking species, and keeps out of sight as much as possible. The call-note is a harsh cry, *tschagra tschagra chagra chrug*. Canon Tristram says that this shrike never exposes itself in any conspicuous situation, but always remains concealed in the thickest recesses. The only nest



INDIAN SCARLET MINIVET (⅔ nat. size).

he took was placed in the centre of an arbutus bush, and was large and coarsely constructed of twigs, with a thick lining of wool and hair. It contained four eggs, which were white in ground-colour, spotted with brown and blotched with red. The adult has the crown of the head and nape black, the eyebrow white, the scapulars black margined with chestnut, the wing-coverts bright chestnut, the wings black, bordered with red, the tail black, broadly tipped with white, the chin white, and the under-parts ashy grey.

The Minivets. The shrikes of the genus *Pericrocotus* possess a bill shorter than the head, moderately broad at the base, hooked and notched; the nostrils are concealed by the frontal plumes; the wing is long and pointed; the tail long and greatly graduated; and the feet are short and comparatively feeble. Mr. Oates points out that the members of this genus are remarkable for the stiffened shafts of the feathers of the rump. The minivets are peculiar

to India and Eastern Asia; the Siberian minivet, inhabiting Mantchuria in the summer time, and migrating through China to winter in the Philippine Islands and the Malay Peninsula, being the hardiest of the family. It is grey above and white below, but the majority of minivets are gaudy in their attire, scarlet and yellow predominating in their plumage, or at least in that of the male bird, for the females are less gorgeous. The brilliantly-coloured Indian scarlet minivet (*Pericrocotus speciosus*), like other members of its genus, is arboreal in its habits, and lives in family-parties, which fly briskly about the branches of their favourite trees in active pursuit of their insect prey. The call-note of the species is lively and frequently repeated. Nesting in April, this minivet constructs a beautifully cup-shaped nest of moss trimmed with lichens, which is placed in a slender branch. In colour the eggs are greyish white, marked with brown and inky purple. The adult male has the whole head, back, and scapulars glossy black; the lower surface from behind the throat, together with the rump and upper tail-coverts are vivid scarlet; while the wings are black, barred with scarlet; and the tail is scarlet except the middle pair of feathers which are black.

Other Genera. The number of genera included in the shrike family renders it impossible to allude to all, and we can consequently refer only to a few. Among these the pied shrikes (*Hemipus*) of India and Malaysia differ from the true shrikes by the broad and flattened beak, in which the edge of the upper mandible is merely notched near the tip, in place of being strongly notched and toothed. The wood-shrikes (*Tephrodornis*), of which there are three Indian representatives, are distinguished both from the preceding genus and the true shrikes by the squared tail; the general colour of the plumage being grey. The Australian piping crows (*Gymnorhina*), which are here placed among the crows (p. 323), are by some writers included in the present family; and the same is the case with *Struthideá* (p. 322). On the other hand, the crow-shrikes (*Strepera*) of Australia are more generally referred to the *Corvidæ*; but Dr. Sharpe places the whole three genera in the *Laniidæ*. There is also some difference of opinion as to whether the cuckoo-shrikes (*Campophaga* and *Graucalus*), which range from India to Australia, are likewise members of this family, Dr. Sharpe referring them to a distinct family (*Campophagidæ*), while Mr. Oates places them here. Agreeing with the minivets in their spiny rump-feathers, the cuckoo-shrikes differ in having the tail but moderately instead of greatly graduated, while the outer feathers are more than three-quarters (instead of less than half) the entire length of the tail.

The Waxwings.

Family *Ampelidæ*.

The waxwings, together with the allied South American family of the greenlets (*Vireonidæ*), are generally placed between the shrikes on the one hand, and the thrushes and warblers on the other. Containing only five genera, with not more than some nine species, they are characterised by a short and slightly hooked bill, broad at the gape, long wings, and short legs; their plumage is very soft and silky. The waxwings are inhabitants of the northern half of both hemispheres,

and form a single genus, *Ampelis*. The metatarsus is short; the feet are weak; and the inner quills of the wings are tipped with curious red horny appendages, compared to pieces of sealing-wax. The Bohemian waxwing inhabits the northern parts of the Old and New Worlds; the Japanese waxwing breeds in South-Eastern Siberia, and winters in Japan, China, and Formosa; while a third species, the cedar-bird, is peculiar to North America. Great interest for many years attached to the nesting-habits of the Bohemian waxwing (*A. garrulus*), which were surrounded by mystery until solved by Messrs. Dresser and Wolley. The former of these ornithologists found the waxwing breeding in Finland in



BOHEMIAN WAXWING (½ nat. size).

the year 1858, only two years after the latter had obtained the nest of a waxwing in Lapland.

Writing of his nest-hunting experiences, Mr. Dresser says that, after finding a tree in which a waxwing built, "I climbed up to the nest, which was in the fork between the main stem and the first branch, and not above nine or ten feet from the ground. The moment I touched it, the young ones (five in number) flew out. I jumped down, and made a cut at the largest with my cap, and secured him. Directly the young one which I had caught began to cry out, several waxwings flew from the neighbouring thicket, all, however, keeping out of gunshot, except two

which came close round me, and both of which I shot. I then sat down and imitated as well as I could the call of the old birds. I was soon rewarded for my trouble by a young one coming out of a blueberry bush, close by, and calling lustily. I then climbed up again and took the nest away carefully, so as to preserve the shape, and to my great delight found one egg in it. We hunted for several hours in the higher part of the island for another nest, but, although we saw about nine old birds, we didn't succeed in finding another nest." The eggs of the waxwing are pale blue, marked with purplish underlying shell-markings and black overlying surface-spots. In certain winters large numbers of waxwings cross the North Sea to winter in the British Isles, where, unfortunately, their pretty plumage and strange appearance mark them as a certain prey of the loafing gunner. In its habits the waxwing is confiding and tame, though much less so in the spring and



A FLOCK OF WAXWINGS.

summer than in the winter. "At the latter season of the year," writes Mr. Dresser, "I used to see large flocks in Southern Finland, usually frequenting the mountain-ash trees, and very often seen in the gardens quite in the centre of the towns. So tame are they that, when fired at, and one or two killed, the remainder will only fly to a short distance, and soon return to the same tree again. The flocks are often very large; and I have known of more than twenty specimens having been killed at one shot; I once killed as many as fourteen at a shot off a large mountain-ash tree, on which a flock was perched picking off the berries. It is a peculiarly silent bird; and I watched a flock for some time without hearing any of them uttering a sound. The only note I have heard is a low plaintive whistle, from which, I imagine, it is called by the Finns by the name of tilhi, as this gives some idea of the sound of its call-note. When frightened, or suddenly disturbed, the same

note is uttered, but is then shriller and louder in tone. The bird sits very erect, and carries its crest so that it is distinctly seen; when frightened, it at once raises its crest, slighly spreading it. A flock busy feeding on a rowan tree, especially if the ground and tree are covered with snow, is a most pleasing sight; and I have often sat and watched them from a window close to which was a small mountain-ash, to which they often came to feed on the berries, which latter having large clusters, like bunches of coral beads, forming a rich contrast to the pure white snow." Waxwings in confinement are somewhat inactive birds. Sometimes, it is true, they will hop restlessly from perch to perch, or even take a brisk fly around the aviary; but for the most part they prefer to squat upon some favourite perch, occasionally uttering a short succession of running notes. They feed somewhat greedily, and show a preference for dried currants. During the winter months small flocks of waxwings may often be seen in Southern Sweden, flying hither and thither at a considerable height, and presenting somewhat the appearance of starlings, from their long wings and comparatively short tails. The adult male waxwing has the upper-parts generally light greyish brown; the forehead and the crest are reddish chestnut; a broad black streak passes through and above the eye from the base of the bill; the primaries are blackish, with the outer web towards the tip white on the outer feather, and yellow on the inner ones, and the inner web broadly tipped with white; the secondaries are blackish grey, tipped with red wax-like appendages; the tail is grey at the base, black towards the tip, and terminated by a broad bar of yellow; the throat is black; and the under-parts are vinous red.

Cedar-Bird. A well-known bird in the orchards and gardens of the United States is the cedar-bird, or cherry-bird (*A. cedrorum*), a smaller species than the Bohemian waxwing, and less beautifully coloured, but still possessing considerable interest. The cedar-bird nests somewhat late, generally building in an orchard or garden; the nest is placed in a bough, or upon a limb of the tree. The nest is built of coarse, dry stalks of grass, lined with very fine stems of the same. The eggs are bluish white, thickly marked with blackish spots. The young are at first fed upon insects, but, as they advance, berries become their chief diet. A young bird reared from the nest proved to be very impatient of confinement, but when suffered to fly at large descended from the trees in which he passed the day, in order to perch upon his owner's arm. The cry of the young bird for food is loud and incessant. The cedar-bird flocks in July and August, and betakes itself to regions in which whortleberries are plentiful, in order to gorge upon the fruits. In October these birds descend to the lower parts of the country, to feed upon the berries of the red cedar; thirty or forty birds may sometimes be seen fluttering among the branches of one small cedar-tree, plucking off the berries. In the fall and beginning of summer the cedar-bird becomes extremely fat; hence it was formerly esteemed for the table. The adult bird has the head, neck, breast, upper part of the back, and wing-coverts purplish cinnamon, shading into ash on the rump; the forehead, lores, and eye-stripe are black, the wings slaty grey, with the inner feathers tipped with red horny appendages; and the tail is grey, tipped with yellow.

H. A. MACPHERSON.

CHAPTER V.

The Perching Birds,—*continued.*

Thrushes and Warblers to Swallows.

Families *Turdidæ* to *Hirundinidæ*.

If we follow Dr. Sharpe, in including the warblers in this family, it will be an extensive one, embracing not only the thrushes proper, but likewise the chats, ouzels, warblers, grasshopper-warblers, and leaf-warblers. Mr. Oates, on the other hand, regards the warblers as a distinct family, which he does not even place in juxtaposition with the thrushes. Used in the wider sense, the family is characterised by the beak being slender but rather depressed, and variably modified in the different groups; the wings are comparatively long and slender, with ten primary quills; while the tail-feathers may be either ten, twelve, or fourteen in number. Although variable, the feet are generally slender, and the metatarsus is elongated; while the nostrils are free from hairs. In the typical members of the family, the plumage of the nestling is mottled or squamated, but in the warblers it is like that of the adult female, but more brightly coloured. With the exception of New Zealand, members of the family are found throughout the world.

True Thrushes.

The true thrushes (*Turdus*) and their allies constitute a subfamily (*Turdinæ*), the members of which, together with the chats and redstarts, agree in the mottled or squamated plumage of the nestlings; there is but one complete moult in the year, the number of tail-feathers is never less than twelve, and the metatarsus is smooth behind. In the present subfamily bristles are present at the rictus of the gape. More frugivorous in their tastes than the chats, the thrushes spend a larger proportion of their time on the ground, more especially in open meadowlands, searching for worms and slugs. All possess fine vocal powers; and they all build cup-shaped nests, generally composed in part of mud. The true or spotted thrushes (*Turdus*) have the beak of moderate size, decurved and notched near the extremity; the wings and tail are long, and the tail is slightly graduated; there is no pattern on the underside of the wing; and the metatarsus is longer than the fourth toe. The feathers of the throat and breast are more or less spotted at all ages. The true thrushes are most abundant in South America, which is the home of no fewer than twenty-four species. Ten breed in North America, while only five breed in Europe and Northern Asia, namely, Père David's thrush, and the four species next described. Nine species are peculiar to Africa, such as the olivaceous thrush of the Transvaal, another species from Natal, and

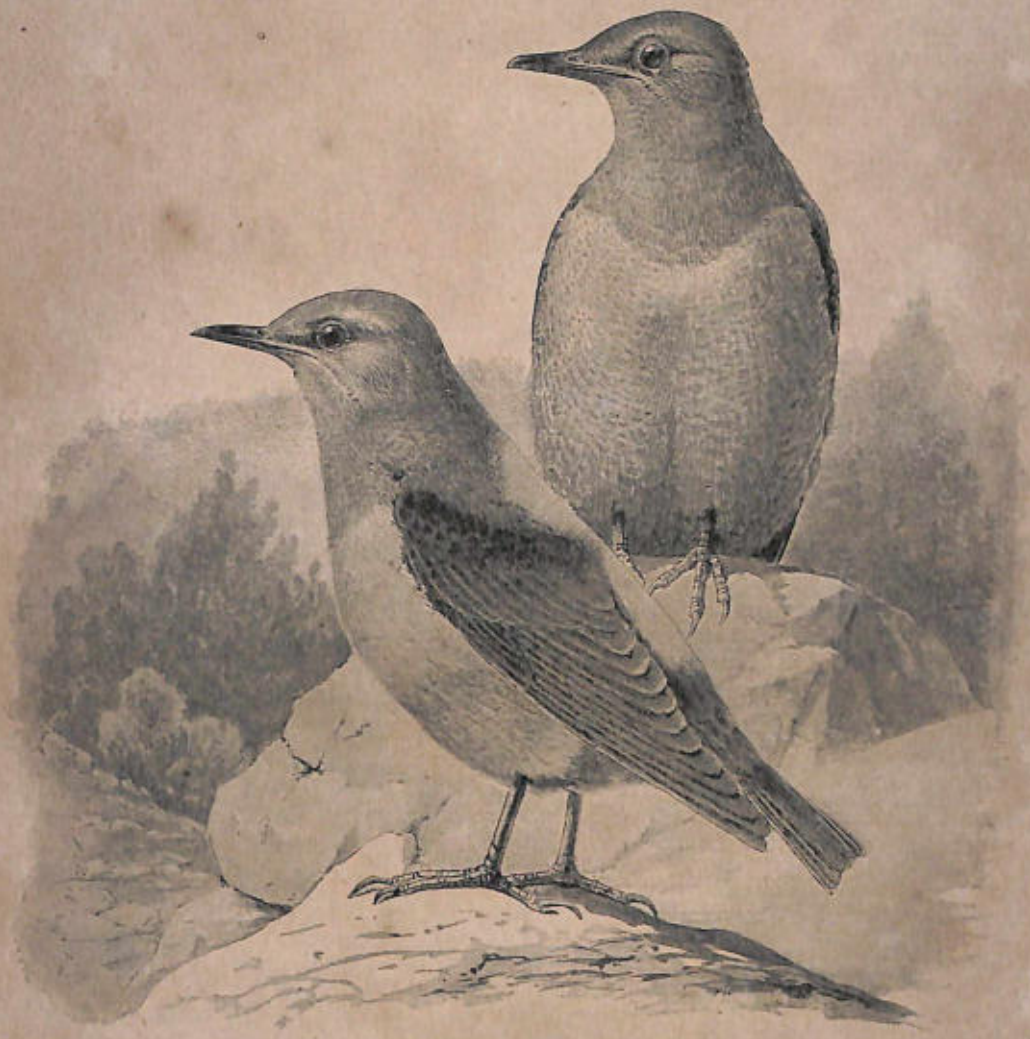


GROUP OF THRUSHES.

1, Missel-Thrush ; 2, Redwing ; 3, Song-Thrush ; 4, Fieldfare ; 5, Blackbird.

the South African thrush; this last uttering a peculiar half song, half call, as if it were troubled with a cold.

Missel-Thrush. The missel-thrush (*Turdus viscivorus*) is found in nearly every part of Europe at the one or other season of the year, breeding in the northern regions, and wintering partially in the southern parts. It has enormously increased its breeding-range in the British Isles during the present century; and



A PAIR OF ROCK-THRUSHES.

in the autumn and winter months is shy and retiring, hunting the open fields in flocks, which exercise extreme vigilance over their common safety. Although this bird feeds principally upon worms and berries in the winter, its common name is derived from its passionate fondness for the berries of the mistletoe, which are rejected by the majority of small birds, even when pressed by hunger. The missel-thrush pairs early in the season, and the nest is generally placed in some conspicuous position. In districts where magpies are numerous it often builds its nest in a bush

or low tree close to a cottage, as though recognising a certain protection in the neighbourhood of man. The nest is built of stems of dry grass, moss, and vegetable fibres, often trimmed externally with grey lichens; the eggs being greyish green in ground-colour, spotted with chocolate. During the breeding-season the missel-thrush exercises a watchful surveillance over the orchard or garden in which its nest is built, boldly mobbing jackdaws and even larger intruders, if they attempt



SONG-THRUSH AND RING-OUZEL (½ nat. size).

to rob its belongings. The old birds exhibit much devotion to their young, and will permit of a very close approach whilst feeding them. When the young are fledged, they gather into family parties, which scour the country in search of new feeding-grounds. The song of the storm-cock, as it is frequently called, can be heard to the best advantage on a stormy day in springtime, when the bird sends forth his loud sonorous notes, as though in defiance of the elements. A migratory species, and often snared on its autumn journey through Central Europe, the missel-thrush is not so subject to abnormal variations of plumage as is the song-

thrush. The adult male is greyish brown above, washed with golden on the rump; the sides of the neck are greyish brown, streaked with darker; in the tail the greater part of the outermost feathers are greyish white; the throat is white, finely spotted with brown; and the under-surface buffy-white, closely spotted with black.

Song-Thrush. A favourite in many parts of Europe, the song-thrush (*T. musicus*) is in no degree dependent upon man for its existence, being, at least, as much at home among the surf-beaten rocks of the Hebridean shores, as in the parks and orchards of the south of England. Breeding early in the year, or rather commencing to do so, it rears several broods during the season. Most nests are built of stems of grass and fibrous roots, interwoven with mosses, and lined with clay; but the prettiest we ever saw was entirely constructed of bright green moss. The nest is often placed in a hedge or low shrub, sometimes in a niche in an ivied wall, sometimes in a fruit-tree. Such song-thrushes as rear their young amidst the treeless straths of the north of Scotland are content to build their nests upon the ledge of some convenient boulder of rock, sheltered from the weather. The eggs are bright blue, well spotted with dark brown. The song of the thrush is generally poured forth from the bough of a tree; but in Scotland thrushes often sing from the roofs of houses, and even from a grassy knoll on the hillside. The food of the song-thrush consists principally of earthworms and insects; and this bird confers a great benefit upon the gardener by the warfare which it wages against snails. Near the sea, also, it feeds in the winter upon whelks and other small molluscs, which it obtains upon the rocks of the shore when the tide has begun to ebb. On the other hand, it must be admitted that the song-thrush consumes a great deal of ripe fruit. In Norway it is a special favourite, and holds the same place in Scandinavian poetry that the nightingale does in the songs of other countries. The adult male is dark brown above, tinted with golden brown; the throat is buff; the under-parts being golden or buffy white, closely spotted with brown. The song-thrushes, which breed in the Hebrides, are of a greyer coloration than more southern specimens.

Redwing. The most delightful song to be heard in the solitudes of the forest in Northern Europe is that of the redwing (*T. iliacus*), which generally chants its flute-like melody from the top of a fir-tree. Never nesting in colonies the redwing appears to seek the society of the fieldfare, since one is sure to find a pair of redwings wherever a colony of the latter species exists. Professor Collett says that in the eastern part of Norway the redwing builds its nest in bushes and low trees, but in the barren, treeless portions of the west coast of Norway, like the song-thrush of the Hebrides, it modifies its habits to suit its surroundings; the nest being often placed upon the ground, between stones, on fences, or in stunted birch-trees. Redwings, like other thrushes, show great anxiety if their nest be approached, snapping their bills, and uttering a mournful cry. The eggs of this species are pale bluish-green, profusely covered with greenish brown markings. In the fall of the year, redwings unite in large flocks, and many of them cross the North Sea to the British Isles and Germany, migrating chiefly at night, when they can often be heard passing over the housetops of our towns, calling at frequent intervals to their companions. The redwing is not a very hardy

bird, suffering severely in protracted frost, even while other birds are able to retain sound condition. The explanation of this must be sought for in the fact that it subsists upon worms and other insects rather than upon berries. The adult is olive-brown above; a broad line of buffy white passes over the eye; the under-parts are white, streaked with brown; and the flanks and under wing-coverts are bright rufous.

Fieldfare. The fieldfare (*T. pilaris*) is the most abundant of all the northern thrushes, alike in the pine-clad valleys and in the regions of birch. It breeds in colonies, and the nests are placed in fir-trees and birches at various elevations, some being as much as fifteen feet from the ground. They are generally built of long, dry, fine grass, with a coating of mud or clay between the outer and inner layers of that material. Professor Collett relates that a fieldfare once nested in a milk-pail inside a dairy, and successfully reared its young; and Mr. Dresser found a nest in a hollow top of a rotten stump, not a foot above the ground. Whenever an intruder approaches their nest, the old birds fly round, uttering loud and harsh cries, and thus attract attention to the whereabouts of their treasure. The eggs of the fieldfare resemble those of the blackbird, being bluish green in ground-colour, speckled and blotched with reddish brown. The young are fairly tame when they first leave the nest, but soon become shy and wary even on their nesting-grounds. It is possible that their shyness or boldness may depend upon the extent to which the birds are molested. Myriads of fieldfares annually cross the German Ocean to winter in the British Isles and Central Europe; and on one occasion a solitary straggler landed as far west as Iceland. The adult male has the head and hind-neck ashy grey, the feathers of the crown having dark centres; the back and wing-coverts are rich chestnut-brown; the wings and tail blackish brown; the eyebrows whitish; and the under-parts rich ochre, thickly spotted with black.



THE FIELDFARE.

The Blackbirds. The birds of the genus *Merula* are true thrushes in all structural characters, and differ from the foregoing chiefly in the important particular that the plumage of the adult male is more or less widely distinct from that of the female. In a number of species the male bird is black or slaty grey. No fewer than sixteen of the species referred to this genus are peculiar to South America; while twelve inhabit Australia, and fourteen are found



BLACKBIRD AND SPARROW-HAWK.

in the Oriental region. Nine species inhabit Northern Asia, and two others are well-known European birds. The common blackbird (*M. vulgaris*) does not usually inhabit the most northern parts of Europe, but breeds in most districts of this region, migrating from the colder regions before the approach of winter. It is resident throughout the year in the south of Spain, Algeria, and the Canaries. During the summer months the blackbird frequents gardens and orchards, nesting in shrubs and hedges, sometimes upon the ground. The nest is composed of grass-stalks and mosses, together with dead leaves; and, under pressure of circumstances, can be completed in a couple of days, the female alone working at the structure. The eggs are bluish green in ground-colour, closely freckled with light brown. The song lacks the compass and variety of the song-thrush, but is nevertheless powerful and well sustained. The blackbird is specially liable to sport white feathers, especially in the case of the male; the tendency to such variations having been proved to be hereditary. Albinos are sometimes taken in the nest, uniting the possession of red irides with bleached white plumage. The adult male has the plumage uniform black throughout; but the female is quite unlike her mate, being dusky olive-brown above, and reddish brown on the under-parts.

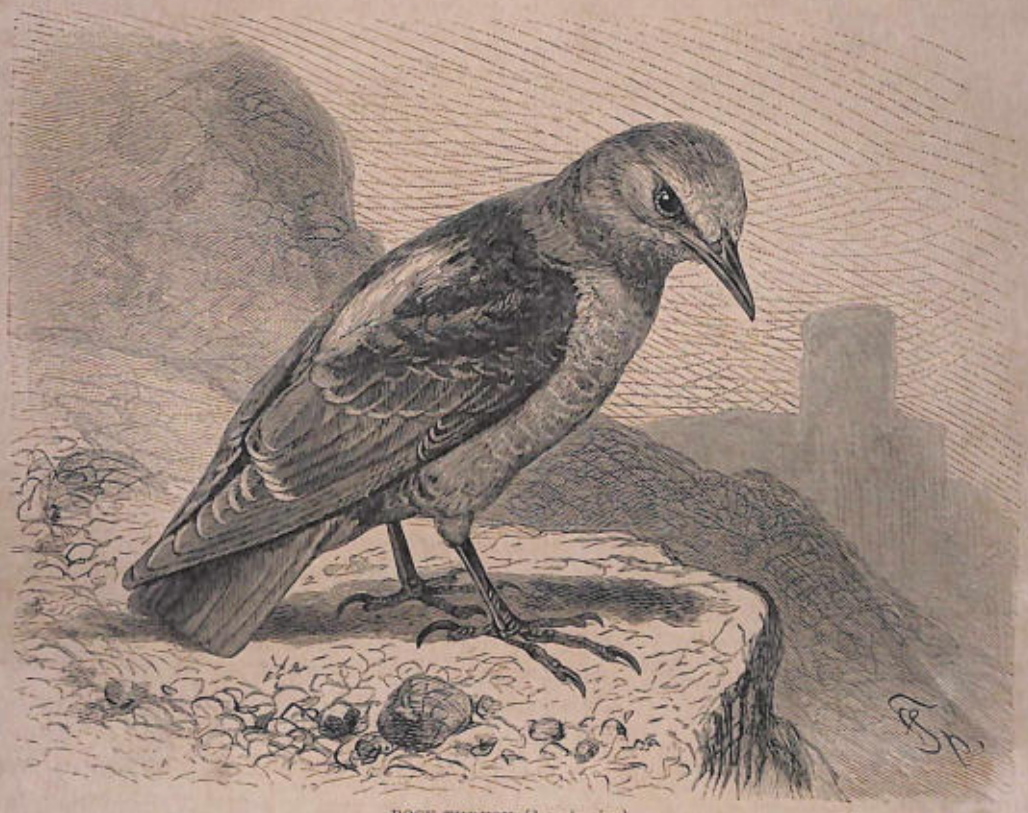
Ring-Ouzel. The ring-ouzel (*M. torquata*), represented in the illustration on p. 472, is a mountain-loving species, spending the summer months among the heaths and pine-forests of the hills of Central and Northern Europe.

In Northern Europe the rock ring-ouzel arrives upon its ground in April and May, and the females soon after join their partners. Generally nesting in some wild solitude, building in the rocks that overhang a mountain burn, especially where the ground is rough and well covered with heather, the ring-ouzel is shy and wary, and rarely permits a very close approach to the nest. In Switzerland, however, a fir-tree is the more common site for the nest, which is always built of dry grass and heather, and lined with fine stems. The eggs are blue, finely spotted with reddish brown. The young occasionally fly as early as the beginning of June. All through the early summer months the ring-ouzels live among the sheep on the hillside; but when the fruits ripen in autumn, the fell-throstles or mountain-blackbirds, as these birds are often called, approach the neighbourhood of orchards and gardens, and proceed to levy blackmail upon the crops. They are especially partial to cherries, though when the berries of the mountain-ash ripen, the ring-ouzels gorge themselves to repletion upon their favourite fruit, so that they become fat and in high condition before they leave the shores of Europe to seek a more genial climate in Northern Africa. Flying strongly and direct, the ring-ouzel utters a song which is both sweet and powerful, and audible at a great distance, although inferior to that of the blackbird. The harsh, chuckling notes which this bird utters when its haunts are invaded cannot well be confused with those of any other bird. Mr. Howard Saunders says that the ring-ouzels, which breed in the Swiss forests, frequent the vineyards by the lakes in the autumn time, levying toll upon the grapes, which the owners guard so jealously. During migration, the ring-ouzel is sometimes found with blackbirds and thrushes at lighthouses. The adult male, in breeding-plumage, has the upper surface blackish brown; the wings being brown with whitish edgings; most of the feathers of the under-surface have pale grey margins; and a broad white gorget extends across the breast, and is always conspicuous.

Rock-Thrushes. The representatives of this small group (*Monticola*) have a stout, straight bill, arched towards its extremity; and while the wings are moderate in length, the tail is short and even. The legs are stout, strong, and well adapted to progression over irregular surfaces. The rock-thrushes are peculiar to the Old World, three species inhabiting South Africa, and a fourth Abyssinia, while two breed in the Himalaya, one of which extends eastward into Western China. The two best known species, the blue thrush and the rock-thrush of Western Europe, range from Northern China to Spain and Italy.

Common Rock-Thrush. The rock-thrush (*Monticola saxatilis*) is a summer visitant to the more barren portions of the principal mountain ranges of Central Europe and Siberia, but does not reach the far north in its annual wanderings. Like its cousin the blue rock-thrush, it is partial to rocky gorges among the hills and regions far removed from any human habitation, save for the chance presence of a shepherd's hut or farmstead in some hollow among the mountains. It is a shy and wary species, constantly vibrating its tail like a redstart, and migrating to its breeding-ground in flocks, where it commences to nest in May. The nest is generally built in a precipitous position among crags of rock, often close to some mountain waterfall; although the rock-thrush sometimes nests in holes in the stone walls that are built to protect the Rhenish vineyards. The nest is

composed of fine roots, moss, and dried herbs; and the eggs are pure light blue, without spots. The young are often reared from the nest by hand, especially in the north of Italy, and are much prized as cage-birds; the song of the rock-thrush being extremely beautiful, though not so fine as that of the blue rock-thrush, which we incline to place first in the rank of European songsters. Timid and fearful as is the rock-thrush in a state of freedom, if reared from the nest it becomes a charming pet; and we have kept both old and young birds, and found them tame and confiding. Although the rock-thrush is a very local and even rare bird in most parts of its range, and does not ordinarily migrate farther north than



ROCK-THRUSH (½ nat. size).

Central France, stragglers have been identified in Great Britain, as well as in Heligoland. The food of the rock-thrush consists principally of beetles and other insects, but the bird shares the fondness of its congeners for wild berries and garden fruits. The adult male has the head and neck ashy blue; the scapulars are blackish, slightly washed with blue; the centre of the back is pure white; the tail and upper tail-coverts are light red; the entire throat ashy blue; while the rest of the under-parts are rufous orange.

Blue Rock-Thrush. The blue rock-thrush (*M. cyanus*) is chiefly found in the countries bordering the Mediterranean, and is a wild, shy bird of solitary disposition, resident in single pairs in rocky districts. Canon Tristram has shown that this bird is the "sparrow that sitteth alone upon the housetop" of the Psalmist.

Colonel Irby writes that "a pair nested in a hole outside the wall of my stables at Gibraltar, in June 1869. Five eggs were laid, which were hatched about the 20th. The nest was of small dried roots, and was very scanty. When the young were hatched, I broke through the wall from the inside of the stable to the nest, making the hole large enough to admit a small cage, in which I placed the nest and young; over the inside hole I then hung an old coat so as to shut out the light from the inside, cutting a small slit in the coat, through which I used to watch the old birds feeding their young within six inches. Both birds fed them at intervals of not more than five minutes. The food consisted almost entirely of centipedes, with now and then a large spider or bluebottle-fly by way of change. Two of the five young died in the cage, from the old birds not being able to get at them. Of the other three, only one attained maturity, living till October. He was very tame, and of most engaging habits and disposition, in fact what the Spaniards call '*simpatico*.' In his younger days he was fed on soaked bread and bruised snails." The blue thrush is a well-known bird at Rome, at Malta, and in many other European resorts of tourists. Everywhere it frequents rocks, ruins, and old walls, pouring forth its delicious music in solitary wastes. It is a favourite cage-bird, and as such commands high prices; but it is excessively delicate and difficult to keep. The adult male is of a general dull blue above, the head and breast having a silvery gloss, while the under-parts of the body are dull blue. The female differs from the mate, in being greyish brown above, tinted with blue, and reddish buff on the lower-parts.

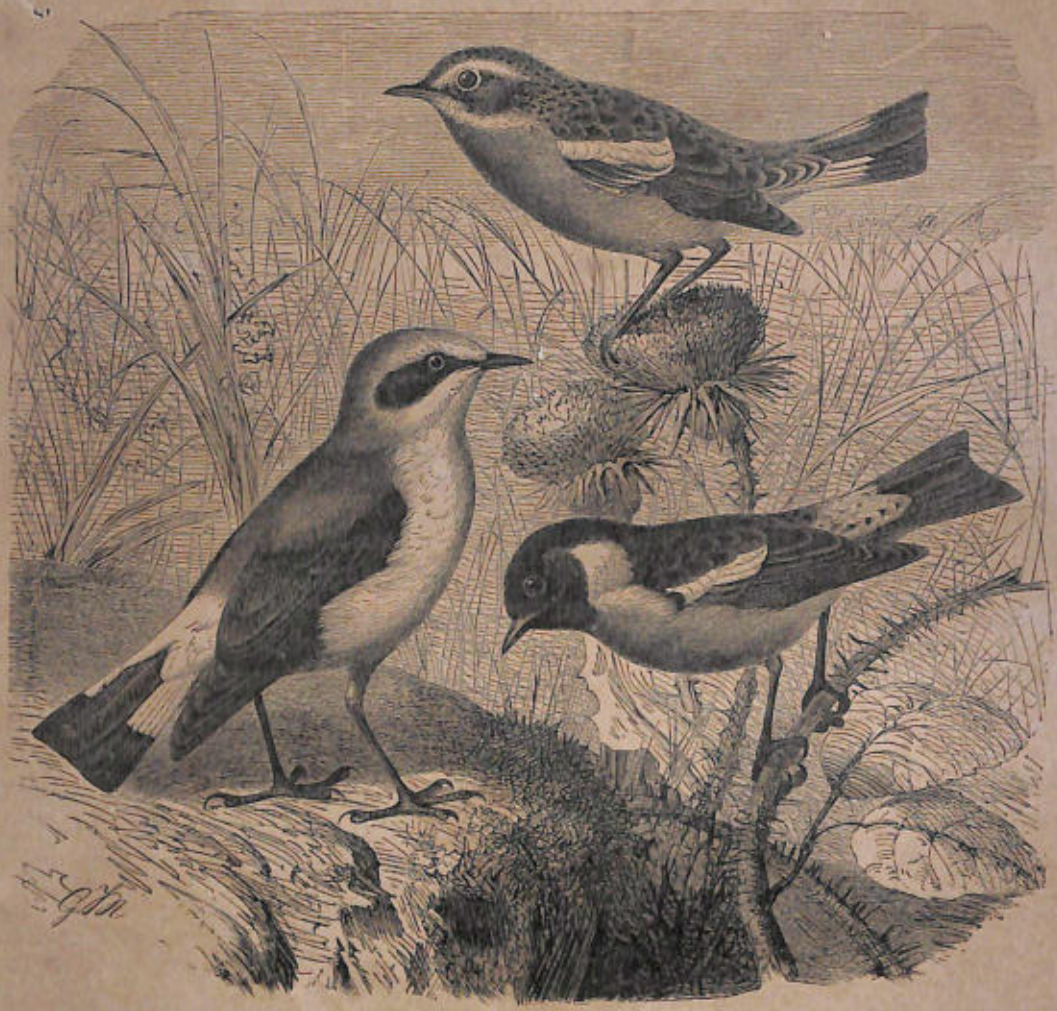
Bluebirds. Possessing a characteristic plumage of sky-blue (associated with chestnut in two instances), the bluebirds (*Sialia*) are easily distinguished from all other North American birds. The bill is straight and compressed, notched near the extremity; while the wings are pointed and much longer than the tail, which is slightly forked; the feet being stout and short, and adapted for perching, and not for running, as in the chats. Bluebirds are peculiar to the American continent, and have no nearly allied representatives in the Old World. No more charming bird is to be found in the United States than the blue-bird or blue robin (*Sialia sialis*), which breeds as far north as Southern Canada, and passes the winter months in great numbers in the Southern United States. It is one of the first birds to arrive in the States in spring, preceding the swallows and many other species; indeed, it is occasionally observed as early as January and February in its summer home. The male is a cheery songster, and all his movements are characterised by grace and energy. The nest is placed in the hollow of some tree; the eggs are pale blue, and unspotted; and several broods are reared in a season. The bluebird is often imported to Europe as a cage-bird, and has often bred in confinement. Mr. A. G. Butler gives the following account of some pet birds of this species: "my blue robins made friends early in June, the cock-bird giving every insect he got hold of to the hen, to induce her to receive his attentions; the hen was very coy, and refused his advances until about the end of the first fortnight; the pairing was a noisy affair, as the cock-bird kept up an incessant shrieking noise, with his body elongated, and his beak turned up to the ceiling, for fully half an hour beforehand, and for quite ten minutes afterwards. On Sunday the 16th of June the hen spent the whole day

in carrying up hay to a large, deep box, nailed against the wall near to the ceiling, and on the surface of this she formed a saucer-shaped depression, in which shortly afterwards she laid three eggs; while sitting she was fed by the cock-bird, but whenever he gave her an insect she invariably left the nest to eat it. In thirteen days the eggs hatched, and two days later two of the young birds were carried out dead; the third bird was safely reared, and moulted into his adult plumage towards the end of August. The young bird left the nest when twenty-three days old. I had been led to suppose that he would resemble the hen; but, in addition to his greatly inferior size and spotted breast, he was altogether of a far more cinereous tint. In about eight or ten days he was perfectly able to feed himself." These bluebirds preferred to feed their young upon insects, which they invariably swallowed and disgorged several times before carrying them to the young. The adult male has the head and upper-parts deep azure-blue; the throat, breast, and sides of the body chestnut; and the lower-parts white; while the female is blue, mixed and obscured with reddish brown.

True Chats. Occupying an intermediate position between the robins and the true thrushes, the chats (*Saxicola*) form a second subfamily characterised by possessing a strong bill and well-developed rictal bristles; the wing is pointed and equal to the tail, and the metatarsus and foot are adapted to their desert-loving habits. Resembling the fly-catchers in the mode of taking their insect-prey, the chats differ from other small birds by their frequent vibration of the tail when perching and running. They are most strongly represented on the African continent, five species inhabiting North Africa, while six are peculiar to the south of the Ethiopian region, and five others inhabit Abyssinia and Nubia. Eight belong to the European avifauna, while four species breed only in Persia, and another four in Turkestan. The wheatear, which may be considered the best known form of the genus, has a straight bill, broadest at the base and slightly curved towards the extremity; the legs and bill being black, and the metatarsus not scutellated. The bastard-primary feather is small, and the wings are comparatively flat and pointed. In all the more typical species, the rump, upper tail-coverts, and the base of the tail are pure white in both sexes; the tail consisting of twelve feathers of nearly equal length. The russet chat (*Saxicola melanoleuca*) breeds in Italy, Greece, South Russia, and Palestine; the western form summering in Morocco, Algiers, Spain, and the south of France. The isabelline chat (*S. isabellina*) breeds in Asia Minor, South Russia, and Siberia, and has been obtained in Madagascar; while the Indian desert-chat (*S. deserti*) passes the summer in the cultivated districts of Turkestan, wintering in North-West and Central India.

Wheatear. One of the earliest of the many migrants that traverse the length and breadth of Europe during their annual migrations is the common wheatear (*S. œnanthe*), so well known in most parts of the British Isles. Arriving in March and April, the wheatear is both a moorland and maritime species. Many may be seen on a Scotch grouse-moor or any sheep-farm in the north of England; and some remain very late in the ploughed fields of the midland counties. Numberless pairs spend the summer months playing about the rabbit-

holes which line the sand-banks that form the coast-line in many districts of Britain. The wheatear builds its nest in a variety of situations; sometimes in a loose heap of stones, sometimes in a rabbit-hole or beneath a heap of dried peats; and we once found a family packed into an old tin pot lying in a hollow of a shingly sea-beach. The eggs are light blue. The song consists of some very sweet notes, generally uttered upon the wing. These birds leave the British



WHEATEAR, WHINCHAT, AND STONECHAT (½ nat. size).

shores chiefly in August and September, although some commence their journey in July, while other belated stragglers linger on into early winter. The range of the wheatear is very extensive, including, according to season, a great part of Asia north of the Himalaya (including Gilgit), Africa, and North America. The adult male in the breeding-season has the crown and most of the upper-parts greyish blue, the lores and the ear-coverts black, the upper tail-coverts pure white, and constantly displayed; while the tail is black and white, and the throat and under-parts are buffish white.



WHEATEAR, STONECHAT AND WHINCHAT.

Black Chat.

The black chat (*S. leucura*) inhabits the rocky districts of Spain, Italy, and North-West Africa, being replaced in India by a closely-allied species. Partially resident in its breeding-grounds, it is only a summer migrant to many districts; and it is essentially a bird of desolate mountains, which it enlivens with its lively, active figure. Preferring the wildest and most rugged situations, it is a shy, cautious bird, avoiding the haunts of men; and as, even when wounded, it generally manages to creep into some deep fissure to die, it is difficult to secure. Brehm states that the male black chat often "either dances about on a precipice or a stone, or runs up the precipice, spreading its tail and wings like a blackcock, nods its head, turns sharp round, rises singing into the air like a tree-pipit, and then gradually sinks with outspread wings to the ground, where it finishes the last strophes of its song in the neighbourhood of the female bird, which quite silently watches the antics of her mate. In all its comical postures it knows how to show its beautiful white tail to the best advantage. If there are any trees or prickly-pear bushes in the mountains, it will also repose on them during the intervals of its dance and song; otherwise it selects the most prominent positions for its resting-places." The black chat builds about the middle or end of April, placing its nest in some hole or fissure of the rock, frequently in a precipitous situation. The nest is large, loosely constructed of dry stalks of grass, and the finer stems of various wild plants, and lined with soft fibres and hair. The eggs are pale light blue, with a zone of pale reddish spots around the larger end. The song of the black chat is wild and sweet, and has been compared, when heard in autumn, to that of the blue thrush, although it is not so loud and clear, and generally concludes with a peculiar churring sound, resembling that of the black redstart. The adult male in the breeding-season has the entire plumage of the upper and lower parts of the body sooty black, with the exception of the rump and upper tail-coverts, which are pure white. The two central tail-feathers are black, and the remainder white, broadly tipped with black; while the under tail-coverts are pure white. The female is a duller bird than her mate, being blackish brown instead of sooty black.

Whinchat.

The whinchat (*S. rubetra*)[1] winters in Africa, extending its range farther north than the stonechat in the breeding-season. Passing through Spain in the month of April, it makes its way to the Arctic Circle by the end of May; one of the principal routes by which its spring journey is accomplished lying along the valley of the Rhine, where the species is extremely abundant. The whinchat loves the neighbourhood of grass-meadows, from which the song of the male may often be heard resounding, while his mate is engaged in the duties of incubation. The call-note of the species is loud and monotonous, representing the word "*utick*." The nest, usually placed upon the ground and adroitly concealed, contains eggs of a bluish green colour, often spotted with fine specks of reddish brown. When the young are fledged, they live in a family-party with the old birds, which exhibit the greatest anxiety over the safety of their progeny. Subsisting upon insects, and especially beetles, the whinchat is very partial to warm, sunny situations, especially if they are well bushed and command

[1] By many ornithologists the whinchat and its allies are separated as a distinct genus, *Pratincola*, on account of their broader beak and more numerous rictal bristles.

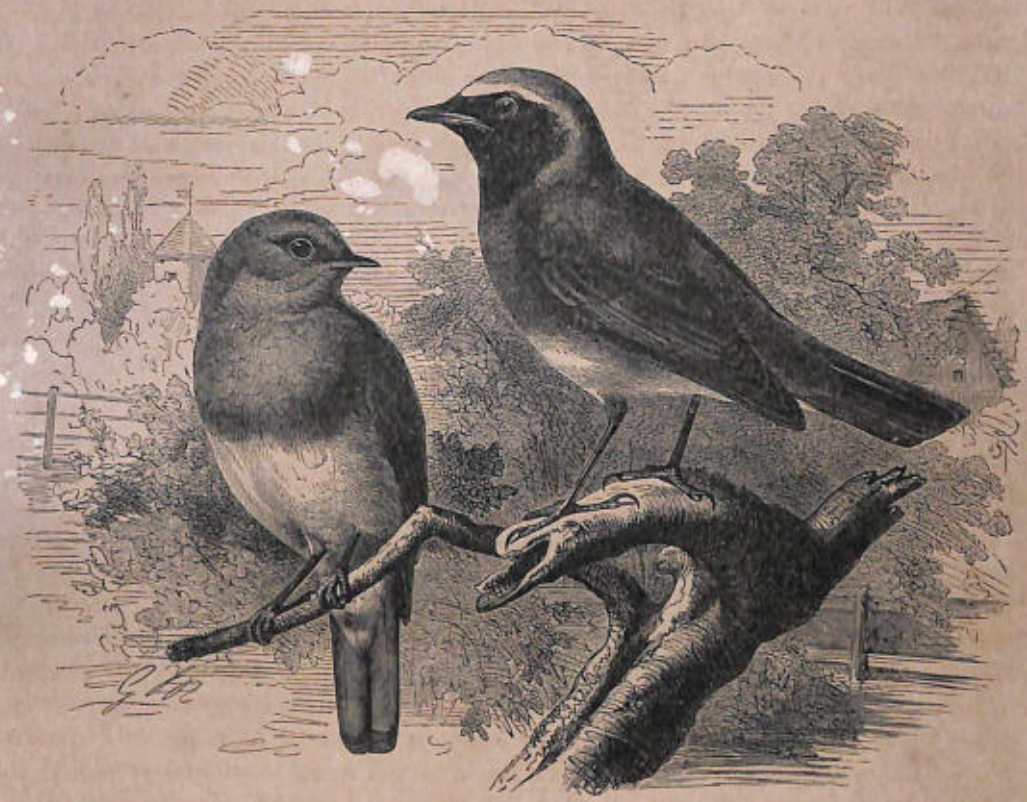
a southerly aspect. It leaves its home in Central and Northern Europe in August and September, rarely, if ever, delaying its departure into late autumn. The adult male has the crown and upper-parts blackish brown, many of the feathers having light buff edges. The tail is white, banded with blackish brown for the terminal half, while the throat and under-parts are pale fawn colour, varying much in intensity. A conspicuous white eyebrow is also present.

Stonechat. The stonechat (*S. rubicola*) is found throughout Central and several parts of Northern Europe, being a resident in many places, while to others it is but a summer or winter migrant. During the summer, generally to be found on common lands, chalk-downs, or other open places, the stonechat is an early breeder, nesting in April, and concealing its choice of a site with much care. In Oxfordshire stonechats seem to be very partial to aquatic situations, one old male having haunted a certain wet ditch close beside the Isis for several months during one winter; and they have been known to build at the bottom of a hedge adjoining a flooded meadow. The stonechat builds its nest of moss and dried grass, lining it with feathers and hair; the eggs being pale greenish blue, finely spotted with reddish brown. The stonechat has a short but rather pretty song, and is a somewhat noisy species when its haunts are invaded. The adult male in summer has the entire head and back glossy black, with a white collar; the tail is blackish brown, the outer feathers having the outer web light buff; and the under-parts are rufous, but vary considerably in different individuals. The female is a browner bird than her mate. This group of the genus is represented by several species in India, where they are commonly known as bush-chats.

Fork-Tails. The redstarts and robins, together with the Indian group of fork-tails, bring us to another subfamily (*Ruticillinæ*), differing mainly from the chats in their habits; these birds being terrestrial, and capturing their insect-prey on the ground, instead of flying from a perch and returning thereto, after the manner of the fly-catchers. They have a slender, compressed beak, a long metatarsus, and feet well adapted for running; and the majority of the species are denizens of Europe and Asia, north of and including the Himalaya. The first genus of this subfamily is formed by the Indian fork-tails (*Henicurus*), which are small birds, having the general appearance of pied wagtails, but differing from them in possessing a forked tail and ten primaries, together with a coarse bill. The type has the bill nearly as large as the head, stout and straight; the rictal bristles are well developed; the wing is large, the first primary being about half the length of the second; and the tail is much longer than the wing, and deeply forked; the outer tail-feathers being one-third longer than the innermost ones. Fork-tails are chiefly found in the Himalaya, and generally in the neighbourhood of mountain-streams, but they also range into Tenasserim. All are solitary in their habits, and move their tails incessantly up and down after the manner of wagtails, and are in the habit of generally perching on rocks or bare branches near the ground.

Redstarts. Exclusively confined to Europe, Northern Africa, and Asia north of the Himalaya, the redstarts (*Ruticilla*) are characterised by the short, slender, black beak, and finely developed rictal bristles, and the black and smooth legs; while most of them have the rump and tail red. In Europe

the genus has half a dozen representatives. Among the prettiest of the summer migrants to Northern and Central Europe is the graceful and attractive bird popularly known as the firetail, or common redstart (*R. phœnicurus*), partial to parks and gardens, and on its first arrival often perching on the lower branches of large trees; the male possessing a very charming song. The redstart commonly builds in a hole in a wall, or the interior of some hollow tree, or upon a shelf in some outhouse; and we once found an open nest of this species placed in the top of a thick bush. The eggs are pale blue, sometimes slightly speckled with red; while the young are easily reared from the nest by hand, and are rather liable



REDBREAST AND REDSTART (½ nat. size).

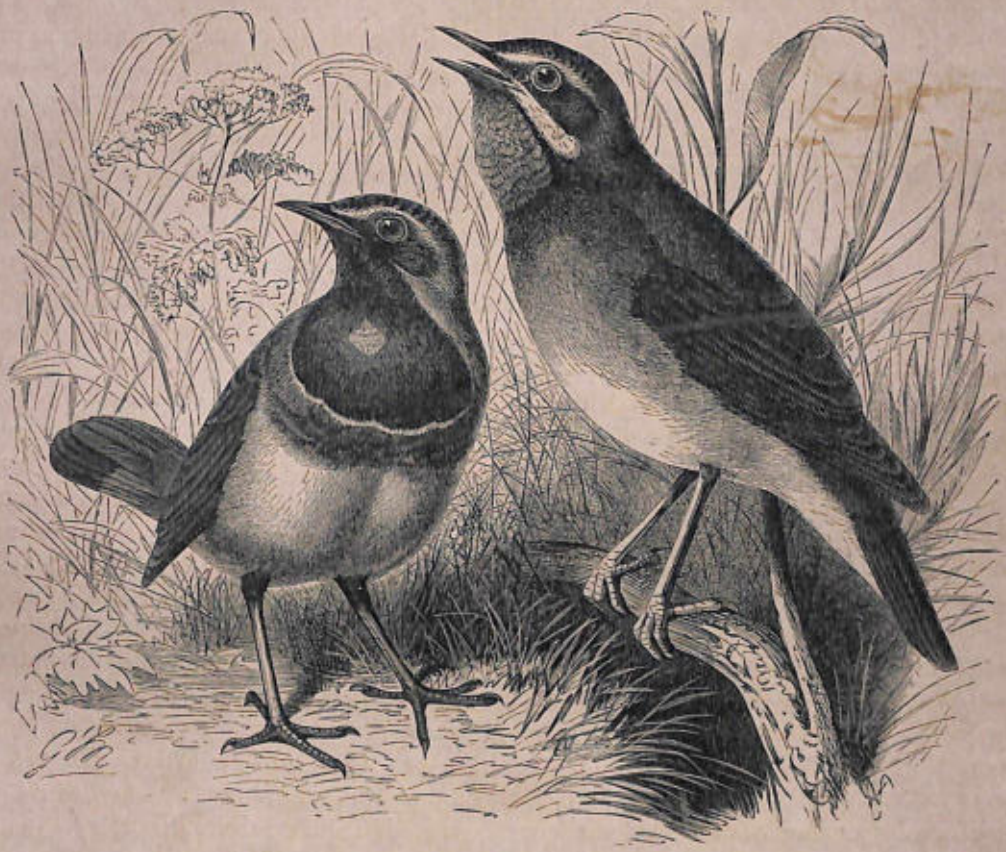
to sport a few white feathers in their first plumage. Foraging among dead leaves for insects, they spend more time upon the ground than the young of any of the allied forms. Often rearing two broods of young during the course of the summer, the redstart in its flight is swift and elegant. Although the male birds generally sing from the branches of trees (unlike the male black redstarts), we have known them to sing habitually upon the roof of a house, exactly as the latter would have done. Leaving their breeding-ground in early autumn, stray birds of this species are often to be met with on the British coast at that season when waiting for an opportunity of taking their departure. The adult male, in summer, has the forehead pure white, the top of the head, scapulars, and back leaden grey; the rump and upper tail-coverts are bright chestnut, as is the tail,

with the exception of the two central feathers; the chin and throat being jet black and the lower-parts bright bay.

Black Redstart. The black redstart (*R. titys*) is a well-known bird in many parts of Central Europe, frequently seen even in large cities. Modifying its habits according to the region it inhabits, in Switzerland the black redstart breeds chiefly about the chalets on the mountains, attaching itself to the neighbourhood of farm-buildings, and obtaining most of its food around the outhouses. In Germany it is quite a common garden-bird, dwelling near human habitations, and generally chanting its notes from the gable of a roof. It begins to sing very early in the morning, and continues until late in the evening; no bird being more self-conscious or more frequently seen in a prominent position. The males are pugnacious and desperately jealous of rivals, although they do not perhaps take to fighting quite as naturally as redbreasts. The nest is built of stems of grass, moss, and dry leaves lined with hair and feathers, thus forming a comfortable cradle for the young. The eggs are white, and five or six in number. The female sits very closely during incubation; and when the young first leave the nest, the old birds continue their devotion, and cater for them with unremitting industry. The greater part of their food appears to consist of flies, at least during the finest period of the summer; and even when they first leave the nest the young birds catch midges on their own account. The young of the first brood generally have to be independent of their female parent early, because, as soon as they are qualified to quit the mother, she lays a fresh clutch of eggs; and it falls, therefore, to the male chiefly to feed the fledged young of the first brood, and his usual practice is to take them to the top of a stone wall, or some other sunny place within view of his favourite point of observation, and gradually leave them to shift for themselves. The young that are reared late in autumn have a harder struggle for existence, especially in Switzerland, where the weather often breaks up in August. Black redstarts are birds that like fine weather; and in stormy weather they are apt to become somewhat disconsolate, and sit moping, with their feathers puffed out. In the summer the species is home-loving though certainly somewhat restless, and never seen in the same position for more than half an hour at once. When the season for migration arrives, this redstart loses, however, its domestic habits, becoming shy and unobtrusive, and setting forth on its journey with a restless energy. Although never breeding in the British Islands, many of these birds annually visit the south-western parts of England during the autumn, and even pass the winter under the shelter of cliffs or in the neighbourhood of houses. They generally arrive in Devonshire in parties of two or three in the autumn; while those that winter in England assemble again in March on the coast for their departure. The plumage of the adult male is a dark bluish grey above, with a conspicuous white patch upon the wings; the forehead and throat are black; the tail is chestnut, tipped with blackish brown, excepting, of course, the two central tail-feathers, which are blackish brown throughout; the breast and lower-parts being slaty grey. The female and young males have the upper-parts brownish grey, and lack the black throat of the adult male; the males of the year breeding in the grey plumage just described.

Blue-Throated Warbler.

So much difference of opinion prevails among ornithologists as to the generic limitation of the birds here included under *Erythacus*, that it will not be of much use to attempt to define the genus. For instance, while Professor Newton includes the blue-throated warbler in *Ruticilla*, Mr. Oates makes it the type of a distinct genus, *Cyanecula*; and while the same ornithologist separates the nightingales (as *Daulias*) from the redbreasts, Dr. Sharpe places both in the present genus. We accordingly proceed to notice some of the better-known species without further preliminaries. One of the loveliest of all the



BLUE-THROATED AND RUBY-THROATED WARBLERS (⅔ nat. size).

group is the blue-throated warbler (*Erythacus suecicus*), the Arctic form of which, represented in the woodcut, has the blue gorget spotted with chestnut-red; while on the other hand the variety of the bluethroat breeding south of the Baltic has the throat spotted with white, or even entirely blue without any spots at all. The Arctic form of bluethroat twice annually crosses the length and breadth of Europe, but it is so seldom noticed on migration through Central Europe as to have given rise to suggestions of impossible distances, conjectured to have been accomplished without rest. It should be observed that Mr. Oates, with whom we are disinclined to agree, regards these two forms as specifically distinct. The Arctic bird reaches its northern breeding-grounds at the end of May, and takes up its residence in

willow-swamps and other damp situations. Its song has been compared by Mr. Seebohm to that of several other birds. "His first attempts at singing are harsh and grating, like the notes of the sedge-warbler, or the still harsher notes of the whitethroat; these are followed by several variations in a louder and rather more melodious tone, repeated over and over again somewhat in the fashion of the song-thrush. After this you might fancy that the little songster was trying to mimic the various alarm-notes of all the birds he can remember; the *chiz-zit* of the wágtail, the *tip-tip-tip* of the blackbird, and especially the *whit-whit* of the chaffinch. As he improves in voice he sings louder and longer, until at last he almost approaches the nightingale in the richness of the melody that he pours forth. Sometimes he will sing as he flies upwards, descending with expanded wings and tail to alight on the highest bough of some low tree, almost exactly as the tree-pipit does in the meadows of our own land. When the females have arrived, there comes at the end of his song the most metallic notes I have ever heard a bird utter. It is a sort of *ting ting*, resembling the sound produced by striking a suspended bar of steel with another piece of the same metal. The female appears to shun the open far more carefully than her mate does, while he will be perched upon a topmost spray, gladdening the whole air around him with his varied tuneful melody, she will remain in the undergrowth beneath him gliding hither and thither more like a mouse than a bird through the branches." The nest of the bluethroat is very well concealed in the side of a tussock of grass and is lined with fine roots and hair; and the eggs are olive-coloured. When the young leave the nest, they forage about for insects in the undergrowth, peering at a stranger with the pretty wistfulness of young robins, to which they bear a rough resemblance in their actions. In Spain the bluethroat is to be met with in very dry situations, but that is only when the birds are on migration; and the same is probably true of its occurrence in the arid districts of Ladak. From our own observations the bluethroat seems to migrate singly or in couples, but Mr. Gaetke states that they arrive in flocks upon Heligoland, both in the month of May and in early autumn. On Heligoland they are chiefly to be found in the potato-fields in autumn, while in spring they frequent the gooseberry and currant bushes of the gardens. We have seen bluethroats sheltering in dry scrub on migration; when every now and then a bird would flit out of its cover, dart upon an insect, and then steal away into the recesses of the bushes, to emerge a moment after for another rapid sally. On the Norfolk coast the bluethroat is well known as a September visitant, and has even appeared in considerable numbers when weather-stayed. We met with bluethroats in the neighbourhood of the Lake of Geneva, one of which, with an entirely blue gorget, frequented a garden, although most of those seen inhabited reed-beds in the marshes of the Rhone. The adult male has the upper-parts brown, with a conspicuous white or buff eyebrow; the throat and upper-breast are metallic cobalt-blue, centred with a large spot of pure white or chestnut, a band of black succeeding the blue, bordered by another band of chestnut; the rest of the under-parts being buffy white.

Redbreast. An inhabitant of the greater part of Europe, the redbreast or robin (*E. rubecula*) is such a familiar and well-known bird as to require but scant notice here. Breeding alike in our gardens and shrubberies and

in the middle of lonely woods, it constructs its nest of dry leaves, moss, and dead grass, lined with a little hair. The eggs are white, blotched and streaked with light red. When the young birds are fledged, they flit about the gardens and outhouses gathering a variety of insects. Many of them migrate in autumn, while others linger to utter their silvery notes during the dead months of the year, drawing near the cottages and farmhouses at the approach of frost. The plumage of the male robin is olive-brown above, tinted with grey; the neck, forehead, and throat being bright orange, the remainder of the lower-parts olive-brown. The robin of the Canary Islands has been classified as a distinct species.



THE REDBREAST.

Rubythroat. Another beautiful species of warbler is the rubythroat (*E. calliope*), represented on the right side of the illustration on p. 485, which makes its summer home in the extreme north of Russia and Siberia, breeding among the tundras of the Arctic Circle, after the ice and snow have thawed and disappeared. Mr. Seebohm says that the song of the rubythroat "is very fine, decidedly more melodious than that of the bluethroat, and very little inferior to that of the nightingale. When first I heard him sing I thought I was listening to a nightingale; he had his back towards me when I shot him, and I was astonished to pick up a bird with a scarlet throat. The feathers were as glossy as silk, and when I skinned him I thought I had rarely if ever seen so beautiful a warbler. The rubythroat appears in the south of Siberia as early as the beginning of April. Its nest is said to be a slight structure, and the eggs are olive-grey. It is a bird of shy and solitary habits, frequenting thickets and close cover, and obtaining its food chiefly upon the ground. It loses the brilliant colour of the throat in confinement. It winters in the Philippine Islands, South China, Burma, and Northern and Central India, occasionally straying into Europe. Jerdon once met with a rubythroat on board ship a little south of Bombay, when a single bird of this species took refuge on board his vessel in the month of November. The adult male has the upper-parts of a uniform olive-brown; the eyestripe and cheeks being white; while the chin and throat are glossy scarlet; and the breast ash-grey shading into buffy grey.

Nightingale. The nightingale (*E. luscinia*) is celebrated in Western Europe as an incomparable songster, and has from all times enjoyed just reputation for the perfection of its vocal powers. Wintering in Africa, it reaches its summer home in the British Isles about the 13th of April, the males being the first to arrive. Its range in the British Isles is somewhat circumscribed; and it does not breed north of Yorkshire. The nest is a loose structure of stems of grass

and dry leaves, generally raised a little from the ground by a deposit of dead twigs, and screened from observation by a profusion of wild brambles or a crop of stinging nettles; the eggs being uniform olive-brown or coffee-coloured. The female, though shy, is much devoted to her charge, and will allow a stranger to stand close beside her without exhibiting her agitation further than by a slight nervous movement of the head which only enables him to obtain a better view of the little russet bird, her dark eye beaming out of its whitish orbit. The nightingale is easily trapped, and was formerly an object of eager pursuit among bird-catchers, who used to imitate the cry of the bird in order to lead it up to the trap which they had prepared for it, bated with a live insect. One bird-catcher informed us that he once caught two male nightingales in this manner in less than ten minutes; this occurred, of course, in a locality where nightingales were plentiful, and upon the first arrival of the males. When the nightingale has hatched her young both parents become absorbed in catering for their progeny. The song is chiefly heard during the night, simply because other birds are then comparatively silent, but the nightingale sings with great power even during the middle of the day. The male has the upper-parts russet-brown shading into chestnut on the upper tail-coverts and tail; the lower-parts being buffish white shading into greyish white on the breast and flanks.



THE NIGHTINGALE.

Eastern Nightingale. In the east of Europe the English nightingale is replaced by a somewhat larger bird (*E. philomela*), which has a distinct song, differing from that of its congener in its greater volume and inferior perfection. It breeds generally in thickets in the neighbourhood of water, and builds a similar nest to that of the well-known bird. The plumage of the eastern nightingale differs from that of the common species in being of a more olive-brown, especially on the upper tail-coverts, in having a more pointed wing, a smaller bastard-primary, and in being slightly spotted or streaked on the breast with grey. A third species is the Persian nightingale (*E. golzi*).

New Zealand Robins. Here may be noticed two Australasian genera of birds, placed by some among the flycatchers, but regarded by Dr. Sharpe as allied to the stonechat and whinchat. It should be observed, however, that the same ornithologist separates (as *Pratincola*) the last-named birds from *Saxicola* to place them among the flycatchers. The New Zealand robins (*Miro*) are characterised by having a slender bill, straight, and furnished with rictal bristles; the wings being moderate and extending to half the length of the tail, and rounded; while the tail is broad and even, the feathers being sharply cut off at their tips. The metatarsus is very long and slender. This genus belongs to the avifauna of New Zealand and

the Chatham Islands; the species peculiar to the latter group of islands being entirely black. The North Island robin (*M. australis*) is confined to the gloomy forests of the interior of the North Island; and the following description of its habits is given by Sir Walter Buller, who writes that, "as the popular name implies, it is naturally a tame bird; and in little-frequented parts of the country it is so fearless and unsuspicious of man that it will approach within a yard of the traveller, and sometimes will even perch on his head or shoulder. It is a favourite companion of the lonesome woodcutter, enlivening him with its cheerful notes; and when sitting on a log, he partakes of his humble meal, it hops about his feet like the traditional robin, to pick up the crumbs. Like its namesake in the old country, moreover, it is noisy, active, and cheerful. Its note is generally the first to herald the dawn, while it is the last to be hushed when evening shades bring gloom into the forest. But there is this noticeable difference between the morning and the evening performance; the former consists of a scale of notes, commencing very high and running down to a low key, uttered in quick succession, and with all the energy of a challenge to the rest of the feathered tribe. The evening performance is merely a short, chirping note, quickly repeated, and with rather a melancholy sound; three or four of them will sometimes join in a chirping chorus, and continue it until the shades of advancing twilight have deepened into night. It lives almost entirely on small insects, and the worms and grubs that are to be found among decaying leaves and other vegetable matter on the surface of the ground in every part of the woods. Its nature is pugnacious, and in the pairing-season the male birds often engage in sharp encounters with each other." The North Island robin goes to nest in October and November. The nest is generally against the bole of a tree at a moderate height from the ground, built of coarse moss, lined with fern-hair and vegetable fibres. The eggs are creamy white in ground-colour, thickly freckled, and speckled with purple and brown. It is much to be regretted that this charming little bird has recently become comparatively rare, though the robin found in the South Island is still fairly abundant. The adult male has the upper-parts dull ashy grey, the feathers having whitish shafts; the wings are dark brown, with white bases to the secondaries; the tail-feathers are dusky brown, margined with ash; the throat, breast, and sides of the body are hoary grey; and the abdomen is white.

Dhyal Bird.

We come next to a small group of birds closely related to the redstarts and robins, but distinguished from all other members of this subfamily by the black and white tail, equal in length to the wing, and considerably graduated. Peculiar to the Old World, these birds are most abundant in the Indian region; the finest songster amongst them being the white-browed warbler (*Copsychus albospecularis*) of Madagascar, the notes of which rival those of the sweetest European birds. The common dhyal bird (*C. saularis*) of India, represented in the woodcut, occurs in every part of the empire. It is resident in Ceylon and Southern China, but is replaced by *C. mindanensis* in the Philippines. The Indian species is a common and familiar bird throughout its range, exhibiting a confiding and friendly disposition like the European redbreast. The cocks are highly pugnacious in the breeding season, and engage in frequent scrimmages with their rivals. The nest is a rough structure, built in a hole of a tree, in an old

stump, or in the crevice of a wall. The nesting holes of the barbets and woodpeckers are often utilised by the dhyal bird. The male has a pleasing song, not unlike that of the redbreast, but of greater compass. This species is often kept as a cage-bird, and has been trained to turn somersaults at a gesture from its owner. The adult male has the head, neck, breast, and upper-parts glossy black; the wings and tail are black, varied with white; and the abdomen and under tail-coverts white. The female has the upper-parts of a uniform dark brown glossed with bluish; the throat and breast are dark grey; and the wings and tail dark brown varied with white.



MALACCA DHYAL BIRD.

Shamas. The shamas (*Cittocincla*) are closely related in structure to the last, from which they are distinguished by the proportionately greater size of the tail, which considerably exceeds the wing in length. The shamas are shy and retiring birds, avoiding the neighbourhood of houses, and obtaining their food in the woods and jungle. The black shama (*C. nigra*) inhabiting the Malayan region, is a skulking species, haunting the dense cover near to the coast. One has been recently discovered in the Philippines (*C. cebuensis*); while the Andaman shama (*C. albiventris*) is peculiar to the islands from which it takes its name. The best known is the Indian shama (*C. macrura*), a permanent resident in the plains of India, and a timid but graceful bird, much sought after by Indian bird-catchers, on account of its beautiful song. For this reason the shama is often imported into Europe as a cage-bird, but it is delicate, and requires care in the colder climate of Great Britain. The shama nests from April to June, retiring into the depths of the jungle, and constructing its nest of grass and dead leaves in the hollow end of the broken branch of a tree. The eggs are greenish marked with reddish brown, and vary in number from three to four. The adult male has the head, breast, back, and wing-coverts black; the rump and upper tail-coverts are white; the tail-feathers are black and black-and-white; and the abdomen and under tail-coverts bright chestnut.

The glossy black and chestnut colours of the male are replaced in the female by dark brown and pale rufous.

Grey Warbler. The grey warbler and its congeners (*Gerygone*) possess a slender straight bill slightly curved and compressed; the wings are rather short and rounded; the tail is long and rather rounded; and the metatarsus long and slender. The birds of this group are found in Australia and New Zealand, ranging also to New Guinea and adjacent islands. The grey warbler (*G. flaviventris*) is mentioned here, because it performs the function of a foster-parent for the young of the two species of cuckoos found in New Zealand. It is a bird of sombre plumage and unobtrusive habits, but utters at short intervals a note of much sweetness; and is plentiful in every part of New Zealand, where it appears to be as much at home in the woods as in the open scrub. Its food consists of small insects, which it obtains in the leafy tops of forest trees as well as in the dense foliage of thick bushes. Sir Walter Buller says: "In the Hot Lakes district I have found it flitting round the steaming geysers, apparently unaffected by the sulphur-fumes, and catching the minute flies that are attracted thither by the humid warmth. Down by the seashore its note may be heard in the low vegetation that fringes the ocean beach; whilst far up the mountain-side, where the scrub is scarce and stunted, it shares the dominion with the ever-present *Zosterops*. Its sweet thrilling warble is always pleasant to the ear, being naturally associated in the mind with the hum of bees among the flowers, and the drumming of locusts in the sunshine." The grey warbler is remarkable for the form of its nest, which is a domed structure, belonging to one of two types—the bottle-shaped nest with a porch entrance, and the pear-shaped form without a porch. The materials used in nest-building are dry moss, grass, vegetable fibres, and spider-webs. The eggs are white, often spotted with red. The grey warbler is an attentive parent to the young of the cuckoos, which are foisted upon it; and probably owes its preservation to the fact that it builds a pensile nest, out of the reach of rats and other vermin. The adult male is olive-brown above; the sides of the neck are dark ashy grey; the tail feathers are ashy brown, shaded with black; and the throat, breast, and sides cinereous grey.

The True Warblers. While the chats, redbreasts, nightingales, and other members of the subfamily *Ruticillinæ* are included by Mr. Oates among the *Turdidæ*, the true warblers and their kindred are regarded by the same ornithologist as constituting a separate family, *Sylviidæ*. On the other hand, Professor Newton includes the *Ruticillinæ* in the *Sylviidæ*; thus showing how very close is the resemblance between the true warblers on the one hand and the thrushes on the other. Accordingly, we prefer to follow Dr. Sharpe in including all those birds under one great family, of which the true warblers will constitute a separate subfamily (*Sylviinæ*). Having thus indicated how extremely difficult it is to separate the thrushes and their allies from the true warblers (*Sylvia*), it may be mentioned that the latter are generally of small size, and usually of plain-coloured plumage. More insectivorous in their habits than the thrushes, and also more migratory in their movements, they usually possess slender bills, adapted to the pursuit of insects. Their wings are variable in size; and the feet slender, and furnished with fine toes. The young of the warblers, unlike those of the typical thrushes, do not

differ materially from adults in colour. This group of birds, in common with the *Ruticillinæ*, is of almost universal distribution, but so preponderates in the Eastern Hemisphere, that Mr. Wallace describes it as an Old World assemblage only meagrely represented in North America.

Whitethroat. The common whitethroat (*Sylvia rufa*) is one of the most abundant of summer birds throughout Europe, arriving in its breeding-haunts in April, and speedily commencing to make its artless nest, composed of dry stems of grass and flowering plants, lined with finer bents and sometimes a little horsehair. The eggs are white, mottled with olive-green specks. The male sings noisily upon the wing, generally starting up from the top of a hawthorn hedge, and then slowly descending, with the tail at an angle to the body. It may frequently be seen picking small moths off the blossoms of the gorse, as it flits actively from one plant to another, and utters a harsh croak. The adult male has the upper-parts greyish brown, the wing-coverts and innermost secondaries being edged with chestnut, the outer tail-feathers margined with white, and the lower-parts buffy white.



LESSER AND COMMON WHITETHROAT (½ nat. size).

Lesser Whitethroat. The lesser whitethroat (*S. curruca*) is a scarcer bird than the last, but its pretty song may be heard about the hedgerows and bushes in many parts of Europe. The nest is placed in a bush or shrub, firmly built of strong bents, lined with finer bents, fibre, and horsehair; the eggs being white, spotted with olive-brown. The lesser whitethroat is very partial to gardens, this being partly accounted for by its fondness for fruit, which is especially manifested when raspberries become ripe. It becomes very tame in confinement, and eats pears and other fruit with avidity. The adult male has the upper-parts slaty grey, suffused with brown on the back, the wings and tail are brown; the under-parts white, the breast tinged with pink, and the ear-coverts dark brown, and conspicuous.

Subalpine Warbler. The subalpine warbler (*S. subalpina*) has a wide range, inhabiting the whole of the Mediterranean region, as well as North Africa and

the Canaries. It is an agile bird, building a globe-shaped nest, placed in thick bushes, and situated from three to five feet above the ground, which is built of stems of grass, lined with fine fibres. The eggs are greenish white, finely spotted with brown. The subalpine warbler is full of activity, and flits about the bushes catching insects. The adult male has the upper-parts slaty grey, the wings are brown, with pale edges, the tail brown, with more or less white on the outer feathers, and the throat and breast chestnut, shading into paler chestnut on the flanks, and to nearly white in the centre of the breast.

Spectacled Warbler. This pretty little bird (*S. conspicillata*) is another Mediterranean species, resident in some parts of its habitat, and in others a summer visitant. A migrant in the north of Spain, it is there somewhat shy and retiring, flitting about the roadside in a furtive, uneasy fashion, and quite solitary. The spectacled warbler builds its nest in a small bush about a foot from the ground, and the eggs are white, blotched with green. The short, sweet song has been compared to that of the goldfinch. The adult male has the crown slaty grey, shading into greyish chestnut on the centre of the back; the wings are dark brown, edged with chestnut, the tail-feathers dark brown, the outer ones being partially pied; while the chin is white, fading into slaty grey on the throat, which again fades into vinous red on the breast and flanks.

Sardinian Warbler. Another South European bird is the pretty black-headed Sardinian warbler (*S. sarda*), an active, restless species, partial to the neighbourhood of undergrowth. It builds in a branch of some tree, generally at a small distance from the ground; and constructs its nest of blades of grass and roots lined with fine bents. The eggs are greenish white blotched at the larger end with greenish grey. This warbler is common in the pine-woods around Cannes, as also in the gardens near the sea; and its habits have been compared to those of the whitethroat. The male sings from a bush, and then darts off in a jerking flight into the air still singing; while the old birds, like the blackcap, simulate the appearance of being injured when they find their young endangered, trailing their wings in the dust and exhibiting the greatest distress. The song is not unlike that of a garden-warbler, but is more intermittent. The plumage of the adult male is slate-grey above, shading into black on the nape, head, and ear-coverts; the wings are dark brown edged with grey, and the tail is dark grey tipped with white, the throat being white fading into greyish white.

Orphean Warbler. The orphean warbler (*S. orphea*) is one of the larger representatives of the group in Europe, which it visits in April, not continuing its journey north of the Baltic. Mr. Seebohm writes that "the song is louder than that of the blackcap, but I thought it somewhat harsher. Its alarm-note is very loud, as loud as that of the blackbird. In the Parnassus I found it very common, and obtained thirteen nests between the 3rd and 21st May. They were easy to find in the bushes which were scattered over the rocky ground above the region of the olive and the vine; but when we got into the pine-region they disappeared. My friend Captain Verner informs me that he has found nests of this bird in Spain placed near the summit of young cork-trees, about twelve feet from the ground. The nest is a tolerably substantial one and deep, composed of dry grass and leafy stalks of plants. Inside it is built of finer grasses, and lined sparingly with thistle-

down or the flower of the cotton-grass. . . . The ground-colour of the eggs of the orphean warbler is white, sometimes faintly tinted with grey and sometimes tinted with brown. . . . The colour of the overlying spots varies from olive-brown to nearly black." The orphean warbler is a large form of the blackcap, and decidedly more elegant in shape than that species. The adult male has the crown sooty black; the general colour of the upper-parts is dull slate-grey; the wings and tail are brown, and the under-parts white shading into grey upon the breast and flanks.

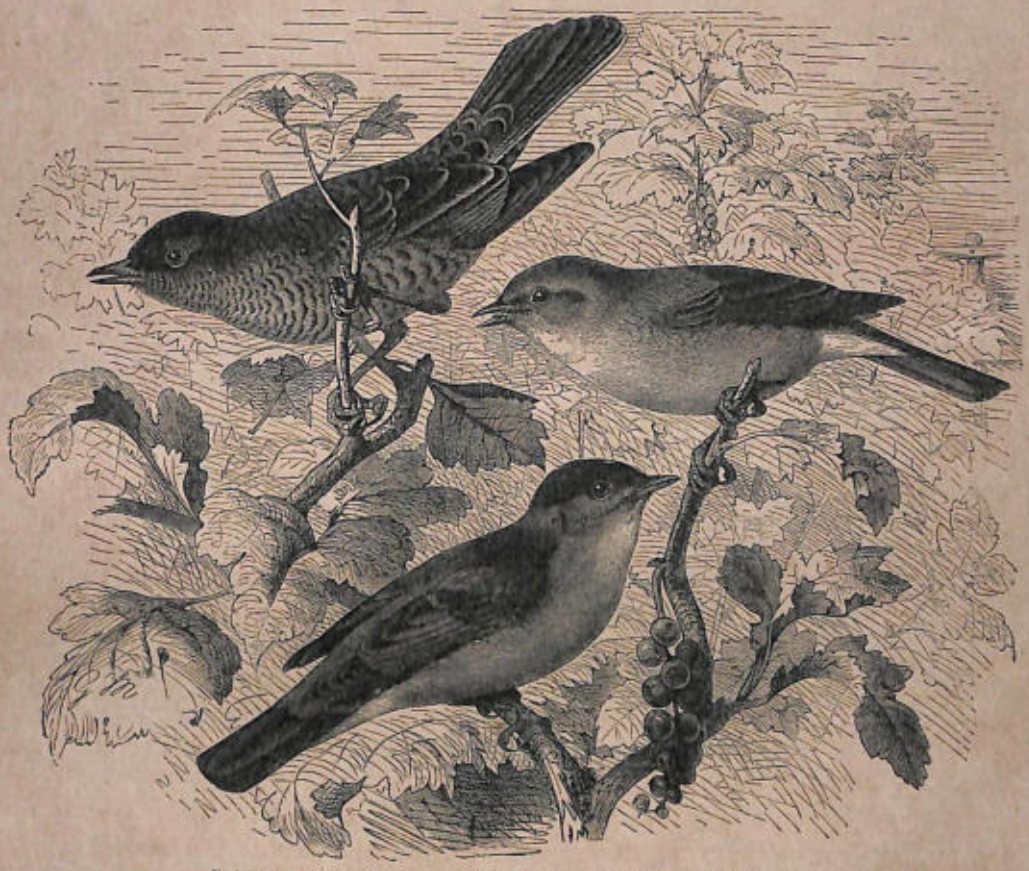


RUFOUS AND ORPHEAN WARBLERS (½ nat. size).

Garden Warbler. A more skulking species than the last is the garden-warbler (*S. salicaria*), which arrives in its summer haunts in Europe about the same date as the blackcap. It is rather a retiring bird, and is consequently often overlooked. It has a sweet song, generally poured forth from the centre of some thick bush or other cover; its nest is of dry stems and moss, lined with fibres and a few hairs; its eggs are greenish white blotched with grey and olive-brown. The garden-warbler is partial to fruit, but we have not seen it strip the berries from the elder-bushes in the same way as the blackcap. The adult male has the upper-parts olive-brown, darker and greyer on the wings and tail; and the under-parts greyish white.

Blackcap. Among the sweetest songsters that visit the gardens and shrubberies of Europe is this slim and attractive species (*S. atricapilla*), which arrives in the British Isles in April, and at once takes up its abode in

orchards and woodlands. The male bird upon its first arrival frequently sings in highly exposed situations; indeed, he can hardly do otherwise, since in backward seasons his progeny are hatched before the leaves of many trees have unrolled. The female constructs her nest of dry stems of grass and fibres, lining it with fine roots and hair; the eggs being generally yellowish brown, clouded with a darker colour. The song of the blackcap is rich and well sustained; and from the rich quality of its notes the bird has been termed the Norfolk nightingale. The blackcap is a most anxious parent, exhibiting lively distress if the safety of the young



BARRED WARBLER, GARDEN WARBLER, AND BLACKCAP (½ nat size).

be menaced. The young feather very rapidly and leave the nest proportionately earlier than do many other birds. In July the song of the blackcap becomes soft and subdued, and the bird then sings in close cover, shunning notoriety. The blackcap is a favourite cage-bird; we have seen hundreds caged in Paris, and many more in Berne and other continental cities. In the Canaries there occurs a curious variety in which the black of the cap extends over the nape and shoulders as well as round the throat. The typical adult male has the forehead and crown pure black, the upper-parts bluish grey, suffused with olive-brown, the wings and tail brown; while beneath it is bluish grey. The female has the cap of a rusty red; and in captivity sings sweetly, although less powerfully than her mate.

Barred Warbler. The barred warbler (*S. nisoria*) arrives in its summer quarters in Europe somewhat later than the majority of migrants, and takes up its abode chiefly in gardens; constructing a bulky nest, more compact than that of most warblers, of roots and dry stems neatly lined with horsehair or fibres. The nest is generally built in a thorn bush not far from the ground, and the eggs are buffish white spotted with brown and ash-colour. The barred warbler is shy and skulking in its habits, and even in confinement it retains this shyness, although this does not extend to birds reared from the nest. The adult male has the upper-parts brownish grey; the under-parts being greyish white, finely barred with brown.

Dartford Warbler. The Dartford warbler (*S. undata*)[1] is a resident but local bird in the temperate parts of Europe, breeding also in the mountains of Algeria. It is a small, retiring species, fond of thick covert, and used to be tolerably common even in the neighbourhood of London until exterminated by several severe winters. Mr. Swaysland wrote to us in 1883: "I have taken several hundreds of eggs of the Dartford warbler within a few miles of Brighton, but the birds were all exterminated in a recent severe winter. I have not heard of any since, though formerly we could find a dozen pairs within a few miles. I have taken the eggs of a single pair three or four times in a season. If the nest contained three eggs when I first robbed it, the next clutch usually contained five eggs, but if it contained four eggs the first time the second laying usually consisted of the same number." The Dartford warbler builds a very slight nest, composed of dry stalks and lined with finer stems added to a little wool. The nest is usually extremely difficult to find, and can only be discovered by patient observation of the old birds. Mr. Newman often observed the Dartford warbler in the neighbourhood of Godalming, and has left the following sketch of its winter habits:—"When the leaves are off the trees, and the chill winter winds have driven the summer birds to the olive-gardens of Spain or across the straits, the furze-wren is in the height of its enjoyment. I have seen them by dozens skipping about the furze, lighting for a moment upon the very point of the sprigs and instantly diving out of sight again, singing out their angry impatient ditty for ever the same. They prefer those places where the furze is very thick, high, and difficult to get in." The egg of the Dartford warbler is white or buff in ground-colour, suffused with olive or reddish brown. The song of the male is lively, and often uttered upon the wing. The nestlings which Montagu reared began to sing as soon as they assumed adult plumage. The plumage of the adult male is very dark sooty brown, shading into slate-grey on the head; tail dark grey, the outside feathers tipped with white; the under-parts are chestnut-brown, shading into white on the centre of the belly, and having the feathers of the chin and upper throat tipped with white; the under tail-coverts are grey tipped with white.

The Willow Warblers. The yellow-browed warbler (*Phylloscopus superciliosus*) figured on p. 505, is an example of a genus differing from the preceding by the supplemental bristles in front of those of the rictus of the gape being stronger and more numerous, while the beak is short and stout. The genus includes the chiff-chaff (*P. collybita*), wood-wren (*P. sibilatrix*), willow-wren (*P. trochilus*), etc. The yellow-browed warbler passes the summer in North Siberia, where Mr. Seebohm

[1] Frequently separated generically as *Melizophilus*.

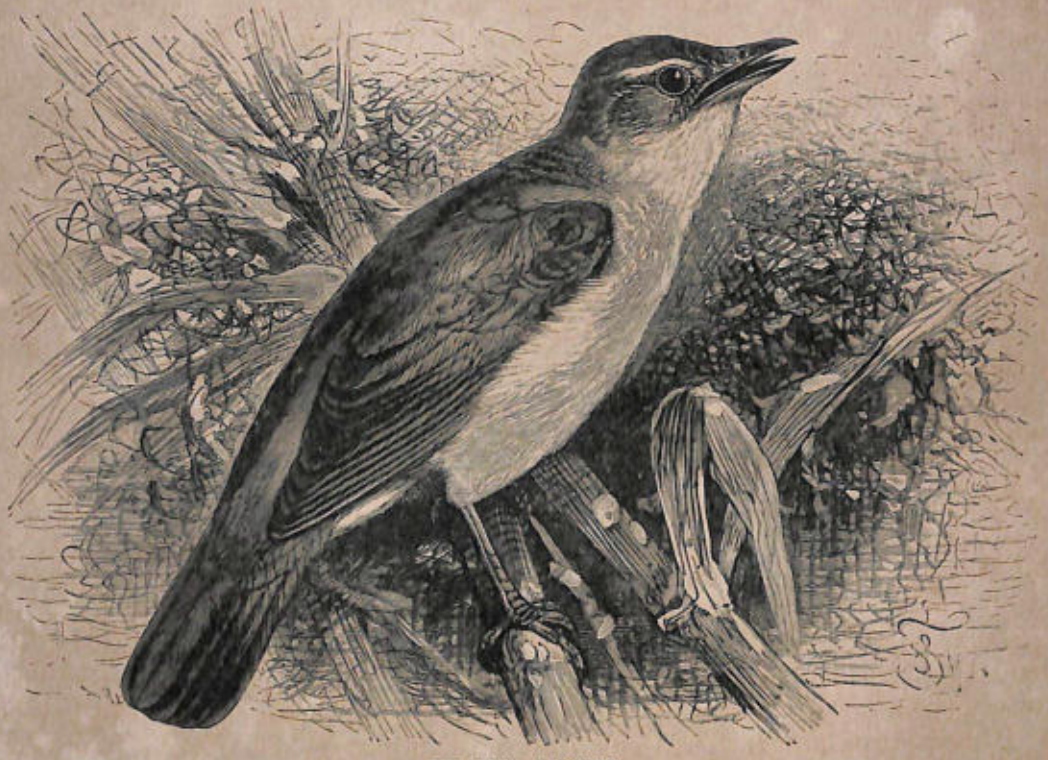
first discovered its eggs, of which he gives the following account:—"As we were walking along a little bird started up near us, and began most persistently to utter the alarm note of the yellow-browed warbler, a note which I had learned in Gaetke's garden in Heligoland. As it kept flying around us from tree to tree we naturally came to the conclusion that it had a nest near. We searched for some time unsuccessfully, and then retired to a short distance and sat down upon a tree trunk to watch. The bird was very uneasy, but continually came back to a birch-tree, frequently making several short flights towards the ground, as if it were anxious to go into its nest but dare not whilst we were in sight. This went



ICTERINE WARBLER (⅔ nat. size).

on for about half an hour, when we came to the conclusion that the treasure we were in search of must be within a few yards of the birch-tree, and we again commenced a search. In less than five minutes I found the nest with six eggs in it. It was built in a slight tuft of grass, moss and bilberries, semi-domed exactly like the nests of our willow-warblers. It was composed of dry grass and moss ends lined with reindeer hair. The eggs were very similar in colour to that of our willow-warbler, but were rather more spotted and smaller in size. The yellow-browed warbler occasionally straggles into Europe on the autumnal migration. The adult male has the upper-parts olive-green; a well-defined narrow greenish yellow eyestripe extends over the eyes; the wing-coverts are tipped with yellow forming two bars across the wings, the wing quills and tail are brown, the lower-parts white suffused with yellowish green.

Icterine Warbler. As an example of another genus differing from *Sylvia* by the length of the beak from the gape exceeding (instead of falling short of) the third toe and its claw, may be mentioned the icterine warbler (*Hypolais philomela*); eight other species of the genus being known. Annually visiting temperate Europe south of the Baltic, the icterine warbler is a graceful slender bird, and on its first arrival may be observed flitting actively about the lower branches of trees and bushes in quest of insect prey. Although in coloration this warbler bears some resemblance to the willow-warblers, it does not form a dome to its nest like those birds, nor does it build near the ground. On the contrary, its pretty nest is of dry stems of grass interwoven with moss, wool, and other materials, in some small tree, generally eight or ten feet from the ground. The eggs are brownish



THE REED WARBLER.

pink in ground-colour, spotted with dark purplish brown. Mr. Seebohm gives the following description of the song of the icterine warbler:—"Perhaps on the whole the song of the common tree-warbler comes nearest to that of the marsh-warbler, but often it reminds you strongly of the sedge-warblers. At other times you may trace a fancied resemblance to the chirping of the sparrow, the scolding of the whitethroat, or the scream of the swift." The adult male in spring is olive-green above, the wings and tail are brown, the under-parts are uniformly of a very beautiful and delicate yellow. The female is identical in plumage with her mate but rather duller.

Reed Warblers. Yet another genus (*Acrocephalus*) of warblers is typically represented by the reed-warbler, and is distinguished from all the foregoing

by the feathers of the forehead being short and rounded, instead of disintegrated and with elongated shafts. Moreover, there are no hairs or bristles on the forehead, with the exception of the ordinary ones at the rictus of the gape. In this particular genus of the group, displaying the above characters, the first primary quill of the wing is much less than one-third the length of the second, while the rictal bristles are strongly developed, and the tail is but slightly graduated. The reed-warbler (*Acrocephalus streperus*) is an annual visitor to most parts of temperate Europe, arriving in April and May, and generally taking up its abode in extensive morasses. The nest is a singularly beautiful structure, built in the middle of a wood a long way from water; one which we found was composed of delicate green moss; while another from Romney Marsh was almost wholly constructed of sheep's wool. The eggs are greenish white in ground-colour, clouded or freckled with dark olive. The song of this warbler is rich and much varied. The adult male in spring has the upper-parts rufous brown, the colour being most pronounced upon the rump and upper tail-coverts, while the chin and throat are dull white, and the breast and flanks pale buff.

The sedge-warbler (*A. schoenobœnus*), shown on the left figure on p. 501, is common in many parts of Europe, arriving in April from North Africa, and speedily taking up its residence in some suitable haunt, generally a scrub near the waterside. It generally departs again for the south in September, wintering in Africa. Its song is loud and varied, and often delivered during the stillness of a summer night. The nest is a slight structure, of dry stems without any lining, or of dry stems and a little green moss, lined with the feathers of the gadwall. The eggs are yellowish brown. The adult male in spring has the upper-parts rusty russet-brown, with dark centres to the feathers, the eyestripe being buffish white; while the wings and tail are brown, and the under-parts buffish white.

Grasshopper-Warbler.

Nearly allied to the last, the grasshopper-warblers (*Locustella*), of which there are some eight species, may be distinguished by the smaller development of the rictal bristles, as well as by the more markedly graduated tail, in which the outermost feathers are less than three-fourths the total length. They derive their name from their peculiar chirping notes. The grasshopper-warbler (*L. nævia*) is a regular but local summer visitant to Europe, arriving in Britain in the month of April in small flocks which soon break up, each pair taking up its residence in some sequestered nook either on a heath on the margin of large woods or in the bottom of a deep hedge. On its first arrival the hedges are generally bare or nearly so, a circumstance which naturally facilitates the observation of the movements of this shy bird. Both the male and female sing, but most of the ventriloquising efforts proceed from the male bird. The grasshopper-warbler sings its curious song principally during the early hours of day and shortly before dusk, although it would be a mistake to suppose that it does not sing at other times, for it often sings lustily in the middle of the day. The nest is cunningly concealed in thick herbage; the best plan of discovering its whereabouts being to visit the spot, which the birds are known to frequent, shortly before sunset. If every likely corner be thus explored with the aid of a long stick, the female will almost certainly be detected in the act of slipping

off her eggs, creeping away through the undergrowth with the stealth and rapidity of a mouse. The eggs are pinkish white freckled with darker reddish brown. The adult male has the upper-parts olive-brown with dark centres to the feathers,



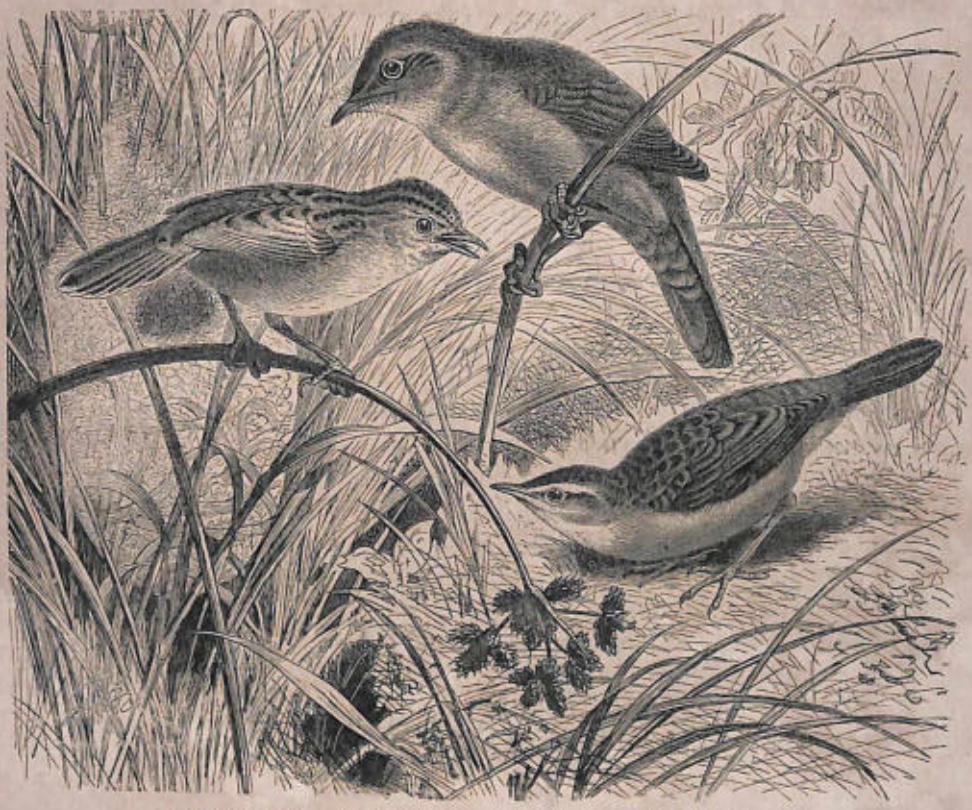
GRASSHOPPER, RIVER, AND SAVI'S WARBLERS ($\frac{2}{3}$ nat. size).

while the chin and centre of the belly are white, shading into buffish brown on the breast and flanks.

River-Warbler. Among the finest of European songsters is the river-warbler (*L. fluviatilis*) of Eastern Europe, which spends the summer months on the shore of the Elbe, the Danube, and other large rivers, where it frequents thickets and dense undergrowth, building a cup-shaped nest of dry stems. The eggs are greyish white, spotted with reddish brown. The song for which the river warbler is remarkable has been compared to the chirping of grasshoppers; during the early hours of the day the bird sometimes sings in exposed situations, but under ordinary circumstances skulks in the most impenetrable thickets. Both sexes have the

upper-parts uniformly dark olive-brown with a scarcely perceptible eyestripe, the under-parts being greyish brown, shading into white on the throat and belly.

Savi's Warbler. One of the rarer and more interesting of European warblers is the little obscurely coloured bird known as Savi's warbler (*L. luscinoides*), which nests in Holland, building a nest of blades of dry sedge firmly interwoven, which cannot well be mistaken for that of any other bird. The eggs are white, sprinkled with ashy brown spots. In the Rhone marshes this bird may be observed actively running up and down the reeds, occasionally uttering a curious cry which has been compared to that of a tree-frog. The male has the upper-parts uniform russet-brown, and the under-parts are pale buffish brown, shading into nearly white on the centre of the throat and belly.

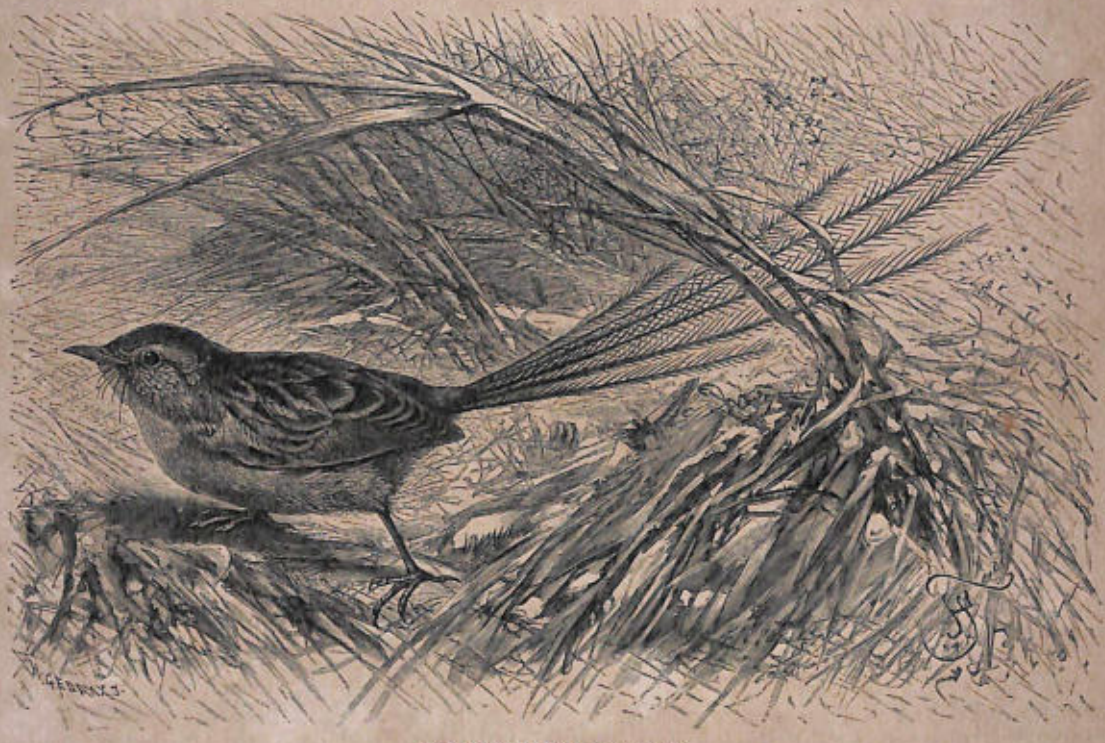


SEDGE-WARBLER, CETTI'S WARBLER, AND FAN-TAIL WARBLER (½ nat. size).

Cettian Warblers. Cetti's warbler (*Bradypterus cettii*) may be taken as the best known European representative of another large group of genera differing from all the foregoing in having only ten (in place of twelve) tail-feathers. As the number of these genera is far too large to be even mentioned here, it will suffice to say that Cetti's warbler holds a high position among the song-birds of Southern Europe, and that it passes the summer in the Mediterranean region, inhabiting close and impenetrable covert during its summer sojourn. It builds its nest of dry stems and blades of grass in the neighbourhood of water. The eggs are brilliant red, and without any spots. In some parts of its range

Cetti's warbler is resident throughout the year. It sings in every month, and it is somewhat startling in winter to hear a loud and abrupt burst of song, resembling that of a nightingale, from a thick bush. The adult male has the upper-parts rich russet-brown; the eye stripe is greyish white, but indistinct; the wings and tail are dark russet-brown; the chin and throat are white, shading into ashy grey on the sides of the breast, and into brownish grey on the flanks and upper tail-coverts.

To the same group belongs the Australian pheasant-tailed warbler (*Stipiturus malacurus*), distinguished by the elongation and peculiar structure of the three central pairs of tail-feathers.



PHEASANT-TAILED WARBLER.

Fan-Tail Warblers. Another group is represented by the fan-tailed warbler (*Cisticola cursitans*), which is one of the smallest of the European reed-warblers, and is easily recognised by its curved beak and fan-shaped tail. It appears to reside all the year through in many parts of the Mediterranean countries, constantly frequenting swampy grounds, and obtaining its food near water.

Accentors. The members of the genus *Accentor* possess a fairly strong bill, broad at the base, with a nearly straight culmen, about half the length of the head; the wings being long and pointed, and the tail nearly square. The legs and feet are strong and generally adapted to progression over rocks and rough surfaces; while the plumage is generally dark brown, varied with rufous. Belonging to Europe, North Africa, and Western Asia, the accentors usually inhabit mountain ranges, although the hedge-sparrow frequents bushes and scrub. Common among the mountains of Europe, the Alpine accentor

(*A. collaris*) inhabits the Pyrenees and Alps, occasionally wandering far from its usual haunts, and reaching the British Islands and Heligoland. It begins to build in May; the nest is round, somewhat shallow, fairly compact, and composed mainly of dry grass stems and very small pieces of moss, the inside being lined entirely with the same kind of moss and the small white feathers of the ptarmigan. The eggs are light greenish blue and unspotted. The adult male has the head and neck grey; the upper-parts are dark brown with light brown edges; the wing-



HEDGE-SPARROW AND ALPINE ACCENTOR ($\frac{1}{2}$ nat. size).

coverts tipped with white; the throat white spotted with black; and the breast and under tail-coverts dark grey, shading into rich chestnut upon the flanks.

Hedge-Sparrow. Although generally nesting in the vicinity of dwelling-houses, the hedge-sparrow (*A. modularis*), which is very widely distributed in Europe, may be found in Spain living far away in the depths of the forest. Its cheery song is often uttered from the top of a small shrub or spray of hawthorn; and, as it is an early breeder, its eggs are often laid before the leaves of the hedges have sufficiently expanded to save them from being chilled by heavy showers of rain. The nest, built of fine roots and moss, is placed in the shelter of a hedge on a bank, under a hawthorn bush, or in the side of an ivied wall, and generally contains four or five blue unspotted eggs. The young when first hatched are invested with black down, but they feather rapidly. In the Hebrides, the hedge-sparrow nests in the sides of burns, adapting its existence to a moorland life. During the winter-time, this bird obtains most of its subsistence in gardens, and may often be seen stealing in and out among the growing plants like

a mouse. Its call-note is loud but monotonous. The hedge-sparrow is very subject to variation of plumage, specimens being often seen prettily pied with white, sometimes symmetrically arranged, while pure white specimens are occasionally met with. The adult has the head and sides of the neck bluish grey, purest in the breeding-season; while the wings and tail are dusky brown, the back reddish brown streaked with darker brown, and the chin and throat grey, the lower-parts being white. Altogether, thirteen representatives of the genus are known.

Goldcrests.

While some ornithologists refer the accentors to one distinct family (*Accentoridæ*) and the goldcrests to a second (*Regulidæ*), we prefer to follow Professor Newton in including both in the same family as the warblers, as is done in his edition of *Yarrell's British Birds*. In addition to their small size, the goldcrests (*Regulus*) are characterised by the straight and slender beak, which is compressed towards the point, where it is notched. The basally-placed nostrils are covered by a single bristly feather, and there are numerous bristles at the rictus of the gape. The rather long wings have the first primary nearly half the length of the second, which is somewhat shorter than the third, and this exceeded in length by the fourth and fifth. The tail has twelve feathers, and is slightly forked; the legs are long and slender, with elongated claws. An inhabitant of the pine-forests of Europe, the tiny goldcrest (*R. cristatus*) is an exceedingly hardy bird, contriving to obtain subsistence when others are famishing with hunger. During the summer months it haunts gardens and the skirts of woods, building its beautiful little nest upon the under surface of some coniferous tree at very varying distances from the ground; the nest itself — an exquisite structure, chiefly of the softest moss and lined with the most delicate of feathers —being sometimes finished as early as the middle of March, while fresh eggs may be taken in the middle of July; considerable latitude thus existing in the breeding-season. The brooding female is never long away from the nest, and, even if disturbed, only flits anxiously about the tree which contains her treasure, uttering a low, troubled cry so long as she is conscious of being under observation. If surveillance be removed, the little bird slips hastily on to her eggs, and probably remains in the nest, trusting to the decorative skill with which she has adorned its exterior to render her detection difficult. The eggs are white, suffused with reddish buff. Montagu found that the female goldcrest would even venture into a room in order to feed her captive young, and this not once in a way but all through the day. When a brood of young goldcrests is going to roost, a scramble takes place among the young for the warmest place; all roosting in a row, and each endeavouring to get an inside position. Although many of the goldcrests haunting the English hedge-rows in winter have been bred in the country, the largest proportion congregating in the coverts at that season are birds which have crossed the North Sea; thousands annually arriving upon the east coast of England, often much exhausted by their travels. The adult male has the forehead olive-green, the crest being bright yellow or orange, banded by a black stripe on either side; while the upper-parts are olive-green tinged with yellow, the wings dark brown edged with greenish yellow, and the lower-parts greyish olive. The female has the crest pale yellow instead of orange, while all her tints are more obscure than those of her partner.

Firecrest. Although a much more local bird than the goldcrest, the firecrest (*R. ignicapillus*) is fairly common in the pine-forests of a good many parts of Europe, often frequenting bushes and scrub as well as the larger branches of trees. Pairing by the middle of April, its whereabouts is generally intimated by its shrill call-note, which is louder and less tremulous than that of the goldcrest. The firecrest builds a similar nest to that of the goldcrest, but the eggs are of a warmer coloration. It is a partial migrant, crossing the North Sea in autumn, but only in very small numbers. Mr. Seebohm writes that these birds "twist



YELLOW-BROWED WARBLER, FIRECREST, AND GOLDCREST (½ nat. size).

in and out among the slender twigs, sometimes with head down and sometimes with feet up; but by far the most curious part of the performance is when they come to the end of the twig and examine the under surface of the leaves at its extremity. They have nothing to stand upon; so they flutter more like bees than birds from leaf to leaf, their little wings beating as hard as they can go. The male has the forehead buff, the crest bright orange, bordered with black on either side; two other black stripes pass through the eye and from the base of the bill downwards; the upper-parts are olive-green varied with gold on the sides of the neck, and the under-parts dull buffish white.

Rubycrest. The rubycrest (*R. calendula*) is a well-known bird in the United States, returning from the far north, in which it breeds, in

September, when it presses gradually south into all the Southern States, a few continuing their journey into South America. Dr. Coues gives the following description of its habits:—"To observe the manners of the rubycrown one need only repair at the right season to the nearest thicket coppice or piece of shrubbery. These are its favourite resorts, especially in the fall and winter; though sometimes, more particularly in the spring, it appears to be more ambitious, and its slight form may be almost lost among the branches of the taller trees. We shall most likely find it not alone but in straggling troops, which keep up a sort of companionship with each other as well as with different birds, though each individual seems to be absorbed in its particular business. We hear the slender wiry note, and see the little creatures skipping nimbly about the smaller branches in endlessly varied attitudes, peering in the crevices of the bark for their minute insect-food, taking short nervous flights from one bough to another, twitching their wings as they alight, and always too busy to pay attention to what may be going on around them." The rubycrest builds a tiny nest consisting of a mass of hair and feathers mixed with moss and some short bits of straw; commonly breeding in the heavy pine and spruce forests on the mountains of Colorado and also in Arizona. It was of the rubycrest that Audubon himself wrote: "When I tell you that its song is fully as sonorous as that of the canary-bird, and much richer, I do not come up to the truth; for it is not only as powerful and clear, but much more varied and pleasing." The male has a rich scarlet crest; the upper-parts are greenish olive, and the wings and tail dusky; the under-parts being yellowish-white.

The Wood-Warblers.

Family *Mniotiltidæ*.

The American family of birds known as wood-warblers may be conveniently mentioned here, not only on account of their popular name, which causes them to be associated with the warblers of the Old World, but also from the circumstance that they are probably more or less closely related to the *Cœrebidæ*, among which they are placed by Brehm. It would be useless to attempt to define the whole family, or to mention the numerous genera; and we consequently select for illustration the black-throated green warbler (*Dendræca virens*) as a well-known example of a large and widely-spread genus. Small in build, the numerous species of this large group have the beak of variable size, conical in shape, and provided with rictal bristles; while the wings are long and pointed, the first and second primaries being the longest. The metatarsus is long, and the claws are rather small and much curved. The coloration of the tail-feathers is a good clue to any member of this genus, since these are almost invariably blotched with white. Of thirty-five reputed species of this genus of wood-warblers, twenty-six have been ascribed to North America, one of the best known of these being the summer yellow-bird of the United States, an abundant and familiar denizen of parks and orchards; while another is the lovely orange-breasted Blackburn's warbler, of which Dr. Coues says, "there is nothing to compare with the exquisite hue of this Promethean torch." The black-

throated green warbler which annually arrives in the Eastern parts of the United States early in May, nesting chiefly in fir-woods, and building in the oblique fork of a bough, generally at some distance from the ground, constructing its nest of a variety of materials, such as vegetable fibres and dry stems, lined with finer grass, horsehair, and feathers. The eggs are white in ground-colour, variegated with purplish spots. The song of the male is plaintive and prolonged, and generally to be heard among the pine-trees. As a straggler, this bird has occurred upon the



BLACK-THROATED GREEN WARBLER (⅔ nat. size).

island of Heligoland. The adult male has the upper-parts olive-green, yellower on the rump, the forehead and sides of the head bright yellow, the chin, breast, and throat jet black, the abdomen white, and the wings and tail dusky, the wings being barred with whitish.

The Dippers.

Family *Cinclidæ*.

The dippers form a small group apparently allied to the thrushes, but specially adapted to a semi-aquatic life. They possess a narrow, straight bill, slightly bent and notched; a very short and rounded wing; and a short and broad tail; the metatarsus being long and smooth; while the feet are furnished with long claws. The sexes are alike; and the young, unlike the adults, are always spotted on the lower surface. The plumage is close and dense, and the body is covered with down. The dippers frequent the beds of clear streams in the northern parts of both hemispheres; while three species exist in South America, one of the latter being Schulz's dipper—a dark, grey bird with a pretty rufous throat, but

similar in size and shape to the European species. The whole of the twelve known species are included in the genus *Cinclus*. The mountain-streams of Europe are all frequented by one or other form of the white-breasted dippers, which agree in habits wherever they are found. The busy, bustling dipper is occasionally to be seen sporting upon the seashore at the mouth of some fresh-water burn; but we connect it more naturally with the eddying rapids of the salmon river, or the rippling waters of the fellside beck. The common dipper (*Cinclus aquaticus*) of Western Europe is a very early breeder, building at the end of winter, sometimes in the branches or the roots of a tree, but generally beneath a bridge, or overhanging rock. The nest is constructed of fine stems of grass, lined with dead leaves, and enclosed in a beautifully formed case of green moss; the eggs being pure white. Although the dipper delights in frosty weather, its song may be heard at any season of the year. Whether the loosened ice be floating down the river, or the flowering of the pilewort in the hedgeside afford an omen that the present is the time to pair, the dipper is ever a perfect embodiment of grace combined with indomitable energy. Retaining a spirit unsoured and unchafed by the petty disappointments of life, nothing ever seems to come amiss to him. When the redwing hops dolefully across the snowdrift, and famishing rooks fall with beak and nail upon weaker birds, the dipper preserves his equanimity intact, and manages to secure an easy competency. The adult has the upper-parts slaty grey; the head brown; the chin, throat, and upper breast pure white; and the rest of the lower-parts chestnut-brown, varying much in intensity. The European species is replaced in the Himalaya by the brown dipper (*C. asiaticus*), which is found at elevations from one to fourteen thousand feet, according to the season. This dipper lays at very different periods, according to elevation, sometimes nesting as early as December: the nests found by Mr. Hume were large balls of moss, wedged into clefts of moss and fern-covered rocks, the one, half under a little cascade, the other about a foot above the water's edge in the side of a rock standing in the midst of a broad, deep stream. The eggs are pure white, similar to those of the European dipper, but smaller. The adult male has the entire plumage chocolate-brown, with the edges of the feathers somewhat paler in places, the eyelids are covered with white feathers, and the wings and tail are dark brown.

The Wrens.

Family *Troglodytidæ*.

The wrens are a group of very small birds, showing a considerable variety of form among upwards of a hundred representatives. They are characterised by a moderate or slender bill, either straight or slightly curved; the nostrils being narrow, or broadly oval, and exposed; while the wings are short and generally rounded; and the tail of variable length, often rounded, and frequently carried over the back. These birds are most abundantly represented in South America, but have their typical representatives both in North America and the northern parts of the Old World. Certain forms are also found in the Himalaya and Tibet,



DIPPER, PIED WAGTAIL AND YELLOW WAGTAIL.

while others occur in Patagonia and North-West America. Among a large number of generic types (nineteen), space admits of our noticing but two.

True Wrens.

The common wren and its congeners have the beak of moderate size, pointed and slightly curved; the wing being very short and rounded, and the tail also comparatively short and rounded. The feet are strong for so small a bird, and the metatarsus is comparatively long. Typically a European bird, the common wren (*Troglodytes vulgaris*) is represented in the Kurile Islands by a race remarkable for its long bill; while the Japanese wren is darker and more rufous on the under-parts than the British one. Mr. Seebohm considers, however, that in the colour of the upper-parts the various forms of wrens completely intergrade, so that it is impossible to draw a line anywhere between the palest desert forms from Algeria and Turkestan and the darkest tropical forms from Kashmir and Sikhim. A pale form of wren inhabits even the desolate Behring Island.



WRENS AND THEIR NEST.

The common wren is one of the most familiar of European birds, its sweet ringing song being heard at almost every season of the year, not excepting frosty weather. The wren builds a pretty domed nest, varying in material with the situation; one of the most unattractive that we have seen being built of strong wheat straws with a little hay added to the dome. Other nests have been made of green moss studded with lichen on the outside, but whatever the material employed the nest is always domed. The eggs are white, finely spotted with red. Mr. Dresser remarks that "the wren has a peculiar habit of building nests which are not required for the purposes of incubation. Although it does not appear that anyone has been able satisfactorily to show for what purpose they are constructed, my own opinion is that they are intended as houses of refuge during cold or inclement weather; and this has been shared by many other naturalists. The wren appears to be susceptible of cold; and, during the winter, an entire family will creep into a convenient hole, and by huddling close together retain as much heat as possible." We have captured wrens in their roost in

winter, but failed to keep them alive, although they are often exposed for sale in the Paris bird-market. The wren generally rears several broods in a season, and the old birds attend their offspring with the utmost assiduity.

The European wren is not, it must be confessed, much of a musician, but some of the South American representatives of the family are renowned for their powers of song. Among them stands pre-eminent the so-called organ bird, or warbling wren (*Cyphorhinus cantans*) of the forests of Amazonia. "When its singular notes strike the ear for the first time," writes Bates, "the impression cannot be resisted that they are produced by a human voice; some musical boy must be gathering fruits in the thicket, and singing a few notes to cheer himself. The tones become more fluty and plaintive; they are now those of a flageolet, and, notwithstanding the utter impossibility of the thing, one is for a moment convinced that someone is playing that instrument. . . . It is the only songster that makes an impression on the natives, who sometimes rest their paddles whilst travelling in their small canoes along the shady bypaths, as if struck by the mysterious sound."

The adult cock-bird of the common wren has the upper-parts reddish brown, banded, except the head, with numerous blackish brown bars; the eyebrows being dull white, as are also the under-parts, although varied with rufous. In Iceland and the Faroes this wren is replaced by the northern wren (*T. borealis*), which is larger, darker, and has the under-parts more strongly barred.

Cactus-Wrens. Some twenty species are included in this group, all of which possess a stout compressed bill. The wings are broad, the tail graduated and fan-shaped, and the claws of the feet strong and much curved. Chiefly inhabitants of Central and South America, the true cactus-wren (*Campylorhynchus brunneicapillus*) is found in California and Texas. Of the habits of this wren, Dr. Coues gives the following description, observing that in "the most arid and desolate regions of the South-West, where the cacti flourish with wonderful luxuriance, covering the impoverished tracts of volcanic débris with a kind of vegetation only less ugly and forbidding than the very scoria, this wren makes its home and places its nests on every hand in the thorny embrace of the repulsive vegetation. True to the instincts and traditions of the wren family, it builds a bulky and conspicuous domicile; and when many are breeding together the structures become as noticeable as the nests which a colony of marsh-wrens build in the heart of the swaying reeds. But it is not a globular mass of material, nor yet a cup; it is like a purse or pouch and also peculiar in its position, for such nests are usually pensile. In the present case, the nest resembles a flattened flask—more exactly, it is like the nursing-bottle with which all mothers are familiar, and this is laid horizontally on its flat side in the crotch of a cactus. It is constructed of grasses and small twigs woven or matted together, and lined with feathers. Including the covered way or neck of the bottle, leading to the nest proper, the structure is some ten or twelve inches long and rather more than half as much in breadth. The bird appears to be an early breeder. Dr. Cooper found it preparing to build nests about San Diego so early as the 26th February. The eggs are white, but so thickly flecked with small salmon-coloured spots, that a rich cast of this tint is given to the whole surface."

The Mocking-Birds and their Allies.

Family *Mimidæ*.

Space admits of only the very briefest reference to the American family typified by the well-known mocking-bird (*Mimus polyglottus*); this family being generally placed between the wrens and the babblers, to the latter of which it is nearly allied. The babblers are but poor songsters, but the mocking-birds are renowned for their vocal powers. Twelve genera are included in the family, but it would be useless to attempt to point out their distinctive characters.



MOCKING-BIRD.

The Babblers.

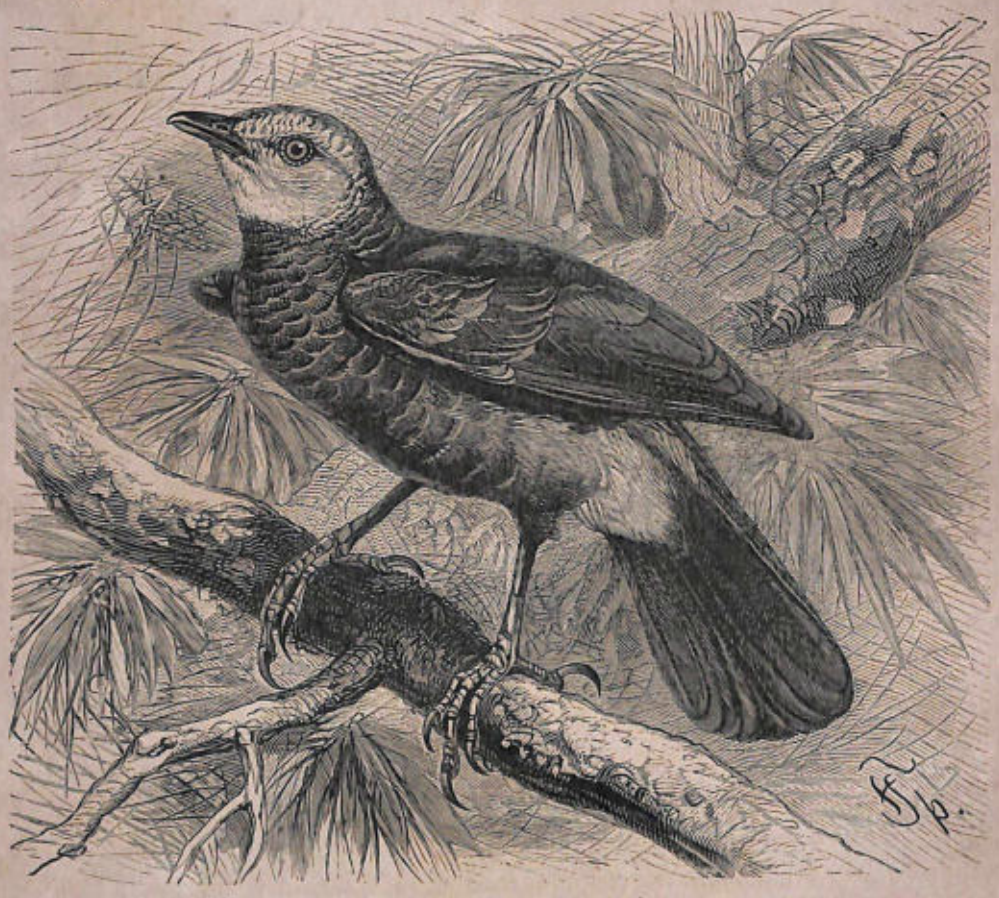
Family *Crateropodidæ*.

This family contains a very large number of birds, the affinities of some of which are doubtful, though the majority agree in possessing a short and rounded wing, together with large and powerful legs and feet. The bill is variously modified, but always adapted to an insectivorous diet, and is furnished with rictal bristles. The babblers belong principally to the Oriental region, though their distribution through the tropical parts of the world is very extensive. The laughing-thrushes (*Trochalopterum*) of the Himalaya and Southern China are well-known representatives of this group, as are the true babblers (*Argya*), which

wander in flocks all over the plains of India and Burma. The scimitar-babblers form another important section of the same family, highly characteristic of tropical Asia, and distinguished by their long curved bills; but we are compelled to restrict our observations to one or two only of the genera.

Typical Babblers.

The birds of this group have a fairly stout bill, with the upper mandible distinctly arched, while the wing is short and rounded; and the metatarsus, toes, and claws are remarkably strong. The style of coloration is generally plain and entirely devoid of gorgeous tints. Several species of the true



ABYSSINIAN BABBLER (½ nat. size).

babblers are found in the African continent, while others are peculiar to the Indian region. Among these the species (*Crateropus leucopygius*), here illustrated, inhabits the forests of Abyssinia, frequenting dense scrub on the slopes of the mountains. A social species, and rarely found without companions of its own kind, it principally lives in flocks of ten or a dozen individuals, which seek their food in company. The flight is laboured, the bird is generally rising but little above the ground, in passing from one bush to another. It is a lively noisy species like all its congeners, and readily announces its whereabouts by its busy chattering. The adult is dark umber-brown above; the sides of the head and chin and tail-coverts are white; the lower-parts are dark umber-brown edged

Green Bulbuls.

Assigned by many ornithologists to a distinct family,—*Pycnonotidæ*,—the true bulbuls, together with the green bulbuls (*Chloropsis*), are regarded by Mr. Oates as not entitled to be separated from the babblers; the green bulbuls belonging to one subfamily of this great assemblage, and the true bulbuls to another. The subfamily (*Liotrichinæ*) containing the green bulbuls presents the following characters:—The sexes are unlike, the birds being either solitary or associating only in small parties; while their habits are entirely arboreal, their plumage brilliant, and their eggs generally spotted. The green



GOLD-FRONTED GREEN BULBUL AND RED-BILLED LIOTHRIX.

bulbuls are characterised by the possession of a slender curved bill equalling the head in length, the tip being notched, and the nostrils oval; the wing is rounded, the tail is short and square, and the feet are short and weak. The birds of this group are only found in Southern and South-Eastern Asia, seven species occurring within the Indian Empire. One of the best known is the gold-fronted green bulbul (*Chloropsis aurifrons*), which forms an excellent cage-bird. Feeding upon the insects which it picks off the surfaces of leaves, this bird is exceedingly difficult to detect amid a profusion of foliage, since its bright grass-green plumage harmonises closely with the green leaves; it lives in pairs or singly. Its range extends over a considerable portion of Bengal and the adjacent States, as well as British Burma and an outlying portion of the spurs of the Himalaya. Jerdon states that it has a sweet song, and is also an excellent

mimic of the notes of other birds. Mr. Oates gives the following description of the male:—"The forehead and front of the crown orange-yellow, ear-coverts and lower-throat black, chin and upper-throat purplish blue; a yellow collar passes round the black of the throat; the remainder of the plumage is bright green."

True Bulbuls.

The true bulbuls, of which there are several genera, among which *Pycnonotus* may be regarded as typical, form a subfamily (*Brachypodinæ*), differing from the preceding by the following characters:—The sexes are alike. The metatarsus is very short, and never exceeds the length of the



PALESTINE AND WHITE-NECKED BULBULS (½ nat. size).

middle toe and its claw; while the wing is rounded and moderately long, and the nape generally furnished with some hairs. As regards their general habits, and the coloration of their eggs, the true bulbuls resemble the green bulbuls. While many of the bulbuls have a more or less largely developed crest, those of the genus under consideration are practically crestless. They are further characterised by having a bill of moderate size with the culmen curved and the sides compressed to the tip; the gape being furnished with a few short, weak bristles, while the nostrils are basal and placed in a groove, the wings are moderate and rounded, the tail is fairly long and rounded, and the feet are furnished with strong claws. Well represented in Africa, this genus is also found in India. Among the species, the Palestine bulbul (*Pycnonotus nigricans*) is very common in Syria, Arabia, Cyprus, and

Rhodes, also visiting the Cyclades; while the white-vented bulbul (*P. arsinoë*) frequents the mimosa groves of Northern Africa. It is considered the finest songster of all the family. Mr. Gurney, who met with this species at Faioum, was told by the natives that it was very partial to apricots, and found it singing among tall palm-trees. In South Africa the red-eyebrowed bulbul (*P. capensis*), the *knif-kop* of the colonists, is well known for its partiality to figs and grapes; and is a bird of sociable temperament, generally living in small flocks.

Liothrix. The red-billed liothrix of India (*Liothrix lutea*), shown on the right side of the figure on p. 513 is the typical representative of another subfamily, including such members of the present family as are arboreal in their habits, and of which the sexes are differently coloured; the first character distinguishing them from the *Brachypodinæ*, and the second from all the rest. In the typical genus, which includes but a single mountain species, the feathers of the slightly-forked tail are curved outwards.

The Flycatchers.

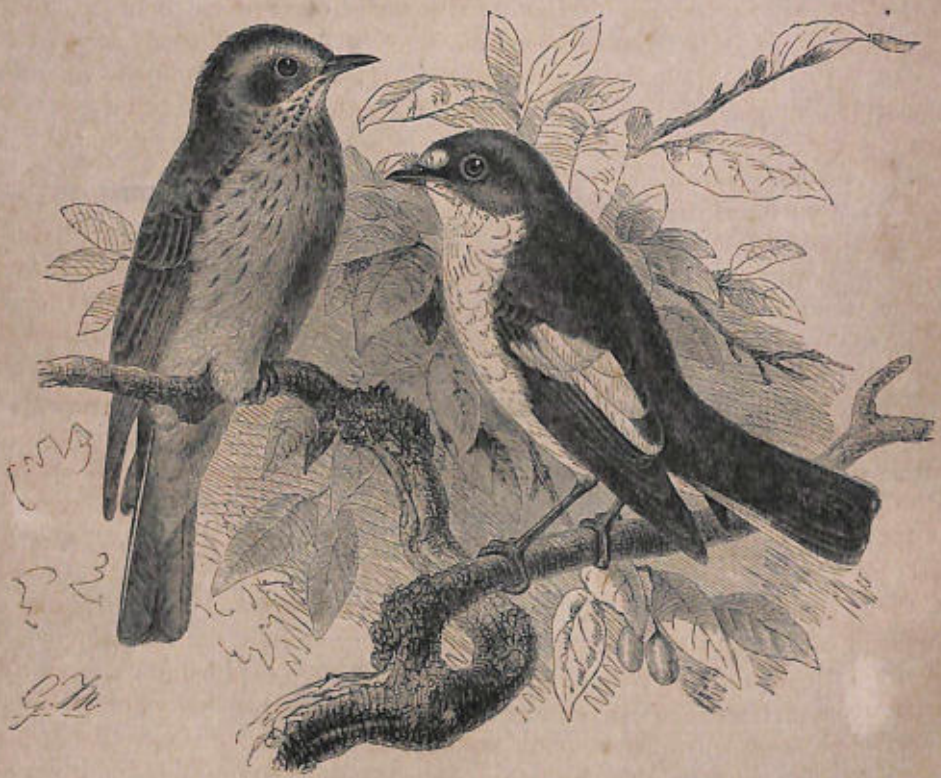
Family *Muscicapidæ*.

The large group of birds now claiming our attention are insectivorous in their habits, and, like the chats, pursue their prey in short flights from a perch, to which they return after the capture. Exhibiting much variety of form and plumage, some species are for the most part plain and homely-coloured birds, while others, such as the Indian paradise-flycatchers (*Terpsiphone*), almost vie with the birds from which they take the first half of their name in the bright coloration of their plumage and the elongation of the central tail-feathers of the male. As a group, Mr. Oates considers that the flycatchers may be best recognised by the mottled plumage of the nestling, and the presence of numerous hairs (distinct from the rictal bristles) stretching from the forehead over the nostrils. There are, however, many connecting links between the most specialised flycatchers with their flattened beaks, and the more warbler-like forms. With smooth, simply notched beak, ten primaries, and twelve tail-feathers, they all have feebly developed legs and feet, which prevent them from walking on the ground, and thus serve to differentiate them from the more typical members of the thrush family. Most abundant in the tropical regions of the Old World, the flycatchers are quite unknown in America.

True Flycatchers. The typical flycatchers (*Muscicapa*), of which there are a considerable number of species, with a wide distribution in the Old World, have the tail considerably shorter than the wing, the second primary equal in length to the fifth, and the wings when closed not reaching beyond the middle of the tail.

Spotted Flycatcher. Among the commonest of European summer birds is the spotted or grey flycatcher (*Muscicapa grisecla*), which does not, however, reach its haunts until later in the spring than the majority of small migrants, not being met with even in Spain until the latter part of April, and being still later in the more northern parts of its habitat. Unlike most English migratory songsters, this flycatcher may be met with throughout the summer in the London

parks, although its sombre plumage, and its habit of perching high up on trees, render it far from conspicuous. Variously placed, the nest of this species may be situated on an ivy-clad wall, in the middle of a shrub, or upon wooded rocks overhanging rivers, while it has been found in the hole of a tree, in a flower-basket hanging at a window, and even in an empty cup. The nest is made of moss, grass, and horsehair, and the eggs are white, much blotched and suffused with light red. Although not disdaining larger insects, the parent birds feed their offspring chiefly on flies, caught in the well-known manner characteristic of the group. In the adult cock the plumage of the upper-parts is uniform brown, with dark central



SPOTTED AND PIED FLYCATCHERS (⅞ nat. size).

lines to the feathers of the crown of the head; the wings and tail are likewise brown; while the sides of the head and under-parts are dull white, the breast being streaked with grey.

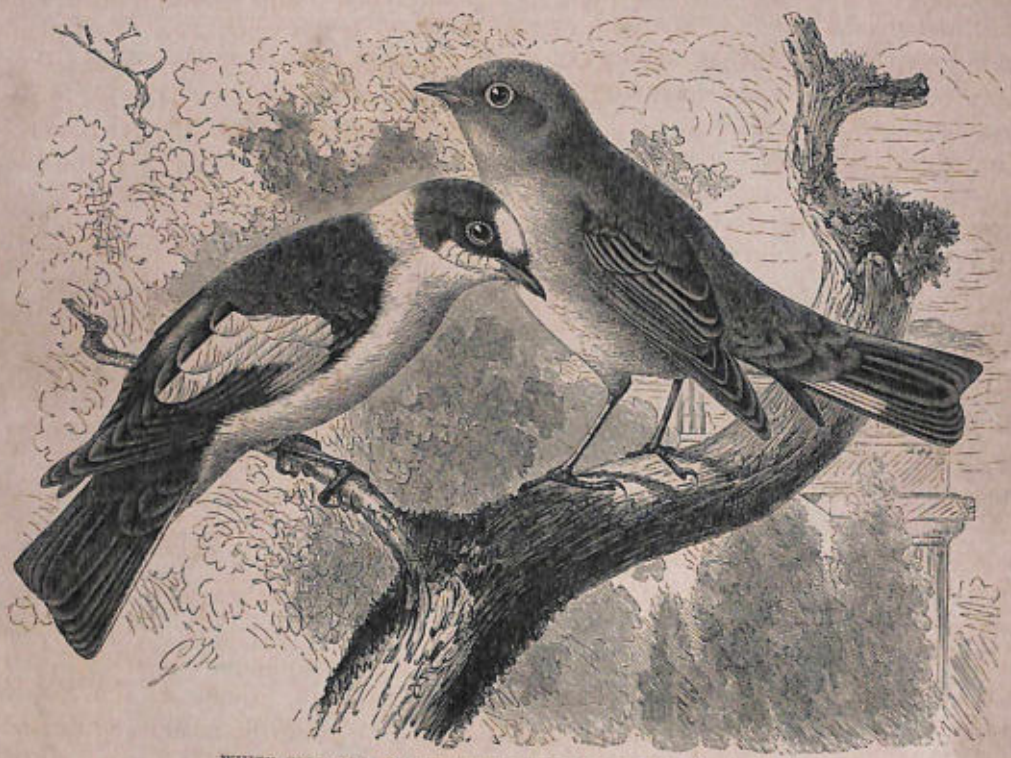
Pied Flycatcher. Spending the summer in central and northern Europe, and passing on migration through the Spanish peninsula in April, the pied flycatcher (*M. atricapilla*) associates its presence with scenes of picturesque beauty in many lands. The male possesses a sweet song, which commences like that of the great tit, and then passes into a sweet strain suggestive of that of the common redstart. The constancy with which a pair of pied flycatchers will often return to the same nesting-hole, during a period of several successive years, is one of the most remarkable traits in its character. The nest is sometimes built in a

chink of a stone wall or ruined building; the stump of a felled tree often supplies a convenient hole; while sometimes we may find a nest in a birch-tree at from four to seven feet from the ground. Another couple will be found to have seized a fissure in one of the dead limbs of a tall Scotch fir; and yet another nest may be in the hollow branch of an ash-tree, while a decayed thorn-bush sometimes holds the nest for several seasons. The nest is only slightly put together, composed almost entirely of small fibrous roots and dried grass, always lined with a little hair, and generally a few decayed leaves on the outside. The eggs, which vary in number from five to six or even seven, are of a pale green, and so closely resemble those of the redstart that it is frequently difficult to distinguish them unless they are contrasted together. The males soon after their arrival will frequently perch for a considerable time upon a branch of some decayed tree, constantly repeating their lively song between their sallies in pursuit of passing insects, but the females are somewhat coy, and rather shun the other sex. Pied flycatchers are birds of strong passion, and do not hesitate to fight for the love of their female companions, but paired couples are devotedly attached to one another. So long as the hen is sitting upon her eggs, her mate caters to supply her appetite with constant activity; and when the young are hatched the old birds are devoted to them, the female feeding them at more frequent intervals than her companion. While the call-note of the male somewhat resembles the sound produced by clattering together two pebbles, the female has a cry like that of a hen chaffinch. Individuals breeding in districts where woodpeckers are plentiful frequently adopt the deserted holes of the latter birds for their own nests. The pied flycatcher rarely spends more than three months upon its breeding-grounds, and, long before the trees have begun to change from green to red and orange, the pied flycatchers in England slip quietly away almost unnoticed, to seek an asylum on the southern side of the Mediterranean. In Switzerland, however, and other parts of Central Europe they seem more loth to bid farewell to the scene of their summer life; and in the former country they are often to be seen poised upon the lower branches of the walnut trees. In the summer they obtain much of their prey upon the ground, and after capturing a victim usually alight upon a fresh perch. In confinement the pied flycatcher is shy and retiring, but contrives to dart upon any insects that may be introduced into its cage with surprising velocity. The plumage of the male in the breeding-season is black above, with here and there a shade of brown; although we have never seen a specimen in which the black plumage was entirely unsullied by a brown tinge. The wings are dark brown, with the primaries white at the base of the outer web; the tail is black-and-white; the forehead is white, as are the cheeks and under-surface.

White-Collared Flycatcher. The white-collared flycatcher (*M. collaris*) visits the south of Europe in considerable numbers, but is always a local bird. Like its congener the pied flycatcher, it frequents the neighbourhood of old timber, and builds its nest in hollow trees; the eggs being greenish blue. The song is distinct from that of the pied flycatcher, as is also the call-note, the latter being a sharp disagreeable whistle. It is possible, however, that the two species interbreed, since the form found in the Caucasus is intermediate between the white-collared and the pied flycatcher. The adult male is black above, the lower back and rump

being ashy grey; the wing-feathers black with white bases, the tail black-edged with white on the outer webs; the forehead white, and a white collar completely encircling the hind-neck; the throat and lower-parts are pure white.

Red-Breasted Flycatcher. The red-breasted flycatcher (*M. parva*) is a summer visitant to Eastern Europe, occasionally wandering into the western part of the Continent. Always a rare local bird, though frequently overlooked, and occasionally straggling to the shores of the British Isles on autumnal migration, it breeds in beech-forests, constructing its nest in some natural cavity, or between a bunch of small twigs and the main stem. The nest is built almost entirely



WHITE COLLARED AND RED-BREASTED FLY-CATCHER (⅔ nat. size).

of moss, with a little lichen and hairs; and the eggs are pale bluish green in ground-colour, freckled with reddish and greyish brown. The song is simple and unpretentious, but the actions of the bird are full of life and energy. The adult male has the upper-parts ashy brown; the two central tail-feathers being dark brown, and the remainder for the greater part white; while the cheeks, throat, and fore-neck are glossy orange, and the rest of the under surface white.

Paradise-Flycatchers. Commonplace and devoid of anything striking in their plumage, the typical flycatchers agree with a large assemblage of genera in having the tail considerably shorter than the wing. Leaving these, we pass on to consider briefly a much more beautiful but smaller group of genera, in which the tail equals or exceeds the wing in length. From their allies, the paradise-flycatchers (*Terpsiphone*) are distinguished by the crested head, and the great length of the middle pair of tail-feathers. The bill is very large, much depressed,

and swollen, with numerous long and coarse bristles at the rictus. Distributed all over India and the adjacent regions, the paradise-flycatchers have the sexes almost or completely alike for the first two years, when the prevailing coloration of the plumage is chestnut. This dress is never changed by the hen birds; but sometimes after the second autumn the cocks assume a beautiful white plumage, and it thus happens that in some cases both members of a pair may be breeding in the chestnut dress, instead of the male being far more gorgeous than his partner. Writing of the Indian paradise-flycatcher (*T. paradisi*), whose range extends from Ceylon to Kashmir, Leith Adams observes, that in the plains of India "its singularly attractive plumage can scarcely escape observation. The adult male has a blue head and white body, with two of the tail-feathers prolonged for upwards of eight inches beyond the tip; those in the female scarcely extending beyond a quarter of an inch. The young birds are chestnut. The paradise-flycatcher does not possess great power of flight, except when hunting for insects; then its movements are quick, it suddenly appears on a branch beside you, and the next moment is seen shooting like an arrow through the grove, at times uttering a harsh chirp—now perched on the upper bough of a tamarind, now on the lower one of a neighbouring tree—spectre-like it suddenly appears, and is as quickly gone." The five eggs laid by the hen are pink spotted with brownish red.

Fantail-Flycatchers. Our notice of the family may be brought to an end by a brief mention of the fantail-flycatchers (*Rhipidura*), which, while differing from the members of the preceding genus by the absence of a crest on the head are distinguished from the other crestless forms of the group by the length of the tail considerably exceeding that of the wing. Possessing a short depressed bill, broad at the base, with the culmen arched, and the upper mandible notched, these birds have the nostrils oval, basal, and nearly covered by the rictal bristles; while the tail is ample and rounded, and the feet are moderate and slender. Full of life and energy, hopping merrily from bough to bough, the fantails construct beautiful little nests covered with cobwebs.

Between forty and fifty species of fantails are known, inhabiting the Oriental and Australian regions, and ranging to Tasmania and the islands of the Malay Archipelago. Thus Layard's fantail inhabits the Fiji group of islands, while the white-bellied fantail is found in the islands of the Philippine Archipelago, and the sooty fantail is peculiar to New Zealand. The white-browed fantail ranges from Ceylon to the Himalaya; while the Javan fantail inhabits Tenasserim, Siam, Cochin China, and the Malay Peninsula. One of the best known of the Indian fantails is the white-browed species (*R. albifrontata*), which breeds all over the plains of India, sometimes nesting in a bush but generally in a mango tree. The nest is cup-shaped and deep, framed of fine stems of grass, and lined with fine grass roots and a little hair; the exterior being coated with cobwebs. It is generally placed upon the upper surface of a nearly horizontal bough; and the eggs are white in ground-colour, with many minute brown specks, and a fine zone of greyish brown at the larger end. This fantail rears two broods in a season. The adult male has the crown, lores, and ear-coverts black, the forehead white; the wings and upper-parts ashy brown, the cheeks and throat black, tipped with white; the sides of the breast black; and the remainder of the lower-parts white.

In the wooded tracts of the lower Himalayan ranges, the white-throated fantail (*R. albicollis*) is to be seen in the summer months, generally frequenting a thickly wooded country; being very partial to mango trees, darting out occasionally with a tumbling flight as if falling from the tree and suddenly returning to its perch. Keeping up an almost incessant snapping sound with the beak as it hawks about the tree for insects, and indulging occasionally in a not unpleasing little song, it nests in some slender upright fork; the nest being composed of dry grass-stems and pieces of dry blades of grass, with here and there fragments of vegetable fibre, and entirely coated with cobwebs; while in form it resembles an inverted cone and is comparatively solid. The eggs of this species are slightly smaller than those of the last; and are wanting in gloss, and of a very pale fawn, or greyish white ground colour, with an irregular zone of grey specks and spots. The adult male is of a general smoky black above with a white eye-stripe; the wings are browner than the back; the two central tail-feathers are black, the remainder being broadly tipped with white; a dull patch of white extends across the lower throat; and the rest of the under surface is slaty black.

One of the tamest and most familiar of Australian birds is the little black fantail (*R. motacilloides*). Gould says that it passes much of its time on the ground, over which it runs and darts with the utmost celerity, and when skirting the stream with tail erect and shaking from side to side it presents an appearance very similar to that of the pied wagtails; the movements of the tails of the two birds, however, are very different, that of the European being perpendicular, while that of the Australian is a kind of lateral swing. Its song, which consists of a few loud and shrill notes, is continually poured forth throughout the entire night, especially if it be moonlight; and the flight is at times gracefully undulating, but always of very short duration. It commences to build in September, often placing its beautiful cup-shaped nest upon some branch overhanging the water. Sometimes it nests upon the upper side of a fallen branch without the slightest shelter from the sun and rain, and at an elevation of only three or four feet from the ground. The nest consists of dried grasses, strips of bark and roots all firmly matted together and covered over with cobwebs, so that the entire nest looks like an excrescence of the wood; it is lined with fine grass, roots, or feathers. The eggs are dull greenish white, blotched and spotted with blackish and chestnut-brown. The old birds are very tame at the nest, and will even perch upon it while the eggs are being removed, uttering a peculiar cry. The adult male has the upper-parts black; the great wing-coverts are brown, as are the primaries; the tail is black, as are the sides of the face, throat, and sides of the breast; and the remainder of the lower surface is white.

The Swallows.

Family *Hirundinidæ*.

Possessing a short and wide bill, deeply cleft, with the gape very wide, and the mouth opening to about the line of the eye, the swallows have the wings

much elongated, and comparatively narrow, consisting of only nine primaries, of which the two outer ones are about equal in length, although the inner ones decrease, while the secondaries are very short. The feet are small and weak, and very imperfectly adapted for progression; while the tail consists of twelve feathers, and is generally forked. As a family, the swallows are cosmopolitan, some species entering the Arctic Circle; the common swallow having strayed to Spitzbergen and Novaia Zemlia.

True Swallows. The true swallows (*Hirundo*) have a short, depressed bill; their wings and tail are very long, and the outer tail-feathers of the adult enormously elongated. The plumage is of a purplish blue above, correlated with a more or less perfect zone on the breast. The swallows construct their nests of fine clay, carefully welded into a compact mass, and lined with feathers.

Africa is the home of many remarkable swallows, and it is in that continent that the members of the genus seem to reach their largest dimensions, the great African mosque swallow (*H. senegalensis*) measuring upwards of nine inches in length, and Monteiro's swallow (*H. monteiri*) being nearly as large. The elongation of the outer tail-feathers is most marked in the wire-tailed swallow (*H. smithi*), which have their shafts produced as much as seven inches, this species inhabiting India and some parts of Africa. Sclater's swallow is a lovely green and white bird, lately discovered in San Domingo.

Chimney Swallow. The migrations of the chimney or house-swallow (*H. rustica*) and its allies, have long excited the interest of mankind; and we confess to sharing in the sentiment which welcomes the return of the swallows to their home in the rafters of the old barn or the cornice of their favourite porch. The 6th of April is the earliest date on which we have observed the swallow migrating through Great Britain, but some forward individuals generally contrive to report themselves at a lighthouse or other haven of safety a week or two before the arrival of the majority of their fellows. Even in the autumn months we have seen a good deal of the migration of the swallows, although the movements of the birds are less generally noticed at that season, because their departure is extended over so many weeks. A few springs ago we left the North of England, and it was only when we reached Abbeville, on the 14th of April, that we fell in with the first bird flying north alone. Early on the following morning at Bordeaux, we saw a flock of swallows evidently newly waking up from a night of slumber; and south of that town we continued to see occasional stragglers, but never met with the species in pairs except in one or two exceptional instances. On our return through France, swallows were to be counted by thousands migrating between Bayonne and Bordeaux; the actual passage of these and other migrating birds being much more prolonged even in the spring than is generally admitted. Whilst we were staying at the village of Burguete, small parties of swallows passed very frequently; we generally saw them flying over the hills to the right and left of the Ronceveaux Pass. There was no hesitation as to what they should do, at least with the great majority: although we witnessed one solitary straggler approach the cloud-capped hills only to swerve from its course and come flying back in a southerly direction, mani-

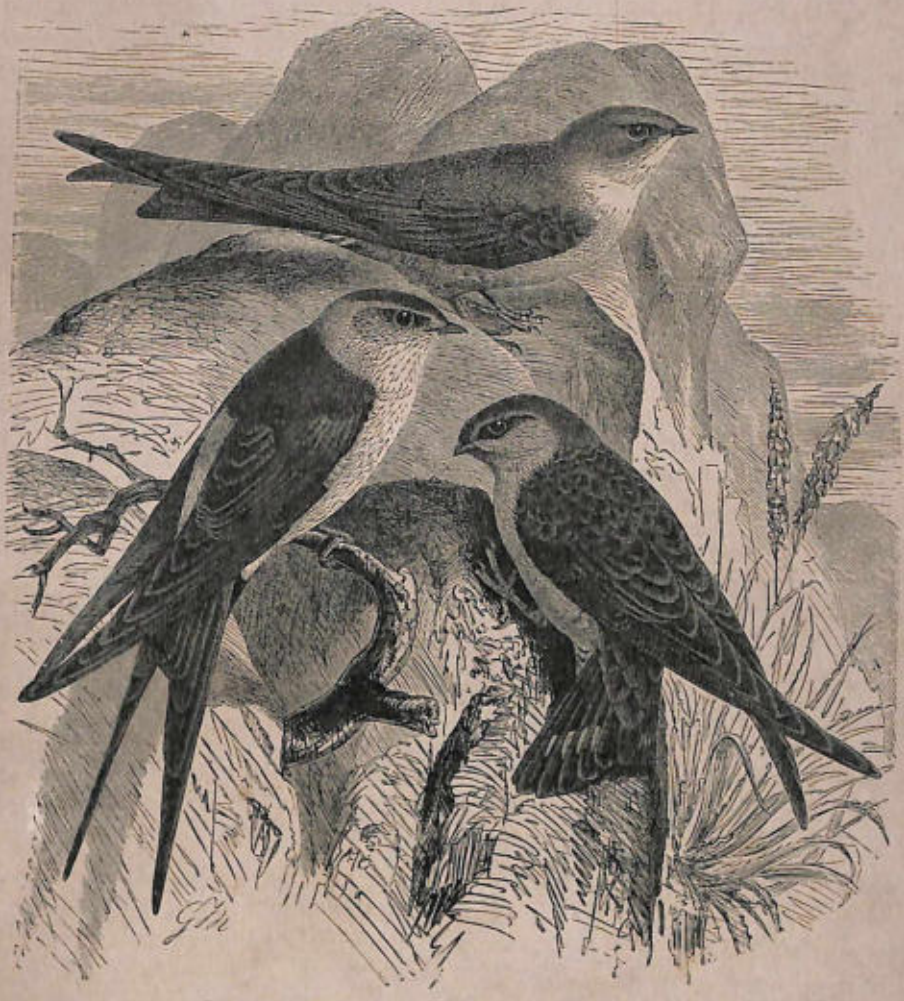
festly unwilling to cross the hills until the clouds had lifted. Unless interfered with, the swallows that come to England build their mud-nests in the same corners many successive years, the nest being generally placed in a situation which affords some support. Nests in trees are very rare; yet the bird does not always require a ledge or shelf for its nest, as in Germany we have seen a good many built in outhouses. The nest is lined with feathers and dry grass; and the first brood



CHIMNEY-SWALLOW AND HOUSE-MARTIN (½ nat. size).

will leave it as a rule during the last days of June, while the second broods are able to fly before August has expired. Some birds even rear late broods during October, but the struggle for existence among the young has then become very severe. The swallow lays from four to six eggs, white in ground-colour, and spotted with brown and grey. The male in summer has the forehead and throat chestnut, a band on the breast, and the upper-parts steel-blue, glossed with purple; while the tail-feathers are spotted with white, and the under-parts pink or white.

Red-Rumped Swallow. This pretty swallow (*H. rufula*) spends the summer in the eastern portion of the Mediterranean, whence it extends eastwards to the Himalaya and Turkestan. Many red-rumped swallows breed in Greece, inhabiting the mountain-ranges of that country. In Palestine this species nests in caves, although the birds do not consort in colonies; the arches of the monastery on Mount Carmel being a favourite breeding-place. The nest is a beautiful



RED-RUMPED SWALLOW AND CRAG MARTIN (½ nat. size).

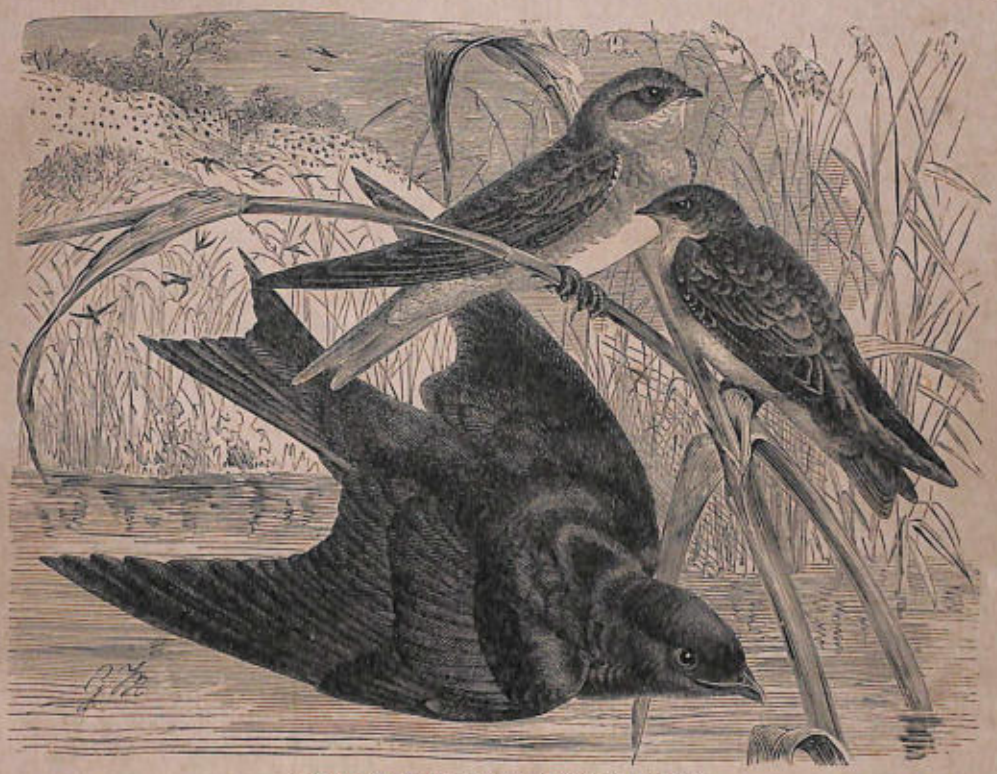
structure built of the same materials as that of the house-martin; the eggs being four in number, and pure white in colour. This swallow is common in warm sheltered valleys in the highest parts of the vine-regions of Greece and Asia Minor, where it may often be seen hawking for insects in company with the swallow and house-martin. It cannot, however, be mistaken for either of these species, as it possesses the long forked tail of the swallows in addition to the white rump of the house-martin; and it may be distinguished by its note, which is lower than that of the swallow. The nests are built of mud, and are similar to

those of the house-martin, although having a curious funnel at the top, so that the whole structure recalls a chemist's retort. The adult male is purplish blue above, the feathers of the upper back being streaked with white; while the rump is pale rufous, merging into creamy white on the upper tail-coverts; the tail-feathers are blackish, glossed with dull blue; and the under-parts cinnamon-buff.

Martins. Some of the martins (*Chelidon*) have the tail forked, while others have it squared; though all have the same short, broad bill and deep gape as the swallows proper, correlated with great length of wing and weak feet. The feathers of the rump are always white, and all the known species have the metatarsus and toes feathered. Of this widely distributed genus, one species is indigenous to Nipal, while another, the Siberian martin, breeds in Northern Asia, building its nests in crowded rows under the eaves of houses, and also rearing its young among the crags of limestone precipices. Blakiston's martin is a well-known Japanese species, which appears to pass the winter in Borneo. No bird is better known in Northern Europe than the black and white house-martin (*C. urbica*), which usually arrives there during the first spring months of the year. The birds which come to Britain are not the first migrants of their race; for we have seen house-martins nesting in Southern Europe in the middle of April, while many of their companions were still migrating in squads. Most people from long observation have come to believe that the house-martin never builds its nest in any position except against the side of some building; but it is a bird which adapts its habits in the breeding-season to whatever locality it happens to find itself established in. For example, in Norway, Mr. Chapman found house-martins breeding in the crags of the river banks; and we have seen them nesting in precipitous cliffs, as they do generally in some parts of Europe. The house-martin builds its nest generally during the month of May, but frequently finds its labours frustrated by the intrusion of a pair of sparrows which proceed to oust the rightful owners from their domicile. The nest is lined with feathers, and the eggs are pure white. It should be understood that the British Isles lie directly in the line of many birds when migrating from their breeding-grounds in Northern Europe to their usual winter-quarters in Africa; the birds that breed in the north of Europe naturally nesting later than those which breed further south. Consequently these northerners, or at least a proportion of their number, chiefly young birds, make their appearance in the British Isles in the month of November almost as a matter of course; and it is therefore only natural to expect that a few young house-martins tarry in England until the commencement of winter. Like the swallow, the house-martin is subject to some variation of plumage, although albinos are much rarer than amongst swallows. This species is the most gregarious of all the European swallows, and may often be seen clustering in hundreds upon the roofs of houses. The adult male has the crown and sides of the head, back, and wing-coverts rich bluish black; the rump and central upper tail-coverts are pure white; the wings and tail dull black; and the chin and all the lower parts dull white. The sexes are identical in colour, but the adults very unlike their sooty-brown young.

Sand-Martins. The slender, plain-coloured martins of this group (*Cotile*) possess a small depressed bill, broadest at the base; while the wings are long in proportion to the tail, which is slightly forked; and the feet are small and

slender. The metatarsus is bare, save for a tuft of feathers at its base. The sand-martins are pre-eminently gregarious in the nesting-season; the best known and most widely distributed member of the genus being the European species (*C. riparia*), which extends its range to Northern Asia and North America. The Indian species (*C. sinensis*) is resident throughout the northern portions of the Indian Empire; while Cowans' sand-martin is peculiar to the island of Madagascar; several species also inhabiting Africa. The common sand-martin (*C. riparia*) arrives in the northern parts of its breeding-range a week or two in advance of the larger swallows, and may generally be seen in sheltered situations during the last days



SAND-MARTIN AND PURPLE MARTIN (½ nat. size).

of March, frequently hawking flies under the crags that overhang salmon-rivers. It soon proceeds to the nesting-grounds, and commences to tunnel the chamber intended to contain its eggs in some sandy bank, gravel-pit, or railway cutting; although sometimes it digs a hole in the bank of a small stream, or even burrows in a heap of sawdust. The male sand-martin is a somewhat jealous bird, and often indulges in a struggle with some rival. The eggs, which are pure white without spots of any kind, are laid in a hole lined with stems of grass and feathers. When the young are able to fly, they join the company of other swallows and martins, and are constantly to be found by the riverside. The sand-martin leaves its summer-quarters earlier than its congeners, and its movements are less extended. On one occasion we fell in with thousands of these martins steadily migrating along the east coast of England, the air being literally full of birds for half an hour, flock

after flock streaming away south in the wake of their predecessors, and many small parties followed the main detachment during the day. The upper-parts of the sand-martin are uniform brown, as is the band on the breast; the lower-parts being dull white. The crag-martin (*C. rupestris*) spends the summer months among the mountain-ranges of Central and Southern Europe; as a rule frequenting rocks and old ruins, and nesting in inaccessible places in the month of March, the nests being often placed in the roofs of caverns in the rocks. Mr. Scott Wilson writes that he saw the crag-martin flying about the perpendicular crags of the Gemmi in June 1885, but observed it more particularly and found it breeding on the 1st June 1886 near Meiringen. In the Eastern Pyrenees the crag-martin builds under the eaves of the houses in the centre of the towns, the nests being large structures of mud, quite open at the top, and lined with feathers. The eggs of the crag-martin are white in ground-colour, profusely spotted with pale greyish brown. The general colour of the adult bird is a light ashy brown above; the lower-parts being creamy-buff; and the tail-feathers are dark brown, the central and outer pairs being conspicuously spotted with white.

Purple Martins. Dr. Sharpe divides the swallows into two groups, according to the character of the outer primary; the majority of genera belonging to the smooth-winged group; while the purple martins (*Progne*) of America and a few African species constitute the rough-winged group, in which the outer margin of the first primary presents a serrated edge in the adult male. The purple martins are birds of robust and elegant form, possessing a long and stout bill, broad at the base; long and pointed wings, and a tail much forked. Although they are most numerous in Brazil and the adjoining states of South America, one species summers in the United States, and another is a native of Patagonia. Darwin's purple martin is apparently confined to the Galapagos Islands; while the Caribbean purple martin is peculiar to the West Indies. The common purple martin (*P. purpurea*) is one of the most familiar of North American birds, and enters the southern borders of the United States as early as February, gradually extending its range over the country, the highest latitudes being reached only in the middle or end of May. In its habits the purple martin differs from most of its congeners in its predilection for nesting in cavities in hollow trees, such as the deserted holes of woodpeckers; this being especially the case in the Western United States. The nest-cavity is lined with fine stems of grass, leaves, and small twigs, quilted with feathers and other soft substances; and the eggs are pure white. Several pairs of birds often occupy the same nest, and the majority of couples are double-brooded. The purple martins leave their summer home in August, retreating into the interior of South America. The adult male has the entire body of a lustrous steel-blue, and the wings and tail bluish black. The female is dark greyish brown, but has the head and back glossed with blue.

H. A. MACPHERSON.

CHAPTER VI.

The Perching Birds,—*concluded.*

Families *Tyrannidæ* to *Menuridæ.*

The American Flycatchers.

The members of the Passerine order described in the four preceding chapters are characterised by having the muscles of the syrinx, or organ of voice, attached to the ends of the half-rings of cartilage forming the windpipe; such muscles being generally of a very complex type. Hence these birds are termed the *Acromyodi*. Those remaining for consideration have, on the other hand, these muscles, which are simple and frequently consist of only a single pair, attached to the middle of the half-rings of the windpipe; and they are accordingly known as the *Mesomyodi*. Since none of them possess the high vocal powers of the first group, they are frequently spoken of as the songless perching birds. As their name implies, the members of the first family of this group are exclusively confined to the New World, where they are represented by upwards of four hundred species, the majority of which are South American. Insectivorous in their habits, the typical members of the family have the beak broadest at the base, from whence it tapers to a fine point, the upper mandible being slightly notched; while the nostrils are basal, and overhung, although not concealed, by bristles. The wing has ten primaries; and the tail, which is generally nearly even, although sometimes forked, is composed of twelve feathers. The metatarsus is relatively short, and the foot weak. The range of these birds extends from the Arctic region to Tierra-del-Fuego.

Tyrant-Flycatchers.

The king-bird, or bee-martin (*Tyrannus carolinensis*), is well known in the United States for the audacity with which it attacks crows, owls, and hawks, and drives them away from the neighbourhood of its nest; and we have heard of a party of king-birds harassing a swallow-tailed kite, which eventually struck down one of its tormentors before it sailed away. The king-bird builds a conspicuous nest, usually choosing an isolated tree, often in an exposed situation; the nest being constructed of vegetable fibres and twigs, lined with horsehair, fine roots, and grasses. The eggs are rosy white in ground-colour, spotted and blotched with purple and reddish brown. Not possessing a true song, the king-bird merely utters a monotonous succession of twitterings. This species owes its trivial name of "bee-bird" to its fondness for the honey-bee; Dr. Coues stating that the king-bird destroys a thousand noxious insects for every bee it eats. Feeding largely upon winged insects, its flight when in pursuit of insects

is accomplished by rapid vibrations of the wings, the bird seeming to float in the air in the manner of a swallow. The king-bird arrives in its summer haunts in April and May, and prolongs its sojourn until September, when it migrates south. The male has the crown flame-colour; the upper-parts blackish ash; the wings dusky, edged with whitish; the tail black, tipped with white; and the lower-parts pure white, except the breast, which is shaded with grey.



KING-BIRD, AND BIENTEVEO TYRANT-FLYCATCHER (½ nat. size).

Bienteveo Tyrant. We owe an excellent account of this species (*T. sulfuratus*) to Mr. W. H. Hudson, who writes that in Buenos Aires "the bienteveo is found in every orchard and plantation; it is familiar with man, and invariably greets his approach with loud notes, especially with a powerful three-syllabled cry, in which people fancy there is a resemblance to the words Bien-te-veo ('I see you well'); while its big head and beak and strongly contrasted colours, especially the black and white head-stripes, seem to give it a wonderfully knowing look as it turns its head from side to side to examine any intruder. It is a loud-voiced,

garrulous bird, and has a great range of sounds, from grating screams to long clear, almost mellow, call-notes. It has one pretty habit which brings out strongly the pleasant feature in its character. The male and female are greatly attached; they do not go afield to hunt in company like the short-winged tyrant, but separate to meet again at intervals during the day. One of a couple (say the female) returns to the trees where they are accustomed to meet, and after a time, becoming impatient or anxious at the delay of her consort, utters a very long clear call-note. He is perhaps a quarter of a mile away, watching for a frog beside a pool, or beating harrier-like over a thistle-bed, but he hears the note and presently responds with one of equal power. Then perhaps for half an hour at intervals of half a minute the birds answer each other, though the powerful call of the one must



THE FIRE-EYE (½ nat. size).

interfere with his hunting. At length he returns; then the two birds perch close together, with their yellow bosoms almost touching, crests elevated, and, beating the branch with their wings, scream their loudest notes in concert, a confused jubilant noise that rings through the whole plantation." In its nidification, the bienteveo departs widely from the traditional habits of its congeners; unlike the majority of tyrants, which build small and shallow nests, this species constructs a very elaborate domed nest, which sometimes takes weeks to elaborate. It is placed in a tree without any attempt at concealment, and is composed of a variety of soft materials, especially wool. The eggs are cream-coloured, spotted with chocolate and purple, chiefly at the larger end. The bienteveo preys chiefly upon large insects such as beetles, which it invariably beats against the perch before swallowing them; but sometimes it carries off the callow young of other birds from their nests. It is also fond of fishing in shallow pools, preying upon tadpoles and small fishes; while occasionally it enters the slaughter-house in search of

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pickings. It is a common thing to see a bienteveo waiting on a rural butcher's cart in hopes of securing some tit-bit. In the fall of the year it feeds largely upon ripe grapes, figs, and other fruit. The adult has the head black, with a large yellow crest and a white eyestripe; the upper-parts are brown; the wings and tail brown edged with rufous; and the lower-parts sulphur-yellow.

Ant-Birds. The type of this group (*Formicivora*) possesses a short conical bill, with the upper mandible hooked; while the wings are moderate, with the fourth feather the longest. The tail is fairly long and rounded, and the feet are furnished with long toes, adapted to progression over the earth, the claws being short and narrow. All the ant-birds are inhabitants of the forests of Brazil, a well-known species being the fire-eye (*F. domicella*), which frequents dense portions of the primeval scrub, creeping about the bushes, and rarely venturing into the open. It possesses a pleasing warbling note, and feeds upon a variety of insects. Its fondness for ants induces it to lay aside its usually cautious and retiring habits, and at times many individuals assemble together to devour ants in woodpecker-fashion. The adult male is nearly all black, and his plumage is set off to great advantage by his white wing-coverts and the fiery red irides of the eye, from which this species takes its name.

The Chatterers.

Family *Cotingidæ*.

Some of the most gorgeous birds of South America are to be found in this family, which is remarkable for the variations of plumage exhibited by certain of its representatives. The chatterers have usually an arched bill, broad at the gape, and adapted to a frugivorous diet; the wings being generally of moderate length, although sometimes reaching almost to the extremity of the tail. The metatarsus is stout and scutellated in front. The greater number of the chatterers are inhabitants of the vast equatorial region of the Amazon, frequenting the interior of the forests, and leading an arboreal life; one of the loveliest being the Pompadour chatterer, so named after the famous Frenchwoman, to whom this and other specimens of birds were being sent, when the ship that bore them from Cayenne fell a prize to a British cruiser.

Umbrella-Bird. The singular bird for which the genus *Cephalopterus* was established has a stout, robust bill, with a strongly-arched upper mandible; the nostrils being open and longitudinal in shape, while the wings are long, and the tail is rounded. The umbrella-bird is, however, best distinguished by the possession of a curious crest, composed of straight, elevated feathers, the extremities of which curve outwards and form an elegant line of drooping plumes. The sides of the neck are naked, but long feathers spring from beneath the throat and from the sides of the neck, to form a loose lappet. Confined in its range to the forests of the plains of the Upper Amazon, the umbrella-bird (*Cephalopterus ornatus*) is a shy, retiring species, living in the higher branches of forest trees, where it readily obtains the wild fruits upon which it chiefly subsists. It has been seen by very few naturalists in its native wilds, but no doubt exists regarding its

peculiar vocal powers. Bates says: "The Indian name of this strange creature is *Uirá mimbéu*, or fife-bird, in allusion to the tone of its voice. We had the good luck, after remaining quiet a short time, to hear its performance. It drew itself up on its perch, spread widely the umbrella-formed crest, dilated and waved its glossy breast-lappet, and then, in giving vent to its loud piping note, bowed its head slowly forwards. The nest of the umbrella-bird is built of small branches, placed in the top of a tall tree." The eggs are white and two in number. In flight



UMBRELLA-BIRD (¼ nat. size).

the helmet or crest is depressed, and the lappet is placed close to the body. The plumage of the male is deep black throughout, the lappet being glossed with steel-blue. The female has only the rudiments of the crest and lappet, and is altogether duller-coloured than the male.

Bell-Birds. Long known to travellers, in consequence of their remarkable vocal powers, so closely resembling the ringing of a bell as to have conferred upon them their popular appellation, three of the four known species of the bell-birds (*Chasmorynchus*) have the plumage of a pure unspotted white, an

unique feature among the chatterers. The fourth species is, however, characterised by a brown head and black wings; although white predominates in its plumage. The bell-birds possess a moderately-curved bill, broad at the base and deeply cleft; the wings extending to the end of the upper tail-coverts, the metatarsus being strong and scutellated, and the toes short and strong. The variegated bell-bird is found in Venezuela, while the snow-white bell-bird inhabits the forests of Surinam, Cayenne, and Demerara, and the naked-throated bell-bird is found in Brazil. Dr. Sclater gives the following account of the naked-throated bell-bird (*C. nudicollis*), which is figured in our engraving:—"This bell-bird was first



NAKED-THROATED BELL-BIRD (⅓ nat. size).

made known to science by the French naturalist Viellot, in 1815, from specimens in the collection of the Jardin des Plantes at Paris. But the best and in fact only good account of it in a state of nature, is that given by that excellent and observing naturalist, Prince Maximilian of Neuwied, in his *Contributions to the Natural History of Brazil*. Prince Maximilian tells us that this remarkable bird is one of the most singular features in the fauna of the wooded coast-region of Brazil, and attracts the stranger's notice as well by its brilliant white plumage as by its clear ringing voice. It seems to be very generally distributed through the woods, resorting especially to the thickest and most secluded parts of them." Hence it resulted that the prince and his party, during their expeditions in the neighbourhood of Rio de Janeiro, became well acquainted with its singular notes some time

before they obtained specimens of the producer of them. Prince Maximilian describes these notes as resembling the sound of a clear-ringing bell, sometimes repeated at intervals, sometimes following each other in quick succession. In the latter case they are more like the sound produced by a blacksmith when he strikes a piece of steel upon an anvil, whence the bird has obtained its Portuguese name ferreiro (smith). The song is heard at all hours of the day, and when, as often happens, several of these birds are in the same neighbourhood, and begin singing against and answering one another, a most wonderful vocal concert is the result." Of this extraordinary bird a living specimen was first acquired for the aviaries of the Zoological Society



BANDED COTINGA (⅔ nat. size).

of London in May 1867. Shortly after it arrived in the Society's gardens it commenced its song, and continued to pour forth its peculiar notes at intervals of more or less frequency for several weeks. These notes have been described by an accurate observer in the following manner:—"The first note is a loud, harsh, and somewhat grating noise; this is followed by six or eight fine, clear, metallic, ringing notes, with an interval of about a second between each of them. The resemblance of these to the sound of an anvil is most extraordinary. The clear metallic ring, repeated at about the same rate that a blacksmith strikes upon the anvil, is so perfect that many persons on hearing it are unwilling to believe the sound could be produced by the delicate organs forming the vocal apparatus of so small a bird." So admirable is the imitation that, when the first bell-bird reached the London

Zoological Gardens, his clear ringing note was mistaken by one of the officials for the sound of a blacksmith ringing on an anvil, and inquiry was made by him as to the work that was going on." The adult male of the naked-throated bell-bird has the plumage pure white throughout, the space round the eyes and throat being covered with a naked skin, only sparingly invested with minute black feathers, which becomes of a fine green in the breeding-season. The female has a blackish head, and the upper-parts dull green; beneath, yellowish, varied with green.

Cotingas. The cotingas are a group of chatterers, distinguished from their near allies, the bell-birds, by the brilliancy of the coloration of the males. The type has the bill depressed, broad at the base, and narrowed towards the extremity, the upper mandible slightly arched; the wings being of moderate

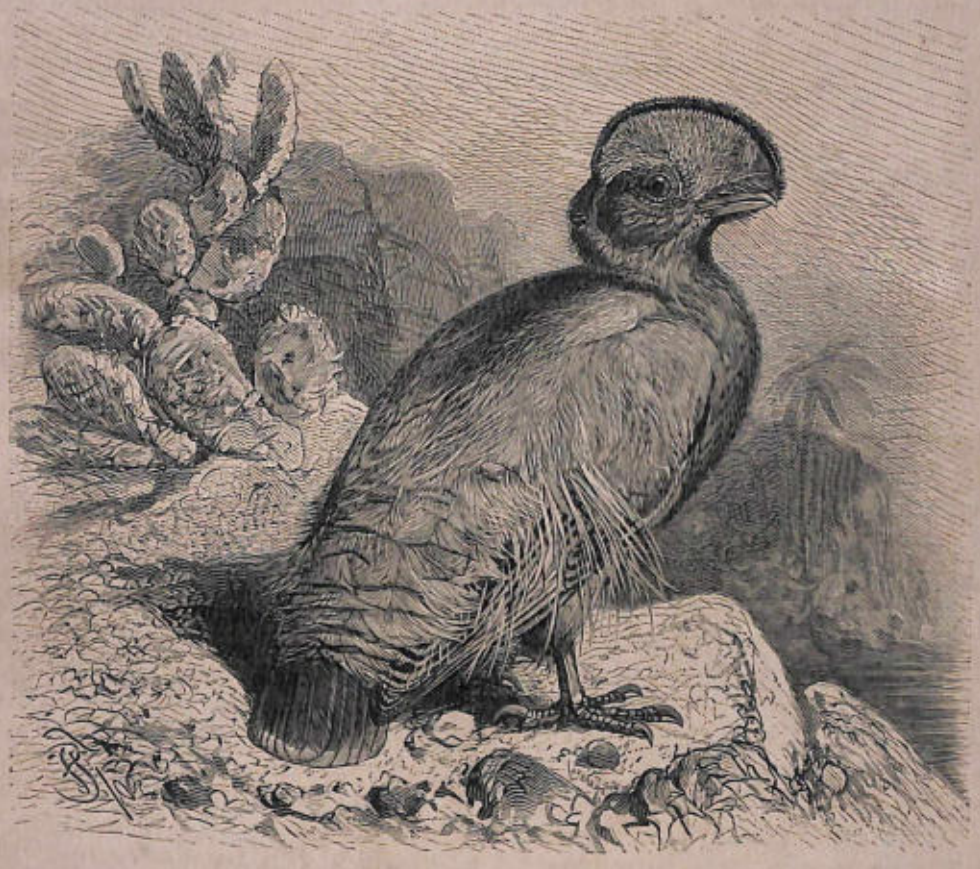


COMMON MANAKIN (⅔ nat. size).

size and pointed; the metatarsus short, and the toes stout, and furnished with fine claws. The cotingas inhabit the forests of Southern Brazil. The banded cotinga (*Cotinga cincta*) is a bird of solitary habits, keeping to the topmost branches of trees, and generally residing in a dense forest, though at times it approaches the cultivated grounds in search of food. It feeds upon a variety of fruits, which its wide gape enables it to swallow with ease. The adult male has the upper-parts and the band across the breast full ultramarine blue, while the under-parts are of a deep plum-colour.

Manakins. These birds (*Pipra*) are of gay appearance, generally exhibiting rich tints of blue, crimson, scarlet, orange, or yellow in combination with chestnut, deep black, black-and-white, or olive-green; and among their most obvious characteristics are their short bill and feeble feet, of which latter the fourth toe is united to the third toe for a good part of its length. Some few are crested; and the tail is very short in the majority of species, but in others the central feathers are much

elongated. Although the whiteheaded manakin has a wide distribution, ranging from the valley of the Amazon to the Isthmus of Panama, the majority of the species are confined to Brazil. Among them, the common manakin (*Pipra manacus*), which is spread over a large portion of South America, is a lively, active, restless species, generally to be seen in motion. Making its home in the dense scrub of aboriginal forests, avoiding large trees, and flitting through the bushes at a short distance from the ground, with a short but swift flight, it is a bird of social disposition, being rarely found solitary, electing to live a common life with its fellows. The



COCK OF THE ROCK ($\frac{3}{10}$ nat. size).

most curious fact about this manakin, and certain of its allies, is the circumstance that its wings are modified by the thickening of the shafts to produce a loud noise, which has been compared to the whirr of a spinning-wheel. The adult has the crown and upper-parts black, as are the wings and tail; the rump being grey, and the throat and under-parts white.

Cocks of the Rock. The birds of the genus *Rupicola* are remarkable for their brilliant coloration, especially that of the males, in all of which orange-red predominates. The type has the bill of moderate size, curving towards the extremity; the upper mandible being as wide as it is high, compressed at the base, and notched at the points; while the nostrils are oval, and hidden by the

feathers of the elevated crest; the wings short and rounded, with the fourth and fifth quills the longest; the tail of variable length; the metatarsus partially invested with feathers; and the feet large and strong. Of the group the best known species (*Rupicola crocea*) inhabits Guiana and the lower countries of the Amazon; while farther to the westward it is replaced by the Peruvian cock of the rock; a third species inhabiting Ecuador.

Although in confinement a somewhat indolent species, such is not the character of the cock of the rock in its native wilds. Sometimes a score or so of male and female birds of this species are observed to have assembled in the neighbourhood of an open space, and to be engaged in watching the performance of the most amorous males. While the dance is in progress the male appears to be entirely absorbed in the proper performance of his task; he gradually hops upwards, accompanying his movements with the most peculiar steps, swaying his head on all sides, and extending the wings; the exhibition is continued until the performer becomes tired, when he gives a cry which is understood by his fellows, and retires from the ring, leaving it to other male birds to continue the entertainment. It is much to be regretted that the brilliant plumage of the cock of the rock causes it to be sought out and shot for the purpose of trade; the adult male being almost wholly of a brilliant orange colour, but possessing a helmet-like crest, which adds to its beauty. The female lacks the brilliant coloration of the other sex, being almost entirely of a more or less uniform reddish brown.

The Plant-Cutters.

Family *Phytotomidæ*.

Remarkable for the serrations in the cutting edges of the mandibles, these birds were formerly placed by naturalists between the finches and the hornbills; but they are now known to be more nearly related to the chatterers. They have the wings relatively short, and the tail long and even; their most marked characteristic being the short compressed bill, the cutting margins of which are minutely serrated like the teeth of a saw. The whole of these thick-billed birds are peculiar to the temperate regions of South America, being found in Chili, Bolivia, and Argentina, where they are represented by four species, all included in the typical genus *Phytotoma*.

The Chilian plant-cutter (*P. rara*), has long been known to naturalists for its destructive habit of feeding upon plants, which it cuts down, often wantonly, with its powerful bill. It builds in lofty trees, but the nests are frequently destroyed in consequence of the bird's mischievous habits; and, like others, this species has also suffered from persecution, owing to the ravages which it sometimes inflicts upon gardens and plantations. It is a plain-coloured bird of a dull grey above and below; with the wings and tail blackish, the coverts being tipped with white. Its voice is harsh and grating. A common bird in Patagonia is the redbreasted plant-cutter (*P. rutila*), generally found alone, but sometimes associating in small flocks. Not migratory, it resides throughout the year in its usual haunts; the male being often to be seen perching upon the top of a bush. Mr. Hudson says

that the bright red breast of the male bird gives it quite a gay appearance among the dull plumaged species that people the thickets of Patagonia. It builds a slight nest of fine twigs, lined with fibres, and generally placed in a thorn-bush; the eggs being bluish-green in ground-colour, with brownish flecks. The male bird has the upper-parts dull grey, with the tips of the tail-feathers and a wing-bar white; and the forehead and under-surface deep brick-red. The female is yellowish grey above, obscurely mottled, and the breast and under-parts buff with dark spots.

The Broadbills.

Family *Eurylæmidæ*.

Deriving their name from, and readily distinguished by, the enormous breadth of their bills, which are generally associated with the possession of bright colours,



JAVAN BROADBILL (½ nat size).

the broadbills are the eastern representatives of the chatterers of the New World. They are birds of fairly powerful make, having the upper mandible dilated at its base, and the tip of the beak abruptly hooked; while the wings are rather short, and the tail is short and rounded. The broadbills, which Wallace considers to be the survivors of a once extensive group, possess a very limited distribution,

ranging from the lower spurs of the Himalaya, through Burma and Siam, to Sumatra, Borneo, and Java.

The type of the genus *Eurylæmus* has the bill broader than the head, the under mandible being very thin, particularly at the base; while the nostrils are basal, the primaries are slightly graduated, the tail short and rounded, and the feet moderately strong. These broadbills are found in the forests of tropical India, as well as those of Sumatra and the Malay Peninsula. Among the species the figured Javan broadbill (*Eurylæmus javanicus*) was discovered upwards of ninety years ago by Dr. Horsfield in the eastern extremity of the island from which it takes its name. Sir Stamford Raffles found it frequenting the banks of rivers and lakes, feeding upon worms and insects; and it seems partial to the neighbourhood of water, building its nest in its aquatic haunts, often overhanging a pool. It is generally found in situations difficult of access, such as are covered with extensive forests, and are intersected with marshes and rivers. The plumage of the head, sides of the neck, and under-parts is violet, varying in intensity. The forehead is nearly black; the upper neck brown; the wings deep blackish brown, varied with yellow; the tail-coverts yellow, the feathers being black at the base; while the central tail-feathers are black, and the outer ones are black, with a white transverse band near the extremity.

The Pittas.

Family *Pittidæ*.

The pittas, or Old World ant-thrushes, are distinguished by the structure of the syrinx and the form of the wing, the first primary of the latter being of large size instead of being nearly suppressed, as in the other Passerines with ten primaries. They are birds of lovely plumage, blue and crimson adorning many of the species. The pittas are most abundant in the forests of the Malay Archipelago, especially in the islands of Borneo and Sumatra. The blue-naped pitta inhabits the Himalaya from Nipal to Assam; while the fulvous pitta is found in the ever-green forests of the hills of Pegu; and Sumatra is the home of the giant pitta. The rainbow pitta of Australia is a beautiful bird, golden green above with bright metallic blue shoulders, velvety black head and throat, and crimson abdomen; but the Malayan pittas are the most gorgeous of the family. Strange to say, a single species of pitta is found in West Africa.

Typical Pittas. The typical pittas (*Pitta*) possess no crests of elongated feathers, but are plain-headed, having a strong, thrush-like bill, gradually curved; while the wings are of moderate size, the first and second quills being but slightly graduated. The tail is very short, almost hid by the coverts, and may be broad and rounded or narrow and pointed. The feet are very long, and adapted to a terrestrial life; for the pittas pass most of their existence on the ground in the midst of dense jungle. They rarely fly long distances, except on migration, but their flight is strong and well sustained. These pittas may be regarded as the most characteristic birds of Borneo, where six species are found, three of the number being peculiar to the island. Of Ussher's pitta, Mr. Whitehead says: "The bright scarlet breast when turned towards one is not easily distinguished

from the scarlet fruits and bright red dead leaves which carpet these forests. The bird when alarmed generally keeps its dark back towards one, which is still more difficult to see in the dusky shades of the forest."

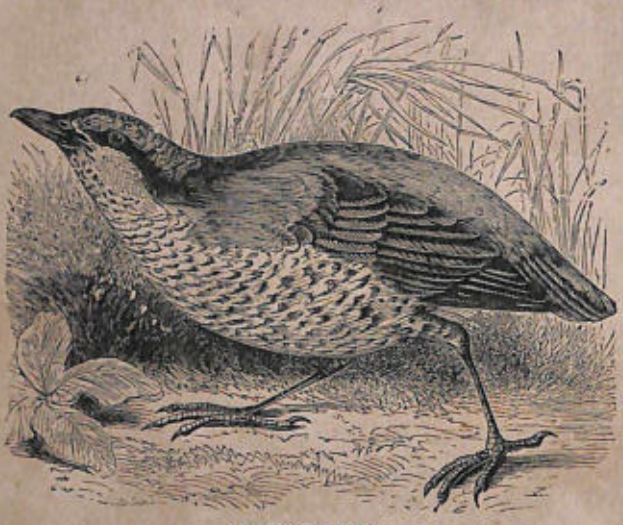
The Indian pitta (*P. brachyura*) ranges from the lower slopes of the Himalaya to Ceylon. Most common in forest-regions, in the Central Provinces, Mr. Oates says that it breeds in July and August, building a huge globular nest of twigs and leaves, on the ground or in a low branch. Mr. Hume says that few Indian eggs are more beautiful than those of this species, these being glossy white in ground-colour, marked with marone and purple. In the Carnatic, the Indian pitta occurs chiefly in hot weather, when the land-winds first begin to blow with violence from the west; and in



INDIAN PITTA (½ nat. size).

many instances it appears to have been blown by the gale from the eastern ghâts, for, being a bird of comparatively feeble flight, it is not well able to contend against the full force of the wind. At such times the pitta takes refuge in huts, outhouses, or any building that will afford it a shelter. The Indian pitta is a taciturn bird, though it possesses a fine loud whistling note; and it appears to be a migratory visitor to Ceylon, arriving from the north with the snipe. Although this pitta is a local migrant, being found in the southern part of its range in winter, and in the central and northern portions in the hot weather and rains, yet a certain number of birds appear to be constant residents in all parts of its range suited to its habits. During its sojourn in Ceylon, the Indian pitta is shy and wary, resorting chiefly to tangled brakes and ill-kept native gardens. It rarely alights on a tree, and is oftenest seen alone; but three or four individuals are sometimes met with in company. It feeds on beetles and other insects. The adult has the forehead, crown,

and lower-parts fulvous; a broad median band extends from the forehead to the nape; the back scapulars and upper-rump are green; the lower-rump, upper tail-coverts, and lesser wing-coverts pale blue; a broad black band passes over the eye; the primaries are black, tipped with grey; the tail is black, tipped with dull blue; the chin and throat are white, and the lower abdomen and under tail-coverts crimson. The blue pitta (*P. cyanea*) which is found in Bhutan, Arrakan, Pegu, Tenasserim, and as far east as Siam, is a bird of considerable beauty, though far inferior in lustre to many of the Malayan species of the genus. Like other members of the family, it lives principally in dense scrub and jungle, obtaining its insect-prey upon the ground. It begins to build its nest in the month of May, making a huge globular structure of dry leaves and twigs, placed upon the ground, and lined with fine twigs and grass roots. The eggs are white in ground-colour, marked with various shades of purple. The adult male has the forehead and crown greenish grey, changing to red, and giving place entirely to red on the nape, where the feathers are long and form a crest; the upper-parts and tail are blue, the primaries brown, with a white basal patch, the lores and a broad streak from the eye to the nape black, the chin and throat whitish, and the lower-parts light blue, barred with black.



THE BLUE PITTA.

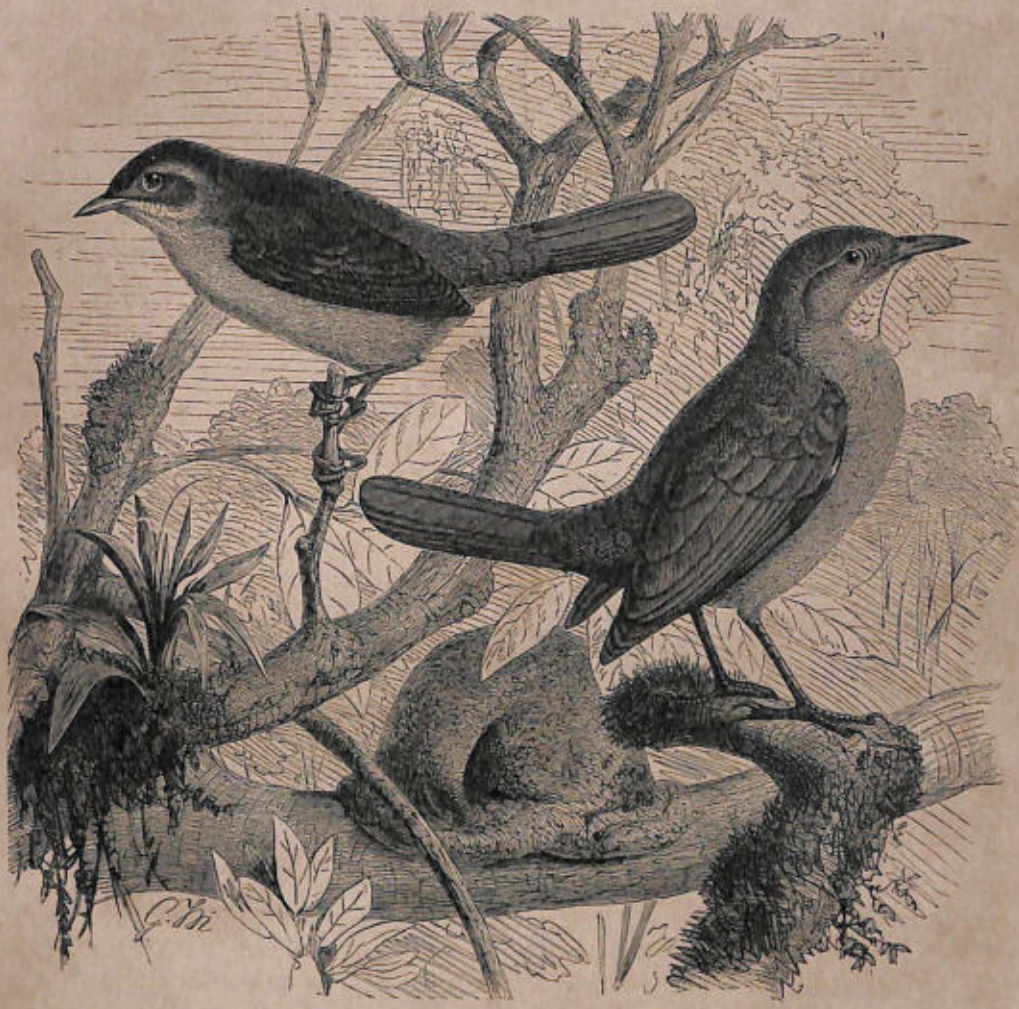
The Wood-Hewers.

Family *Dendrocolaptidæ*.

The wood-hewers are birds chiefly of a brown coloration, with more or less rigid tail-feathers; having the bill long or moderate and laterally compressed, and rather strong, straight, or curved; while the third, fourth, and fifth quills of the wing are the longest, the tail-feathers are stiff, pointed, and often of a ferruginous colour, and the claws of the feet are much curved. Upwards of two hundred and twenty species of wood-hewers are found, ranging from Mexico to Patagonia; no fewer than thirteen of these genera being confined to the high Andes and south temperate America, while fourteen are restricted to the tropical parts of South America. A single species is found in the Falkland Isles. Among this vast assemblage, the limits of space prevent our referring to more than two of the genera.

Oven-Birds. The oven-birds (*Furnarius*) have the bill shorter than the head, laterally compressed and pointed, the upper mandible being

slightly curved; the wings are moderate, the tail consists of twelve feathers, and the feet are strong and adapted to terrestrial progression. The members of this genus range all over South America, eighteen species being restricted to the temperate regions. A well-known species in Paraguay (*F. rufus*), Uruguay, and Argentina is the red oven-bird, which enjoys a wide popularity on account of its familiarity with man, its loud ringing voice, and the



BROWN-FRONTED SPINE-TAIL AND RED OVEN-BIRD (½ nat. size).

wonderful mud-nest which it prefers to build near a human habitation, often upon a projecting beam or the roof of the house itself. Mr. W. H. Hudson says that in favourable seasons the oven-birds begin building in the autumn, and the work is resumed during the winter whenever there is a spell of mild, wet weather; the material used being mud, with the addition of horsehair or fibrous roots, which make the structure harder, and prevent it from cracking. When finished, the structure is shaped outwardly like a baker's oven, only with a deeper and narrower entrance. It is always placed very conspicuously, and with the entrance facing a

building if one be near, or, if at the roadside, looking towards the road. When the structure has assumed the globular form, with only a narrow opening, the wall on one side is curved inwards, reaching from the floor to the dome, and at the inner extremity an aperture is left to admit the bird to the interior, or second chamber, in which the eggs are laid. The interior is lined with dry and soft grass, upon which five white pear-shaped eggs are laid. The oven is a foot or more in diameter, and is sometimes very massive, weighing eight or nine lbs., and so strong that, unless loosened by the swaying of the branch, it often remains unharmed for two or three years. The birds incubate by turns, and when one returns from the feeding-grounds, it sings its loud notes, on which the sitting bird rushes forth to join in the chorus, and then flies away, the other taking its place on the eggs. The young are exceedingly garrulous, and when only half-fledged may be heard practising trills and duets in their secure oven in shrill tremulous voices, which change to the usual hunger-cries of young birds when the parent enters with food. After leaving the nest, the old and young birds live for two or three months together, only one brood being raised in each year. A new oven is built every year, and occasionally a second may be built on the top of the first, when this has been placed advantageously, as on a projection and against a wall. A somewhat curious circumstance occurred at the estancia house of a neighbour of Mr. Hudson at Buenos Aires one spring. "A pair of oven-birds built their oven on a beam-end projecting from the wall of a rancho. One morning one of the birds was found caught in a steel-trap placed the evening before for rats, and both of its legs were crushed above the knee. On being liberated, it flew up to and entered the oven, where it bled to death, no doubt, for it did not come out again. Its mate remained two or three days, calling incessantly, but there were no other birds of its kind in the place, and it eventually disappeared. Three days later it returned with a new mate, and immediately the two birds began carrying pellets of mud to the oven, with which they plastered up the entrance. Afterwards they built a second oven, using the sepulchre of the dead bird for its foundation, and here they reared their young. My neighbour, an old native, had watched the birds from the time the first oven was begun, feeling greatly interested in their diligent ways, and thinking their presence at his house a good omen; and it was not strange that, after witnessing the entombment of one that died, he was more convinced than ever that the little housebuilders are pious birds." The plumage of this oven-bird is earthy brown above, with a slight reddish tinge; the breast and flanks are pale sandy brown; the upper tail-coverts and tail are bright reddish brown. There is no difference in the colour of the sexes.

Spine-Tails. The spine-tails possess a short straight bill, laterally compressed; the wings are very short and much rounded, with the primaries scarcely exceeding the inner secondaries; the tail is broad, with the shafts rather rigid, and the tips are pointed; while the feet are very large and furnished with slender claws. The white-throated spine-tail, like its congener the brown-fronted species (*Synallaxis frontalis*), is a native of the Argentine Republic, and Mr. Hudson says is a summer visitant to Buenos Aires; its arrival in spring being easily recognised by the utterance of its harsh persistent note, which is remarkably strong for so small a bird, reiterated for half an hour at a time with

only intervals of a few seconds. The nest is placed in a low thorn bush, sometimes only two or three feet above the ground, and is an oblong structure of sticks twelve or fourteen inches in depth, with the entrance near the top, and reached by a tubular passage made of slender sticks six or seven inches long. From the top of the nest a crooked passage leads to the cavity near the bottom; this is lined with a little fine grass, and nine eggs are laid, pear-shaped in form and bluish white in colour. The nests are often entered through a long tube, built at a point about halfway up the side, and formed by the interlocking of thorny twigs; and although the diameter of the passage is only large enough to admit the old birds one at a time, yet they pass out with ease and rapidity. In Colombia this spine-tail varies the form of its nest, making it as large as that of an English magpie, and roofing the top with a mass of large leaves to protect it from the heavy rains. The adult bird has the forehead grey; the crown of the head pale chestnut; the sides of the head, neck, back, and tail, pale earthy brown; the upper wing-coverts pale chestnut; the primaries olive-brown; and the lower-parts white tinged with brown.

The Lyre-Birds.

Family *Menuridæ*.

The last representatives of the order that can be mentioned here are the aberrant lyre-birds of Australia, where they are represented by three species, all included in the genus *Menura*, of which the typical and best known form is the common lyre-bird (*M. superba*) of New South Wales. Altogether abnormal in their structure, these remarkable and highly specialised birds can scarcely be assigned to either of the two great groups into which the Passerines are divided, and they must accordingly be regarded as standing to a great extent by themselves. Of very large size, the lyre-birds are especially characterised by the great development of the tail-feathers of the male, which assume a lyrate form, the majority being devoid of hooklets, and thus having the webs formed of separate plumules. The general colour of the plumage is brown; but while in the typical species the large pair of outer tail-feathers have reddish brown transverse bars on a light ground, in Prince Albert's lyre-bird (*M. alberti*) these feathers are uniformly coloured. The lyre-birds are remarkable for their power of imitating the cries and songs of other birds, this faculty being most developed in the species last mentioned; and they are also peculiar in making playing-grounds somewhat similar to those of some of the bower-birds. After remarking that he had never seen more than a single pair together, Gould observes, of Prince Albert's lyre-bird, that each bird appears to have its own walk or boundary, and never to infringe on the others' ground; for they may be heard day after day in the same place, and seldom nearer than a quarter of a mile to each other. Whilst singing, they spread their tails over their heads like a peacock, and droop their wings to the ground, and at the same time scratch and peck up the earth. They sing mornings and evenings, and more so in winter than at any other time. The young cocks do not sing until they get their full tails, which apparently is not until the fourth year; the two central curved feathers being the last to appear. Feeding upon small insects,

and more especially beetles, they commence nesting in May; the eggs being laid in June, and the young hatched in the following month. The nest is constructed of small sticks, interwoven with moss and fibres of roots; while internally it is lined with the skeleton leaf of the parasitical tree-fern, which in texture resembles



THE LYRE-BIRD.

horse-hair; the whole structure being roofed in, and entered by an aperture on one side. But one egg is laid, and this is of a very dark colour, looking almost as though it had been smeared over with ink; the young bird, which is coated with down for the first month, remains in the nest for a period of about six weeks.

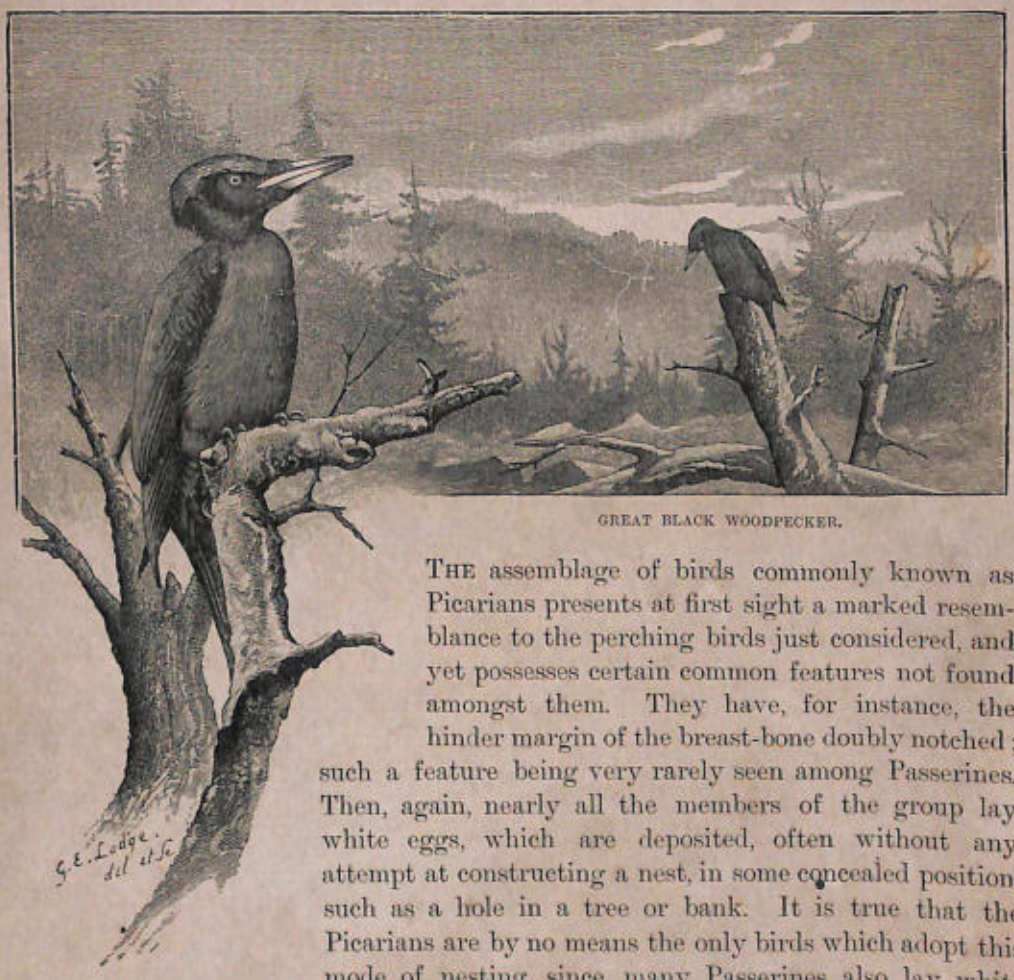
H. A. MACPHERSON.

CHAPTER VII.

The Picarian Birds,—Order Picariæ.

Jacamars to Toucans.

Families *Galbulidæ* to *Rhamphastidæ*.



GREAT BLACK WOODPECKER.

The assemblage of birds commonly known as Picarians presents at first sight a marked resemblance to the perching birds just considered, and yet possesses certain common features not found amongst them. They have, for instance, the hinder margin of the breast-bone doubly notched; such a feature being very rarely seen among Passerines. Then, again, nearly all the members of the group lay white eggs, which are deposited, often without any attempt at constructing a nest, in some concealed position, such as a hole in a tree or bank. It is true that the Picarians are by no means the only birds which adopt this mode of nesting, since many Passerines also lay white eggs and equally conceal them; the sand-martin, for instance, burrowing out a tunnel like the kingfisher, and depositing its eggs deep in the ground. There are, moreover, instances to the contrary, as in the case of pigeons, which lay two

white eggs in an open nest, while humming-birds, which are also Picarian, likewise build an open nest and lay white or light-coloured eggs. No definite rule can be laid down as to the nesting of the Picarians, and there are farther exceptions, though of a modified kind, and capable of a different explanation, such as occur in the case of the cuckoos, some of which lay white eggs, and others variegated and coloured ones. Although, in addition to the above not very important features, there are certain osteological characters peculiar to the Picarians, such as the form of the upper arm-bone or humerus, which exhibits well-marked differences from the corresponding bone of the perching birds, the definition of the order by means of well-marked and exclusive features is by no means easy. The palate is sometimes of the so-called ægithognathous type, and at others of the bridged or desmognathous form; while the structure of the foot is variable in every degree, some Picarians having a foot in which the fourth toe is directed backwards, while in others the foot has the front toes joined together, so as to form a very flat perching surface. The Picarians may be divided into three chief sections, which may be called Scansores, or climbing Picarians; Coccyges, or cuckoo-like Picarians; and Coraciiformes, or roller-like Picarians; the chief differences between these groups occurring in the arrangement of the tendons of the feet, which need not be explained in a work of the present nature.

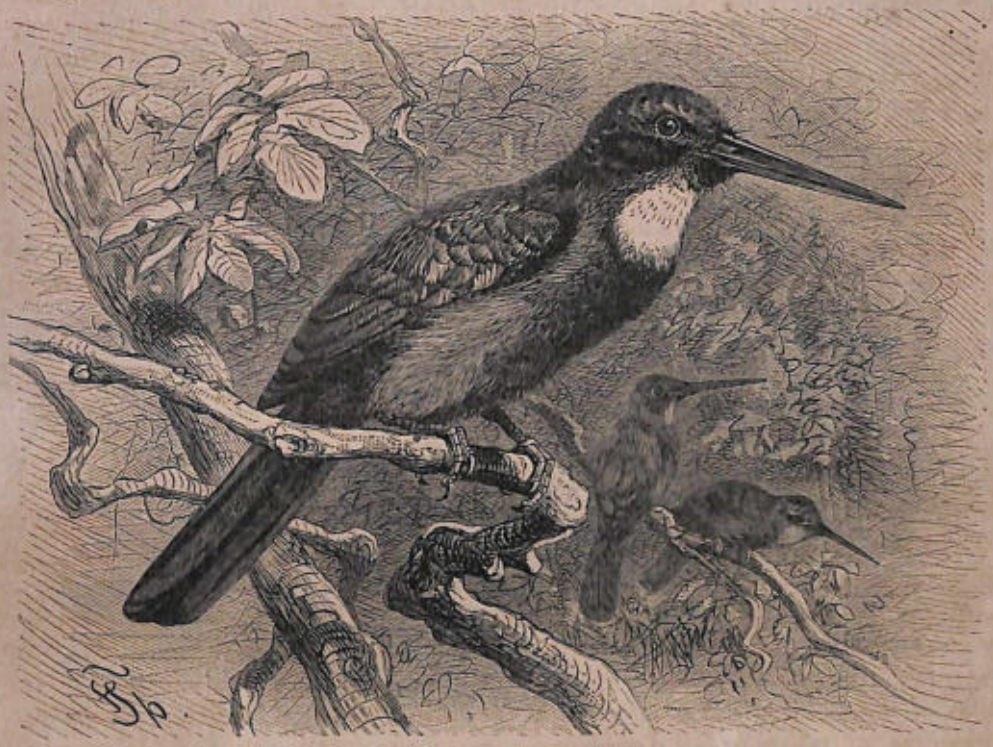
The Jacamars.

Family *Galbulidæ*.

Commencing with the climbing section of the order, our first representatives are the South American jacamars, of which about twenty species are known. All these birds have the so-called zygodactyle type of foot, in which the fourth toe is directed backwards parallel to the first. The bill is peculiarly long and straight; there is an aftershaft to the body-feathers, which does not occur in the allied group of the puff-birds; and there are some further differences in the arrangement of the feathers of the under surface, the tract on the breast having a branch on the throat. The number of tail-feathers varies in a somewhat peculiar manner, the normal number being twelve, but in two genera out of the six (*Brachygalba* and *Jacamaralcyon*) the outer feather on each side is wanting, thus reducing the number of feathers to ten. Although nothing absolutely decisive is known as to the breeding-habits of the jacamars, it is stated that in Tobago they build in holes in mud-banks, like the motmots, and lay pure white and nearly spherical eggs; while the three-toed Brazilian jacamar has been seen boring holes in banks as if for the purpose of nesting.

True Jacamars. Together with four other genera of the family, the true jacamars constitute a subfamily group; *Galbula* and the allied genus *Urogalba* having the middle pair of tail-feathers elongated, while in the others the tail is short and squared; the three-toed jacamars (*Brachygalba*) being notable for the feature from which they take their name. In these jacamars the prevailing colour of the plumage of the upper-parts is in most cases bronzy or metallic green. The green jacamar (*Galbula viridis*) is the best known species of the family, and is

found all over Guiana as far as the Lower Amazons to the south, and as Venezuela to the westward. It is of a coppery-green colour, with a bluish sheen on the crown, the under surface being chestnut, the throat white, followed by a band of bright green across the breast, and the outer tail-feathers blackish. An allied species is the red-tailed jacamar (*G. ruficauda*), which closely resembles the foregoing, but is distinguished by its rufous outer tail-feathers. It is an inhabitant of the same part of South America as the first, but does not extend into Amazonia, being found, however, further to the west, viz. in Colombia. In Trinidad, Mr. F. M. Chapman says that it is not uncommon at and near the borders of the forests. "Its



GREEN JACAMAR ($\frac{2}{3}$ nat. size).

appearance, at first sight, would seem to support its reputation for stupidity, but closer observation will, I think, induce one to believe that these birds are by no means so stupid as they have been said to be. They are the most expert flycatchers I have ever seen, and this in spite of the fact that the shape of the bill would seem better to fit them for almost any other mode of existence. Sitting all drawn in on a dead limb, generally near the ground, they may be compared to a set spring. Their watchfulness permits no insect to pass in safety. They maintain a constant look-out, turning the head quickly from side to side, above, or even half-way round. The dart into the air is made with wonderful celerity. Sometimes it is straight up, again at various angles, and they go as far as thirty or thirty-five feet from their perch. As a rule they return to the same perch after each sally, and may occupy this for many minutes. As they rest they utter a singular call—a loud, clear, piping whistle, not unlike the call of a lost duckling.

This is delivered in a variety of ways. Sometimes it is given as a single whole note, but it may be repeated at intervals of a second for minutes at a time. The dart into the air for an insect interrupts this musical reverie only momentarily, and, on returning to their perch, the plaintive calling is continued; at other times their notes are uttered more rapidly, and may rise into a high, prolonged trilling. This may be ground out as revolutions of sound, when the effect is most peculiar." Mr. Richmond says that on the river Escondido in Nicaragua he met with the black-cheeked jacamar (*G. melanogenia*) on three or four occasions. "It has a piercing cry resembling *kee-u*, with the first syllable very shrill, and strongly accentuated. The bird jerks its tail after the manner of a kingfisher."

Broad-Billed Jacamar. A single species (*Jacamerops grandis*) is the sole representative, not only of this genus, but likewise of the second subfamily of the jacamars. This bird is found from British Guiana to Amazonia, and thence to Ecuador, Colombia, and Panama. It is a bird of large size, fully 10½ inches in length, of the usual metallic-green colour above, chestnut below, with a large spot of white on the throat. It has a broader bill than any of the other members of the family, and is further easily recognisable by its large size.

The Puff-Birds.

Family *Bucconidæ*.

Much resembling the Passerines in external appearance, and like them having twelve tail-feathers, as well as a shrike-like beak, the puff-birds are nevertheless true Picarians, having a bridged palate and zygodactyle feet; while the tendons which serve the toes are of the same type as in woodpeckers and honey-guides. There is no aftershaft to any of the contour-feathers; the oil-gland is naked; and the wing-coverts rather resemble those of the Passerines in their arrangement than the rest of the Picarians. Like the other members of the present order, puff-birds are believed to nest in holes, and to lay white eggs, but really very little is known about them. Confined to South America, the puff-birds have no representatives in the Old World, or even in North America. Seven genera are admitted by Dr. Sclater, the names of which it will be unnecessary to mention, and forty-three species; the range of the family being from Honduras in Central America southward over the whole of South America, as far as Bolivia and Southern Brazil. Puff-birds are said to be generally woodland birds, being found singly or in pairs, and are considered to be of a rather sluggish and stupid nature. Dr. Sclater says that they are a "purely arboreal and forest-frequenting group of birds, seeming to pass the greater part of their lives sitting upon the topmost or outermost branches of trees, generally selecting twigs that are dry and withered for their perch, and looking out for insects, which are captured flying, and which constitute their only food. The swallow-winged puff-birds (*Chelidoptera*) nest in holes in banks like kingfishers, and lay white eggs." Mr. Richmond, when in Eastern Nicaragua, met with Dyson's puff-bird (*Bucco dysoni*) in the forest on the Escondido River, where it was catching insects, and behaving very much like a tyrant-flycatcher. He says that



GREAT BLACK WOODPECKERS EXPLORING.

on making a capture it would seek a new perch, flying in a leisurely way, and showing considerable hesitancy about selecting a place on which to settle. The same observer also found the Panama puff-bird (*Malacoptila panamensis*) on the above-named river, where it was rather rare; stating that it is apparently confined to the thick forests, where it keeps among the lower branches, at times even descending to the bushes. A female bird shot by Mr. Richmond on the 23rd of May was "about ready to deposit eggs; it was shot from a twig directly in front of a hole in a bamboo, in which its nest was probably located. The stomach was distended with insects, principally locusts."

The Woodpeckers.

Family *Picidæ*.

Forming a kind of connecting link between the Perching Birds and the other members of the present order, the woodpeckers constitute a group of considerable interest. Like the majority of the order, the woodpeckers nest in holes, and lay spotless white eggs; but instead of having either the Passerine or the bridged type of palate, they have a somewhat intermediate form, in which the front of the bone termed the vomer is slender, pointed, and slit, instead of being truncated. Moreover, these birds have a distinctly climbing foot, thereby showing their affinity to the other climbing members of the order, such as barbets, cuckoos, or toucans. The structure of the tongue in woodpeckers is, however, entirely peculiar to the family, a similar arrangement of the extensile tongue-bones being elsewhere found only in the humming-birds and the sun-birds among the Passerines. The mechanism of the woodpecker's tongue is somewhat as follows. In the majority of these birds the tongue is long, worm-like, pointed, and barbed at the tip. To permit of its being projected or withdrawn as required, the extremities of the supporting bones are prolonged backwards, sliding in a sheath curving round the top of the skull; and the glands beneath it are greatly developed, secreting a viscid fluid, covering the tongue and causing insects to adhere to it. The peculiar modification of these organs and their application in procuring food are, indeed, closely analogous to those found in the anteaters and several other mammals, and the chameleon among reptiles. In some species the extremities of the tongue-bones slide backwards and forwards in the sheath as the tongue is retracted or protruded; while, in others, as in the common English green woodpecker, their ends are fixed to the sheath, and the protrusion of the tongue is caused by the action of a certain muscle diminishing the curve in which the extremities of the tongue-bones lie when the tongue itself is withdrawn. In only two American genera of the family is this remarkable structure absent. The bill in all the woodpeckers is strong and chisel-shaped, and is thus admirably adapted for hewing holes, and prising off bark to capture insects; the viscid secretion on the tongue being of great use in the latter function; but in the ground-haunting species the bill is less powerful.

There is very little variation in the habits of the member of this family; nearly all climbing trees, in the stems of which they bore out holes for their nesting-place; the direction of the aperture being at first horizontal and then

descending to a depth varying from a few inches to several feet. No nest is formed, the eggs, which are always glossy white, or pinkish white, being deposited on the chips which are accumulated by the birds during the excavation of the hole. They vary from two to seven or eight in number, but the average clutch is four or five. The young are hatched naked and blind; and in this state they remain for some time, although they soon become vigorous; the clamour with which they greet their parents, when the latter bring food to the nest, being proverbial. They soon learn to climb to the mouth of the hole, and even sleep in a hanging position. The tenacity with which the claws grasp the bark of a tree is often illustrated even in death, for sometimes a woodpecker, when fatally wounded by shot, automatically grips the trunk with such vigour as to remain suspended. The geographical range of the woodpeckers includes the whole of America, Africa, Europe, and northern and tropical continental Asia, although no species are found to the eastwards of Celebes, the group being entirely unrepresented in Australasia and the Pacific Islands. The only fossil representative of the group hitherto described appears to be one from the Tertiary strata of the Uinta Mountains, in the United States, and hence named *Uintornis*; but how close this comes to existing forms does not admit of determination.

Constituting a single family, the woodpeckers may be subdivided into two minor groups, namely, those with stiffened tails and those with soft tails. As with other climbing-birds, such as the creepers and wood-hewers, among the Passerines, the stiffened tail is an accessory to ascending trees. In the present group it is the shaft or stem of the feathers which is stiffened and elastic; the ends of the same being generally narrowed to a point, and the webs often showing signs of wear and tear, as the tail is constantly dragged along the rough bark of a tree, or is used as a support for the body of the bird, when the latter hammers away at the bark to procure its insect food. In some instances the tail-feathers assume a more remarkable shape, the hardened webs being turned inwards from their outer edges, so as to make a kind of hollow half-tube; this being particularly observable in the imperial woodpecker. The tail of some of the larger kinds of woodpeckers must, in fact, work havoc amongst the insects on the bark of a tree when the bird is climbing up; and we have seen the tail of a rufous woodpecker, in which the feathers were covered with the heads of ants on the under-side, numbers of the insects being attached to the tail-feathers of the bird.

Ground-Woodpecker. The Cape ground-woodpecker (*Geocolaptes olivaceus*), the sole member of its genus, may be taken as our first representative of the typical subfamily of the group, in all the genera of which the tail is spiny, and has stiffened shafts to the feathers. The species under consideration is a dull-plumaged bird, of moderate size, and about 10 inches in length. The general colour is olive-brown, with yellowish brown shafts to the quills, and orange-brown shafts to the tail-feathers. There is some crimson on the rump, and also on the under surface of the body. The head is slaty grey, with a slight crimson moustache; and the colour of the eye is orange, but it has also been described as whitish pink. This curious woodpecker is common in certain parts of South Africa, where it enjoys a very limited range, being found in the Cape Colony, extending to the Orange Free State and Natal, but apparently not to the Transvaal. Mr. Layard

observes: "This singular bird presents a remarkable instance of the adaptation of creatures to the localities wherein their lot is cast. Though belonging to the woodpecker family it never pecks wood, but bores its way into the banks of rivers, sides of hills, or the walls of mud-buildings, in search of its prey, and for a home for its young. It also seeks for food on the ground, in the same manner as the golden-winged woodpecker of North America; its flight also struck me as very similar. It excavates a hole, sometimes several feet in depth, in which to deposit its eggs, which are pure white, and from three to five in number. Families seem to keep in company, until the arrival of the breeding-season separates them. They feed together, and roost together in some deserted hole, while their loud, harsh cries, as they call to each other, may be heard for a considerable distance." In Natal Mr. Thomas Ayres noticed this woodpecker on the Mooi River, creeping with much agility among the crevices and holes in some loose stone walls erected by the Kaffirs as enclosures for their cattle. Some of the birds were climbing up the face of a perpendicular rock, searching for insects exactly in the same manner as other woodpeckers examine a tree. These birds are fond of perching in twos or threes, sometimes in family parties, on a big rock or ant-hill, with the head and neck only visible to the intruder. Colonel Butler says that a nesting-place found by him in August, contained four fresh eggs, and the nest-hole was bored in soft earth on the face of a precipitous rocky bank or cliff overlooking a running stream. The eggs were laid in a depression in the ground, with no attempt at a nest, about a foot and a half from the entrance, the passage inclining slightly upwards. The general impression amongst naturalists, who have seen this woodpecker in a state of nature, is that the bird never perches on trees; but in the Orange Free State Mr. Symonds says that he saw a number of them sitting on the mimosa trees, chattering and making a great noise.

Bright-Shafted Woodpeckers.

Peculiar to the New World, these woodpeckers are distributed over nearly the whole of North and South America, with the exception of some of the forest-districts, as in British Guiana, Venezuela, and parts of Amazonia and Ecuador, but representatives of the genus (*Colaptes*) occur again in Brazil, as well as in Peru, Chili, and Patagonia. The term golden-winged is due to the bright yellow shafts to the quills, the inside of the wing being also bright yellow; but there are some species to which the name does not strictly apply, such as *C. mexicanus*, in which the shafts of the quills and the quill-lining are red instead of yellow. In certain districts in North America where the golden-winged woodpecker (*C. auratus*) is defined as being chiefly a bird of the Eastern States, and the red-winged species (*C. mexicanus*), as a bird of the more Western States, there occurs a connecting species (*C. ayresi*) with an intermediate habitat between the two. It is not yet satisfactorily determined whether this curious form has been produced by the interbreeding of the golden and red-winged species, but the intermediate bird certainly partakes of the characters of both of them. The bill in these woodpeckers is rather more curved than in ordinary woodpeckers, and it is also weaker; while the birds themselves are less decidedly frequenters of trees, being more ground-feeders than the rest of the family. They excavate, however, their own nest-hole like the majority of woodpeckers; and they also perch horizontally on branches like ordinary Passerine birds instead of flying to a

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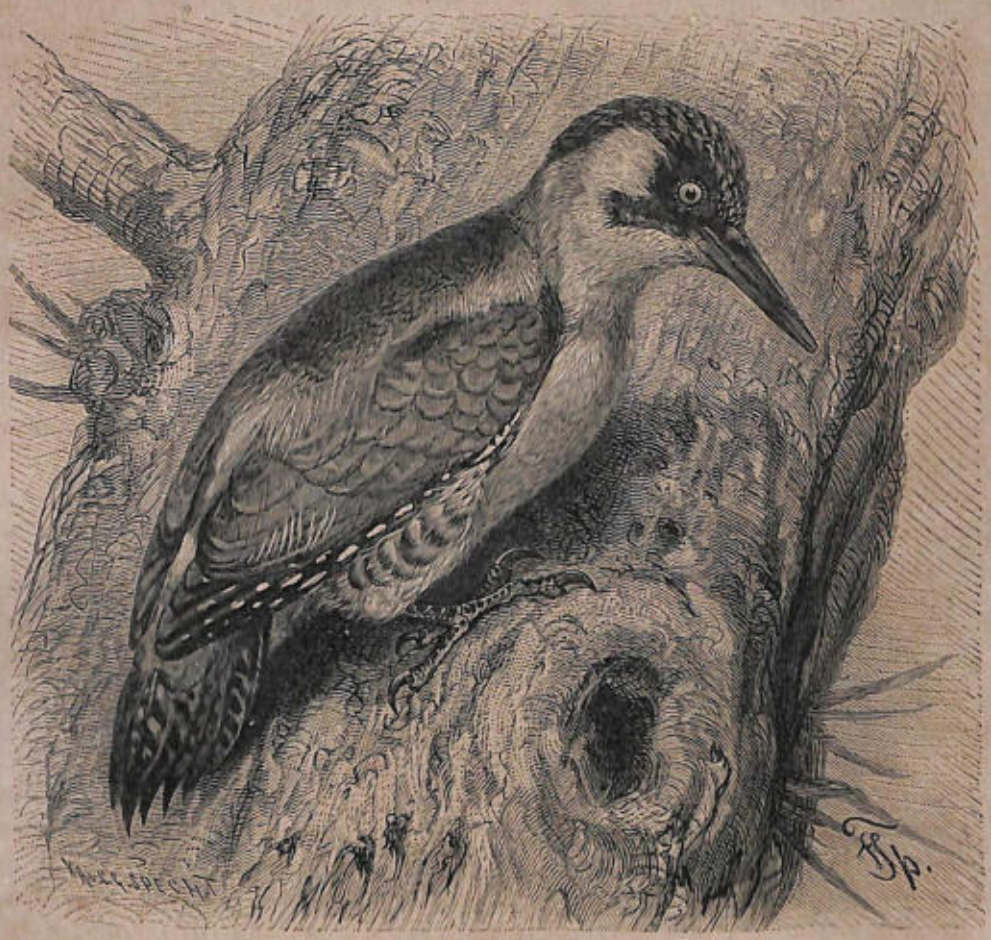
tree trunk and climbing continually, after the manner of the other members of the family.

Golden-Winged Woodpecker. This species (*C. auratus*), familiarly known in the States as the flicker, is a bird about 11 inches in length, of a drab-brown colour above, barred with black, the rump being white; the head smoky grey, followed by a scarlet nape-band; while the sides of the face and throat are drab with a black moustache-band, and a crescentic patch of black on the chest; the remainder of the under surface being white, spotted with black; and all the shafts of the quills and tail-feathers golden yellow. A summer visitor to the sub-arctic parts of North America, and breeding even in the high north, in the middle and southern States this woodpecker is a permanent resident. It feeds largely on ants, and wanders over the open country in search of these insects, being far less of a forest-haunting species than most of its relations. An interesting account of the feeding of the young birds by the parents is given by Mr. Brewster, who says that when first he saw the nestlings there were five of them, about as large as plucked house-sparrows, and perfectly naked. Their eyes were tightly closed, and they appeared to be less than a week old. They were writhing and shivering pitifully, the air being cool and damp at the time. He watched the nest for about an hour, but saw nothing of the parent birds, and as a cold rain-storm began soon after, and lasted through the following night, he concluded that the young flickers would soon be dead. On the 1st of July, however, he found them all alive and vigorous; and then by dint of patience and careful observation he discovered the method by which the young were fed. After a little time the male bird became more accustomed to his presence, and visited the nest when he was not more than fifteen feet away from it.

Pampas Woodpecker. This woodpecker (*C. agricola*), is a remarkable bird, with a weaker bill than usually found in the family, while it has also longer legs and a less stiffened tail than is customary with woodpeckers; these modified characters being probably brought about by the peculiar habits of the bird, which, as its name implies, is an inhabitant of the pampas of Argentina. In size it is a somewhat large species, measuring 12½ inches, and has golden shafts to the wing-quills, but black ones to the tail-feathers, which are entirely black. The quill-lining is golden-buff, the crown of the head is black, while the sides of the face and neck as well as the fore-neck are golden yellow, inclining to orange, the chin and throat being white; the male has a red moustache, and the female a black one. Mr. W. H. Hudson writes that these birds "perch horizontally and crosswise, like ordinary birds, and only occasionally cling vertically to trunks of trees, using the tail as a support. They also seek their food more on the ground than on trees, in some cases not at all on the latter; and they breed oftener in holes in banks or cliffs than in the trunks of trees." In Patagonia he found the species breeding in the cliffs of the Rio Negro, but on the pampas of Buenos Aires, where the conditions are different, there being no cliffs or old mud-walls suitable for breeding-places, the bird resorts to the big solitary ombú-tree, which has a very soft wood, where it excavates a hole seven to nine inches deep, inclining upwards near the end, and terminating in a round chamber. In the treeless region, about the Sierra de la Ventana, in Uruguay, Mr. Barrows says that he noticed the birds about holes in the banks of streams, where they doubtless had nests.

Green Woodpeckers.

Strictly birds of the Old World, these woodpeckers are plentifully distributed in the temperate portions of Europe and Asia, several species occurring in the Himalaya, and hence extending through the Burmese countries to the Malayan Peninsula, Java, Sumatra, and Borneo. In Europe there are three species, *Gecinus viridis*, *G. sharpei*, and *G. canus*, while in Algeria there is a fourth species of the same group, *G. vaillanti*, a species allied to the European ones; *G. awokera* occurs in Japan. All the other green woodpeckers are tropical. The principal characteristic of this genus of woodpeckers is the green plumage, and they are likewise remarkable for the small outer or dwarf tail-feather, which is very short for the size of the bird. One of the most interesting of European birds, not only on account of its habits and bright coloration, but from its association with the poetry of Chaucer, who mentions it by the name of yaffle, by which it is known to the present day in many parts of the south of England, the green woodpecker (*G. viridis*) still "laughs loud" in many a woodland district. Its green colour, crimson crown, and yellow rump, render it conspicuous, and its dipping flight is peculiar, being a series of



COMMON GREEN WOODPECKER (⅔ nat. size).

long drops and ascents, unmistakable to the observer. Like many other birds of bright plumage, the green woodpecker is extremely shy, and is oftener heard than seen. If undisturbed, it may be seen to settle near the bottom of a tree and work its way up to the top, which it does very rapidly, hammering at the bark or prising it off, and gathering in its insect-food with its long suctorial tongue. It feeds largely on ants, and plays great havoc with the ant-hills, into which it digs great holes with its powerful bill. It is also said to attack wasps' nests for the sake of the grubs, and it will, according to Naumann, catch bees, as well as feed on acorns and hazel-nuts. The green woodpecker undoubtedly makes mistakes on occasions, so that it is not uncommon to find holes driven into trees by the birds and abandoned when the inside of the trunk or branch proved to be sound throughout. The beautiful symmetry with which the bird cuts the hole has often been remarked upon, the circular opening appearing as if it had been drilled in the tree. No nest is made, and the eggs, glossy white, and sometimes seven or eight in number, are deposited on the chips of wood accumulated during the process of excavation. Found in suitable localities throughout Europe, this species does not occur beyond the Ural Mountains, though it extends to Asia Minor and Western Persia. In Spain and Portugal its place is taken by Sharpe's green woodpecker (*G. sharpei*), and in Algeria by Le Vaillant's green woodpecker (*G. vaillanti*). Of one of the Himalayan species, the black-naped green woodpecker (*G. occipitalis*), a curious nest was found near Darjiling, and is recorded by Mr. Hume, who writes that "on the 17th of June Mr. Gammie took five hard-set eggs of this species out of a large regularly-formed nest placed at the bottom of a hollow in a tree; the nest being for all the world like that of some babbling-thrush, composed chiefly of coarse moss, roots intermingled with a little moss, and portions of a few broad dry flag-leaves. This was below Rungbi, near Darjiling, at a height of about five thousand feet. It was simply impossible, in my opinion, that the woodpecker should have had anything to do with the making of the nest; but it is very remarkable, I think, that it should even have accepted some other bird's nest as the receptacle for its eggs. The parent bird was captured on the eggs, so that there can be no mistake about the fact."

Grey-Headed Woodpecker. The grey-headed woodpecker (*G. canus*) ranges over the greater part of Europe, but does not visit the British Islands; and it also occurs in Siberia, Northern China, and the island of Yezo. Its habits are similar to those of the green woodpecker, which it also greatly resembles in size and colour, being about 12 inches in length. The under surface of the body, however, is perfectly uniform, without any crescentic marking as in most of the green woodpeckers; and the moustache-streak is black both in the male and female, the male usually having a red moustache. The nape is always grey, but the male has a red head and the female a grey one.

African Green Woodpecker. Passing over the American green woodpeckers (*Chloronerpes*), of which seventeen representatives are known, we come to the African green woodpeckers, all of which are confined to Africa south of the Sahara. Representing in that continent the American green woodpeckers, they have a similar coloration, but a more rounded wing. Fifteen species are known, but nothing remarkable has been recorded about their habits, and the published

notes only serve to show that these habits are like those of other woodpeckers of temperate climates. Thus Mr. Ayres writes of the golden-tailed woodpecker (*Campothera chrysura*): "These woodpeckers are to be observed throughout Natal, wherever there is bush-land, singly or in pairs; their note is loud and harsh; they are very restless in their habits, constantly hunting for food as if they had never obtained a sufficiency. Ants and other insects appear to be their usual food, which



GREY-HEADED AND WHITE-BACKED WOODPECKERS (⅔ nat. size).

they search for and catch on the rough bark of trees. They also hammer away at dead boughs, from which they extract soft grubs, etc.; and their flight is heavy and dipping. This woodpecker makes a hole, for the purposes of incubation, in the trunk of a decayed tree, just large enough at the opening for the bird to enter, but becoming wider inside and reaching downwards to the depth of a foot or eighteen inches; it lays its eggs on the bare wood, without making any nest."

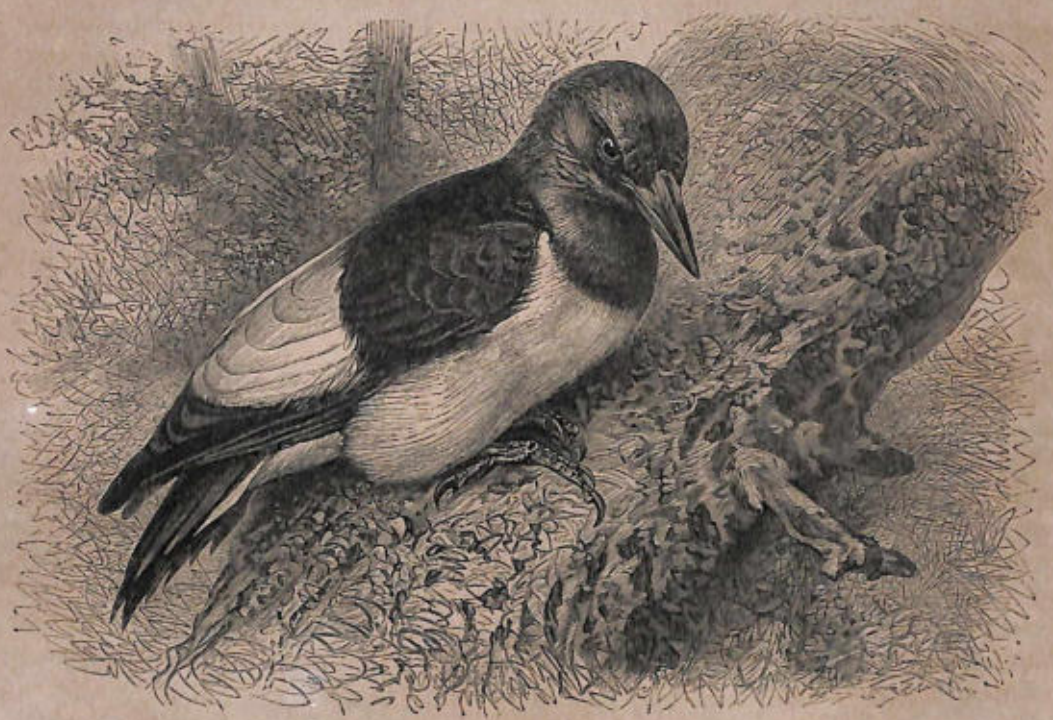
Several allied genera present no particular features. Such are *Chrysoptilus* of South America, with eight species; *Chrysophlegma* of India, Burma, and the

Malayan countries, also with eight species. The last-named genus is remarkable for its large yellow or red crest. Lewis's woodpecker (*Asyndesmus torquatus*) is an inhabitant of Western North America, extending into Arizona and Western Texas; and is remarkable for the structure of the body-plumes of the under surface, these being hairy in appearance, owing to the want of barbicules or hooklets to the web of the feathers. Its habits are also somewhat peculiar; and it is one of the few species in which the colour of the male and female is exactly alike. Dr. Coues writes: "This is chiefly a bird of the vast forests that clothe most of our mountain ranges with permanent verdure. My own experience with the bird in life is confined to the vicinity of Fort Whipple in Arizona, where it is a very common species—a bird of singular aspect, many of its habits are no less peculiar. One seeing it for the first time would hardly take it for a woodpecker, unless he happened to observe it clambering over the trunk of a tree, or tapping for insects, in the manner peculiar to its tribe. When flying, the large, dark bird might rather be mistaken for a crow-blackbird; for although it sometimes swings itself from one tree to another, in a long festoon, like other woodpeckers, its ordinary flight is more firm and direct, and accomplished with regular wing-beats. It alights on boughs, in the attitude of ordinary birds, more frequently than any other American woodpecker, except the flicker, and, with the same exception, taps trees less frequently than any."

Red-Headed Woodpeckers. The well-known North American red-headed woodpecker (*Melanerpes erythrocephalus*) is a representative of a genus exclusively American, and embracing thirty-three species, ranging from the United States to Argentina. In habits these woodpeckers seem to resemble the other members of the family, so that there is nothing particular to record respecting them. In the British Museum there may, however, be seen an illustration of the way in which one of these woodpeckers stores up acorns supposed to be for its winter supply of food. A piece of pine-bark has been pierced with a number of holes, drilled for the purpose of receiving the acorns. The species to which this habit has been proved to belong is the white-fronted red-headed woodpecker (*M. formicivorus*), inhabiting Central America, from Mexico to Panama.

Sap-Suckers. Three species of this genus are known, all of them North American and Central American in habitat; one of them (*Sphyropicus varius*) also occurring in the West Indies. The genus does not possess the long extensile tongue of the other woodpeckers, sharing the want of this essential character with another North American genus (*Xenopicus*). Writing of the habits of the yellow-bellied sap-sucker (*S. varius*), Mr. F. Bolles observes: "I found a sap-sucker's 'orchard' of about a dozen canoe-birches and red maples, most of which were dead, some decayed and fallen. The tree most recently tapped was a red maple about forty feet high, and two feet through at the butt. The drills made by the woodpeckers began at eighteen feet from the ground, and formed a girdle entirely round the trunk. This girdle contained over eight hundred punctures, and was almost three feet in height. In places the punctures or drills had run together, causing the bark to gape and show dry wood within. The upper holes alone yielded sap, and from this I inferred

that what the birds obtained was the elaborated sap descending from the leaves through the fibres of the inner bark. I tasted the sap, and found it unmistakably sweet. The leaves on branches above the drills drooped, but those below were in good condition. I watched the drills on this tree from 12.30 P.M. until 2, and from 4 until 6 P.M., being concealed in the bushes to the north-west of the tree. During nearly the whole of this period of three and a half hours, one or more woodpeckers were in the tree engaged at the drills; they were a male, female, and two young birds. Four visits were paid by humming-birds in the time named, but the visitors were driven away by the woodpeckers. At 5.30 I shot one of the young birds in order to determine the number of individuals using the 'orchard.' His absence



RED-HEADED AMERICAN WOODPECKER.

was unnoticed by the survivors. The next day the male, female, and one young bird were present, the tree being seldom left by all at once. Ten visits were paid by humming-birds; in five cases they reached the drills, and, hovering, drank sap from one or more of them. In the other cases, the woodpeckers being present, the birds were driven away. The work of the woodpeckers seemed to me, armed as I was with an excellent opera-glass and sitting not more than thirty feet from the drills, to be perfectly plain in character. During the morning the female drilled four or five new holes; they were above others in perpendicular series, and yielded sap freely. She was closely attended by the young one, who occasionally swallowed pieces of the soft bark, or cambium-layer, taken from the bottom of the drills; the female also ate some of it. When not drilling or resting, the female dipped sap from the holes near by. The male drilled no holes, but

dipped in those yielding sap. The dipping was done regularly and rather quietly, often two or three times in each hole. The sap glistened on the bill as it was withdrawn, and I could sometimes see the tongue move. The bill was directed towards the lower, inner part of the drill, which, as I found by examination, was cut so as to hold the sap. I looked carefully, again and again, to try and find insects in the sap; but none were there, although numbers crawled upon the bark. Occasionally, with a nervous motion of the head, the birds caught an insect. There was no doubt as to when they did this, either on the bark or in the air, for in swallowing an insect they always occupied an appreciable time in the process."

Mr. Bolles states that the birds consume the sap in large quantities for its own sake, and not for insect matter which such sap may chance occasionally to contain; that the sap attracts many insects of various species, a few of which form a considerable part of the food of this bird, but whose capture does not occupy its time to anything like the extent which sap-drinking occupies it; that different families of these woodpeckers occupy different "orchards," such families consisting of a male, female, and from one to four or five young birds; that the "orchards" consist of several trees usually only a few rods apart; that the forest-trees attacked by them generally die, possibly in the second or third year of use; and that the total damage done by them is too insignificant to justify their persecution in well-wooded regions.

Pied Woodpeckers.

The genus *Dendrocopus* is not only widely distributed over the globe, but to it belong the best known English species, such as the greater and lesser spotted woodpeckers. There are altogether forty-six species spread over the greater part of Europe and Asia, as well as North America; but the genus is absent from Africa below the Sahara, although represented in Algeria and Morocco, as in Palestine and Syria. A resident species in most parts of the British Islands, a considerable number of immigrants arriving in the autumn, during which season a large number regularly pass over Heligoland, the greater spotted woodpecker (*Dendrocopus major*), with its conspicuous pied plumage, is a handsome and striking bird. A notable difference exists, however, between the coloration of the two sexes, the males having a red patch at the back of the head, totally wanting in the females, in which the entire head and nape of the neck is black. The young birds, on the other hand, have the crown red, thus possessing a more striking coloration than either of the parents, a feature not often to be seen in birds. So shy is the great spotted woodpecker, that but few people are acquainted with it in a state of nature, and even where the bird is known to occur, it is by no means easy to get a sight of it. Its single note, resembling the knocking of two stones together—a sort of *chit*—can be often heard, but the bird is not visible, having probably placed the trunk of a big tree between itself and the observer, after the manner of woodpeckers in general. In the spring it makes a peculiar drumming noise on the smaller branches of the trees or on the trunks of dead trees, and this noise, which appears to be a sort of signal-code between one bird and its mate, can be heard for a considerable distance. The species is found in wooded districts, but generally in park-lands, where hollow trees occur here and there; and in these the great spotted woodpecker bores for its nesting-place. The bird seems to pursue a kind of regular round of trees in search

of insects, beginning generally at the bottom and pursuing the uneven tenor of its way towards the top of one tree, sometimes visiting the larger branches on its way up, and betokening its presence by the loud taps which it bestows upon the bark, or by the fall of its pieces, as the bird prises them off with its awl-like bill. Although its chief food consists of insects, secured with great rapidity by means of its long and glutinous tongue, this woodpecker visits orchards and feeds on



GREATER, MIDDLE, AND LESSER SPOTTED WOODPECKERS (½ nat. size).

plums and cherries, while in the autumn and winter it will devour nuts, acorns, and berries. The least of the European species of the genus, and easily recognised by its small size and the five white bars on the wing, the lesser spotted woodpecker (*D. minor*) has in the male the crown red, while in the female the forehead and crown are white, with no red on the head at all. In general habits the present species closely resembles the last, but at certain seasons of the year it is found hunting for insects in orchards or on trees in the vicinity of houses, which is not the case with its larger relative. Being, like most of its kin, a shy bird,

it is not often seen, and, indeed, its presence is generally to be detected by its tapping on the trees, or when flying from one tree to another, at which times the black-and-white bars on the extended wings render it rather conspicuous. It often sits on a branch horizontally, or runs along the under side like a nuthatch. It has the habit, in the breeding-season, of making a drumming noise on the bark of trees, which can be heard for a great distance, and is evidently a call from one bird to the other, as its note is so weak that the sound of it would not travel far. This drumming is performed on the smaller branches of a poplar tree at a great height from the ground, and the nest-hole is also often drilled in the small branches of a poplar, near the top of the tree, making it a matter of some difficulty and danger to procure the nest. The range of this woodpecker is almost the same as that of the preceding species, and, like it, it is represented in North Africa and in Asia by allied species. Another species found in most parts of Europe, and supposed to have occurred once in England, is the white-backed woodpecker (*D. leuconotus*). As its name implies it has a white back, with a black mantle, a red crown, and broad black streaks on the flanks. The female, as in most other species of this genus, has a black head. Its range extends across Northern Asia to Manchuria and Corea. Generally placed in the same genus as the last, the middle spotted woodpecker (*D. medius*) is by some regarded as the representative of a distinct genus (*Dendrocoptes*), on account of its differently shaped beak, and its distinct style of plumage. Unknown in England, this species is distributed over the greater part of Europe, as far east as the Caucasus; but is replaced in Asia Minor and Persia by St. John's woodpecker (*D. sancti-johannis*).

Three-Toed Woodpeckers. Agreeing with three other Indian genera in the absence of the first toe, the seven species of three-toed woodpeckers are rather densely feathered birds, with an Arctic or Alpine habitat. Thus we find them distributed over the high north of America, Europe, and Asia, occurring only elsewhere on mountainous areas, where the same temperature is experienced, as, for instance, on the Rocky Mountains as far south as Mexico, the mountains of Germany and Switzerland, and similar localities in Asia, including the mountains of China, but not occurring in the Himalaya. One of the best known species is the European three-toed woodpecker (*Picoides tridactylus*), a bird of moderate size, measuring rather more than 8 inches in length, and easily recognised by the yellow head and white breast of the male.

Pigmy Woodpeckers. Merely mentioning that the African cardinal-woodpeckers (*Dendropicus*) are small-sized birds, differing from European forms by their shorter tail and rather longer legs, while most of them have yellow shafts to the quills of the wings, and the wing markedly rounded, we pass on to the pigmy woodpeckers (*Iyngipicus*). As their name implies, these are birds of small size, and generally of brown plumage, with white bars, while most of the species, instead of a red head, have a little ornamental tuft of red feathers on the side of the crown. The pigmy woodpeckers have also a more pointed wing than their allies, and their distribution is peculiar, since they are found in Senegambia and North-Eastern Africa where they are very rare, and then the genus reappears in India, where it is by no means uncommon, and thence extends through the Burmese

countries to China, and north to Eastern Siberia and Japan, while to the southward it is found throughout the whole of the Malay countries and islands, extending eastwards to the islands of Lombok and Flores. The habits of these woodpeckers are similar to those of the rest of the family, but they are stated to nest in horizontal boughs like a barbet, instead of hollowing out a hole for themselves in the trunk of a tree.

Crimson-Headed Bay Woodpecker.

This (*Lepocestes pyrrops*) and the other species of the same genus are characterised by their very long and stout bills; the nostrils being exposed, and not, as in the case of most woodpeckers, hidden by



THE THREE-TOED WOODPECKER.

plumelets. This feature, and the very short tail in proportion to their size, may have been brought about by the peculiar habits of the birds, for Davison says that he was greatly puzzled when he first came across the species, and could hardly believe that it was a woodpecker at all.

Rufous Woodpeckers.

Remarkable for their entirely rufous plumage, and for their nearly obsolete first toe, the claw on which is scarcely to be traced, the rufous woodpeckers (*Micropternus*) also lack the nasal "shelf" on the bill. Five species of the genus are known, ranging from India and China to the Malayan countries and islands. Mr. Oates describes the Burmese species (*M. phæoceps*) as a very silent bird, seldom uttering a note, and creeping about in a quiet

stealthy way. Both he and Mr. Davison call attention to the bodies of the birds having a peculiar smell, and being smeared with some gummy substance. The latter writer adds: "They nearly always have their tails more or less studded with ants' heads. These are the large red ants of the jungle, who, when once they seize anything, never loose their hold. You may pick them to pieces, but their



IVORY-BILLED WOODPECKER (½ nat. size).

heads hold on still. They are the sumput-api or fire-ant of the Malays, and they bite unpleasantly. They seize hold of the tail-feathers of these woodpeckers: their bodies get rubbed off, but the heads remain, sometimes in scores, adhering to the lateral webs of the tail-feathers." In the Eastern Himalaya the present species also occurs, and builds in ants' nests; Mr. Hume stating that a nest of this bird was one of the most remarkable he has ever seen. From the end of a large

mango-branch ants of some species had constructed a huge almost globular nest about thirteen inches long and eleven in diameter, involving, as these nests commonly do, all the leaves and twigs springing from that part of the branch. The nest is a grey brown mass of a half felt-like half papier-mâché-like substance, into which the woodpecker had bored a circular entrance about two inches in diameter, and inside it he had scooped out a circular cavity some five inches in diameter.

Ivory-billed Woodpeckers. With this genus we come to the second division of the more typical representatives of the family, which may be known as narrow-necked woodpeckers; the narrowing of the neck by which they are distinguished causing the head to appear disproportionately large. Common to both hemispheres, one genus of the group occurs in Celebes, and is thus the most eastern representative of the entire family. The group likewise includes the largest members of the assemblage, the great grey Malayan woodpecker (*Hemilophus pulverulentus*) being upwards of 18 inches in length. The ivory-billed woodpecker (*Campophilus principalis*), which is the typical representative of the genus under consideration, is now only met with in the coast country of Florida and the Gulf States of North America, although some half century ago it had a much more extended range, reaching to parts of the Southern and Central States. It appears always to have been a very shy bird, so shy, indeed, that Audubon relates that he once found a nearly completed nest, which was deserted by the birds when they perceived that their breeding-home was discovered.

Great Black Woodpecker. Although the generic term *Picus* was taken by Linnæus to include the whole of the members of the family, it is now restricted to the great black woodpecker (*P. martius*) represented in the Plate at the commencement of our notice of the family. The largest of the European woodpeckers, this species is a member of the narrow-necked group, but the plumage on the neck is denser than in any of its allies, probably on account of its inhabiting a more northern area and higher altitudes than any other member of the section. It has the third toe longer than the fourth, and further has the tarso-metatarsus clothed with feathers, indicating a woodpecker of a cold climate. It is a large species, measuring 17 inches in length, entirely black, with the top of the head and crest crimson in the male, the red in the female being confined to a triangular patch on the occiput. The species inhabits the pine-forests of Europe and Siberia, and occurs in Northern China and the north island of Japan. It has often been chronicled as a British bird, but no reliable evidence of its capture exists, and, as Mr. Seebohm well observes, "there is no bird less addicted to migration than the present species, and it is a bird of too powerful flight to be driven from its native pine-forests even by the heaviest gales."

The Piculets. While the whole of the preceding members of the family may be included in one subfamily, those remaining for consideration form a second. Diminutive in size, the piculets have the beak and the ways of a woodpecker, but they have a soft tail like the wrynecks, and not a spiny one like the majority of the family. Little is known about them beyond the fact that there are four genera, with a geographical distribution which is one of the most curious of any birds in the world. Two of these genera, *Picumnus* and *Nesoctites*, have the

face feathered, and are chiefly represented in the New World, the last-named genus being peculiar to the island of San Domingo. *Verreauxia* and *Sasia*, the other two genera of piculets, are Old World forms, the former being an inhabitant of the forest-district of West Africa, and the latter of the Indian region. The largest of the piculets does not exceed 5 inches in length, and many of them are not more than 3 inches.

Green Piculets. Until recently these tiny woodpeckers (*Picumnus*) were supposed to be peculiar to South America, which contains no less than thirty-two species, but in certain parts of the Indian region a similar green piculet is found, together with a second species in Southern China; and Mr. Hargitt has



BRAZILIAN PICULET.

come to the conclusion that these Oriental birds are absolutely of the same form as the South American ones; the resemblance being carried even to the pattern of the tail, which is peculiar among birds; not only are the centre feathers half white, but the outer feathers are also for the most part white, and these characteristic markings run through the whole of the species, be they American or Oriental. Of the American species, although so numerous, scarcely any details of habits have been published, except that they seem to act the parts of tiny woodpeckers; but of the Indian species (*P. innominatus*) a little more is known. Inhabitants of the Himalaya and the adjacent ranges, reoccurring in the the Wynaad, and extending down the high mountains of the Burmese Provinces, the Malayan Peninsula, Sumatra, and Northern Borneo, these piculets nest in holes which they excavate themselves, laying as many as seven eggs, as Mr. Thomson says that he

has seen as many young ones constituting a family and flying about with their parents. Mr. Gammie has found the species nesting in Sikhim, in decaying stumps of small trees, about three feet from the ground, in holes bored by the birds themselves, the entrance being only about an inch in diameter. The hole was three and a half inches deep, and little more than an inch wide all the way; and as with other woodpeckers there were no nesting materials.

Rufous Piculets. The rufous piculets (*Sasia*) differ from the preceding genus in having the sides of the face around the eye bare. They have only three toes, the first being absent. In the Himalayan species (*S. ochracea*) the general colour is rufous-olive above, rufous below; the forehead is golden-yellow in the male, rufous in the female, with a white stripe above the eye. In Tenasserim Mr. Davison found it frequenting moderately open country, especially where bamboos flourished. "It keeps to the undergrowth and secondary scrub and bamboo-jungle, working about the fallen logs. It is wonderful what a loud sound one of these little fellows can produce when tapping a bamboo. I have more than once thought that it must have been some large woodpecker, and was astonished when I could not see it, and when at last I did discover the tiny object I felt quite as much surprised at the sound it was able to produce as it was by my sudden advent. It is very fond of knocking about in low brushwood. I do not know its call, nor do I think that I ever heard one. It is usually alone, but sometimes pairs are met with." Mr. Hume has received a piece of bamboo, selected by the bird for its nesting-place, which was only two and a half inches in diameter. It was a dry bamboo, and into this, at a height of about three feet from the ground and six inches above the joint, the bird had drilled a small circular hole. Interiorly it had grooved with its little bill the whole inner aspect of the lower surface of the compartment, and the little, long fibrous strips thus obtained were collected at the bottom to form a bed for the eggs.

The Wrynecks.

Family *Iyngidæ*.

Of this family only four species are known, one enjoying a wide range in Europe and Asia, while the other three are confined to Africa south of the Sahara; these being *Iynx pectoralis*, inhabiting the eastern districts of the Cape Colony, Natal, and the Eastern Transvaal, and extending to the Lower Congo district in West Africa; *I. pulchricollis* is known from Eastern Equatorial Africa, where it was discovered by Emin Pasha; and *I. æquatorialis*, inhabiting the southern provinces of Abyssinia and Shoa. The wrynecks may be termed soft-tailed woodpeckers; and have the tail rather long, and not spiny; while the nostrils are not concealed by bristles, but partially hidden by a membrane. Their plumage is very remarkable, the whole of the upper-surface being mottled or vermiculated, as it is called, with a crowd of little wavy black lines. The English species is also known as the snake-bird, because of the curious way in which it twists and turns its head about, and elongates its neck, hissing all the way most vigorously, and spreading out the feathers of its head. It has an extensile tongue, like that of the wood-

peckers, but even longer than is usual in that family, and the way in which it darts its tongue out rapidly, completes the resemblance of the head to that of a snake, and has doubtless had something to do with its sobriquet of snake-bird. The common wryneck (*I. torquilla*) is a summer visitor to Europe and Northern Asia; in many parts of Great Britain being known, besides its name of snake-bird, as the cuckoo's-mate, since it generally arrives a little before that bird, and is supposed to be a harbinger of the cuckoo's arrival in the spring. It is also called in some parts of England the pee-pee, doubtless from its curious note, which resembles the words *pee-pee-pee* uttered in a somewhat shrill voice. In summer the wryneck is found over the greater part of Europe and Asia, extending even to Japan; its northern range being about 62° north latitude. Both the Indian and the Japanese birds have been considered to be distinct, but Mr. Hargitt recognises but one form. The Asiatic birds which breed in the countries north of the Himalaya, and even in Kashmir, winter in the Indian Peninsula, and the Japanese birds in China and the Burmese countries. The European wrynecks appear to winter in Northern Africa and extend to Abyssinia, and on the west coast to Senegambia. The wryneck does not climb trees like a woodpecker, though it clings to the trunk of a tree in pursuit of its insect-food. It feeds largely on ants, and is often seen on the ground in pursuit of its prey; and, unlike the woodpecker, it does not bore a nest-hole, but selects one in a tree, generally a decayed fruit-tree, as it is fond of frequenting orchards. The eggs are sometimes as many as ten in number, but the average number is seven or eight. They are white like those of a woodpecker, but not quite so glossy.



WRYNECK.

The Honey-Guides.

Family *Indicatoridæ*.

Long classified with the cuckoos, which they resemble in the structure of their feet, while they are also believed to lay their eggs in the nests of other birds, the honey-guides are now recognised as a distinct group. In place of selecting totally different birds, the honey-guides appear to choose for victims their own nearest kindred, such as the barbets and woodpeckers; the little honey-guide depositing its white eggs into the nests of the red-vented woodpecker, the little tinker-barbet, or the pied barbet, while the large white-backed honey-guide selects the banded barbet as its victim. In structure the honey-guides are now admitted to be akin to woodpeckers and barbets, having many characters in common with both those groups.

especially as regards the zygodactyle foot. The oil-gland is tufted, and there are no blind appendages (cæca) to the intestine. The honey-guides are principally African, no less than ten species out of twelve being found in the Ethiopian region. In the Himalaya, however, the yellow-backed honey-guide is a resident, and in the mountains of the Malay Peninsula and in Borneo occurs the most eastern representative of the genus, the Malayan honey-guide.

Two genera only are known, the true honey-guides (*Indicator*) and the dwarf honey-guides (*Prodoriscus*). The latter genus contains two species, one from South-Eastern, the other from Western and Equatorial Africa, both of them



WHITE-EARED HONEY-GUIDE (½ nat. size).

having only ten tail-feathers instead of twelve, like the rest of the honey-guides. Sir John Kirk states that "the honey-guide is found in forests, and often far from water, even during the dry season. On observing a man, it comes fluttering from branch to branch in the neighbouring trees, calling attention. On being followed, it goes further; and so it will guide the way to a nest of bees. When this is reached, it flies about, but no longer guides; and then some knowledge is needed to discover the nest, even when pointed out by the bird to within a few trees. I have known a honey-guide, if a man, after taking the direction for a little, then turns away, to come back and offer to point out another nest in a different part. But if it does not know of two nests it will remain behind. The difficulty is that it will point to tame bees in a bark hive as readily as to those in the

forests. This is natural, as the bee is the same; the bark-hive, Musinga, as it is named, being simply fastened up to a tree, and left for the bees to come to. The object the bird has in view is clearly the young bees. It will guide to nests having no honey, and seems equally delighted if the comb containing the grubs be torn out, when it is seen pecking at it." The little honey-guide (*I. minor*) is only 6 inches in length. It is said to be of no repute as an honey-guide, but it catches bees like a flycatcher. The white-eared honey-guide (*I. sparmanni*), is one of the larger members of the genus, about 8 inches in length, of an ashy brown colour above, whitish below, with a brownish shade on the throat. The three outer tail-feathers have their bases white, and there is also some white on the lower back and upper tail-coverts; on the shoulder is a yellow band, formed by some of the lesser wing-coverts. This species is found over the greater part of Africa, from the Eastern Cape Colony to the Transvaal, and thence throughout Eastern Africa to Abyssinia, and again occurring in Senegambia, so that it is an inhabitant of the open portions of the continent, but does not occur in the forest-regions of the West Coast. It is a favourite with the natives, who do not like to see one killed. Mr. Buckley, during his journey to Matabililand, says "that the birds were extremely pertinacious in following us, in order to conduct us to a bee's nest, chattering incessantly until they gained their point."

The Barbets.

Family *CAPITONIDÆ*.

This family occupies an intermediate position between the woodpeckers and the toucans; in many of their ways these birds being like the former, while some of their number bear a remarkable resemblance to the toucans. In structure they also have many points in common with these two families, the peculiar zygodactyle foot being exactly like that of the woodpeckers and the other allied families. The barbets have a tufted oil-gland, no blind appendages to the intestine, and possess ten tail-feathers. They have little in common with the puff-birds, which are also called barbets in many works on natural history. The barbets are found in the tropical portions of both the Old and New Worlds, the latter being peculiar to Central and South America. From Brazil and Bolivia up to Costa Rica the American barbets range, but no species has yet been found in Guatemala or in Mexico. In most of the Old World barbets the bill is toothed or ridged, but in the American genus (*Capito*) the bill is smooth, not toothed, and has the ridge rounded. In South America also occurs the singular genus *Tetragonops*, wherein the bill is four-sided and the lower mandible widened at its tip, so as to form a sort of cradle in which the end of the upper mandible rests. Two species of the genus are known, one from Costa Rica (*T. frantzii*) and the other from Ecuador, the latter being a brightly-coloured bird, named *T. rhamphastinus*, from the similarity of its colours to that of a toucan. Barbets are found in the tropical portions of Africa and Asia, but do not extend beyond the Malaysian Islands. Of the seventeen genera recorded from the Old World, Africa claims ten and the Indian region the other seven.

Tooth-billed Barbets.

These birds (*Pogonorhynchus*) are distinguished by the presence of one or more distinct notches or teeth in the edge of the bill, and in some of the species there are deep grooves or ridges, similar to those which occur in some of the hornbills; while there is a sort of beard of coarse bristles on the chin in the red barbet of West Africa (*P. dubius*).

The genus *Melanobucco*, also one of the group of tooth-billed barbets, has thirteen species distributed over various districts of Africa. They are described as frequenting the neighbourhood of woods and bush-country, feeding on fruits



CRIMSON-BREASTED BARBET (⅔ nat. size).—After Keulemans.

and berries, seeds and insects, and nesting in holes of trees, but not making the holes themselves. The black-collared barbet (*M. torquatus*) is said by Mr. Ayres to have a particularly loud note, of which the syllables *kook karco*, repeated eight or ten times, would give a good idea. Frequently both male and female call at the same time, and, when perched close together, keep up a quick succession of bows to each other, bowing at the repetition of each note. Of the pied barbet (*M. leucomelas*), Mr. Andersson says that in Damaraland it is found singly or in pairs, and is remarkable for its clear-ringing and far-sounding notes, which, heard at all hours of the day, are most frequent in the early morning. Its food consists chiefly of fruit

and seeds, but it will to some extent accommodate itself as regards food to the produce of the locality in which it happens to be located. It is rather a lively bird, and sometimes suspends itself below the fruit on which it is feeding, and makes its repast while hanging in that position. Mr. Layard designates the note of this bird as of three syllables, *poo-poo-poop*, resembling those of the coppersmith of India.

Tinker-Barbets. There are thirteen of these tiny birds (*Barbatula*), the largest of which is only 6 inches in length, while the majority of the species scarcely exceed 3 inches. They are all inhabitants of tropical Africa, occurring everywhere from Senegambia and Abyssinia south to the Cape Colony. Of the little tinker-barbet of Natal (*B. pusilla*) Mr. Ayres writes that "the note of this curious little bird so much resembles the tapping of a hammer on an anvil (having that peculiar metallic ring) that it is called in Natal the tinker-bird. It is silent during the winter months, commencing its monotonous cry in the spring, and continuing it throughout the summer. The colour of the tinker-birds is black, streaked or spotted with yellow; the forehead being red or yellow. In some of them there is a white or yellow eyebrow, and a band of red or yellow across the rump.

Brown Barbet. Like the preceding, this barbet (*Calorhamphus hayi*) is a member of the smooth-billed section of the family. It ranges from Southern Tenasserim through the Malay Peninsula to Sumatra, and is remarkable for its sombre plumage, being dark brown, washed with olive-yellow on the upper-parts and yellowish white below, with the throat tinted with red. The bill is black in the male, and reddish or ochre-brown in the female. The length of the bird is about 6½ inches. In Borneo a second species occurs with a brighter and more brick-red throat (*C. fuliginosus*).

Great Barbets. This genus (*Megalæma*) contains only two species, which are the largest of the whole family, measuring over a foot in length; one (*M. marshallorum*) inhabiting the Himalaya, while the other (*M. virens*) extends from Burma to Southern China. The colour is green, with a brownish mantle, and the hind-neck streaked with yellow; the head is blue, as is also the under surface, except on the sides of the body, which are green, and the fore-neck, which is dark brown marked with greenish blue; the bill is pale yellow. The Himalayan species is a well-known feature of the hill-country, where its curious wailing cry is often heard, especially in all the warmer and well-wooded valleys. According to Mr. Thompson, the hillmen have a story that a person who suffered unjustly from law-suits, and who died in consequence, was changed into this bird, whose cry is, *un-nee ow, un-nee ow*, meaning, "Injustice, injustice." This species and its Burmese ally both appear to make their own nest-holes, which they drill into a tree like a woodpecker; many of the barbets laying their eggs in holes on the under side of a branch. All the larger green barbets of the genera *Cyanops* and *Chotorhea* also hollow out their own nest-holes, and Colonel Legge says that, in the case of the Ceylonese barbet the same nest-hole is not used twice; "but, having found a tree with wood suited to its work, it perforates it each year for the new nest, as many as eight or ten holes being sometimes visible in a tree by a jungle roadside. It is only when sounding wood before making its nest that these birds

tap with their bills, the blows being very slowly repeated, with perhaps an interval of ten seconds between each." Colonel Legge also states that there are generally a few bents and grass-stalks collected for the eggs to lie on, but they are scarcely worthy of the name of nest. Mr Hume once discovered in the nest-hole made by a blue-faced barbet a large pad consisting almost exclusively of coarse vegetable fibre, apparently strips of the bark of some herbaceous plant, but a few pieces of grass, a piece of red wool, and one or two other similar miscellaneous scraps intermingled in the pad.

Crimson-Headed Barbet.

Like the African barbets, which are called tinker-birds, the crimson-headed barbet (*Xantholæma hæmatocephala*) gets its name of coppersmith from its metallic note, which much resembles the clinking of metal when struck by a hammer; this note being heard at all times of the day, and given out with monotonous regularity. The writer heard one of these birds at Ajmir, and on creeping up beneath the tree in which it was sitting, found it perched cross-wise on a branch, like a Passerine, and uttering its note at regular intervals, accompanying each utterance with a jerk of the head, first to the right and then to the left. The coppersmith is one of the smaller barbets, measuring about half a foot in length. It is green in colour above, pale yellow below, with green streaks on the flanks. The head is variegated in colour, the forehead being scarlet, with a black band across the crown extending to the sides of the face, which are ornamented with a yellow streak above and below the eye. The throat is bright yellow, with a scarlet band across the fore-neck. The nesting-hole is generally fixed upon by this species in the under side of a hollow bough, and sometimes the eggs are placed at a distance of four or five feet from the original entrance. Jerdon narrates an instance where a pair of these little birds had thus perforated a beam in his vinery, and when they had lengthened the cavity year by year to about five feet they made a second entrance, also from below, about two and a half feet from the nest. This practice of making additional holes for entrance and exit near the nest seems to be adopted by the birds in a wild state also.

The Toucans.

Family *Rhamphastidæ*.

Gaudy in plumage, and ungainly in appearance, these large-billed birds are denizens of the tropical forests of Central and South America, also extending to those of Northern Mexico, almost within sight of the Rio Grande. Resembling the woodpeckers and barbets in the internal structure of their zygodactyle feet, they differ in having the front end of the vomer truncated in the Passerine manner. For the size of its owner the bill among the toucans is of enormous dimensions, giving to these birds an almost ludicrous look. If solid, the appendage would be far too heavy to carry; but in reality it is extremely light, being very thin, and the interior occupied by a fine network of bony fibres, arranged so as to give great strength to the external parietes, without weight. The tongue of these birds is likewise peculiar, the anterior portion consisting of a bony, narrow, thin plate, flattened horizontally, and supported by a process of the tongue-

bone, which forms a ridge beneath it. Measuring nearly 6 inches in length in the larger species, at about 4 inches from its extremity it is obliquely notched on both sides; these notches becoming deeper and deeper towards the apex, thus giving it a brisly appearance. Resembling the barbets in having a tufted oil-gland, the toucans also agree with these birds in the presence of ten feathers to the tail. The beak is generally highly coloured; while frequently the bare face partakes of the same brilliant hues. When asleep, toucans have a curious way of



THE TOCO TOUCAN (½ nat. size).

carrying the tail, which is turned up over the back, while the enormous beak is buried beneath the scapular feathers. According to Dr. Sclater's arrangement, toucans may be divided into five genera; namely, *Rhamphastus* with fourteen, *Andigena* with six, *Pteroglossus* with eighteen, *Selenidera* with seven, and *Aulacorhamphus* with fourteen species; the number of toucans now known thus being fifty-nine. According to the account of Prince Maxmilian, "these birds are very common in all parts of the extensive forests of the Brazils, and are killed in great numbers at the cooler portion of the year, for the purposes of the table. To the stranger they are of even greater interest than

to the natives, from their remarkable form, and from the rich and strongly-contrasted style of their colouring, their black and green bodies being adorned with markings of the most brilliant hues — red, orange, blue, and white; the naked parts of the body being dyed with brilliant colours; the legs blue or green; the irides blue, yellow, etc.; and the large bill of a different colour in every species, and in many instances very gaily marked. In their habits the toucans offer



BLACK-THROATED ARACARI TOUCAN (⅔ nat. size).

some resemblance to the crows, and especially to the magpies; like them they are very troublesome to the birds of prey, particularly to the owls, whom they surround and annoy by making a great noise, all the while jerking their tails upwards and downwards. The flight of these birds is easy and graceful, and they sweep with facility over the loftiest trees of their native forests, their strongly-developed bills, contrary to expectation, being no encumbrance to them. The voice of the toucans is short and unmelodious, and somewhat different in every species."

Toco Toucan. The general colour of this bird (*Rhamphastus tcyo*) is black, with a broad white band across the rump; the under surface of the body is also black, with the vent crimson; the throat is white, fading into yellow on the neck, and followed by a crimson band on the fore-neck. The length is nearly 2 feet, and the bill is nearly 6½ inches long. It has a very wide distribution in South America, being found from Guiana to the Lower Amazon, and extending through Brazil and Bolivia to Argentina. Mr. White met with it near Oran, frequenting the high forest trees in large flocks.

Aracari Toucans. Of the smaller-billed toucans, some of the best known are the so-called aracaris (*Pteroglossus*); and an incident recorded by Mr. Stolzmann, during his travels in Peru, shows how difficult these birds are to see in their forest surroundings, his experience being very similar to that of Bates with the curl-crested toucan (*P. beauharnasi*) on the Amazon. Stolzmann says that when procuring a pair of the yellow-billed aracari (*P. flavirostris*), or yurimaguas, he fired in a high tree at a bird, which uttered some piercing cries as it fell, and in a moment he was surrounded by ten of the birds, keeping up a fearful din. On a second shot being fired, they all disappeared. This circumstance proves, as he says, that although only one individual can be seen, it does not follow that there are no more in the neighbourhood, as they are, in fact, always in little troops, according to the general habit of toucans in Peru.

R. BOWDLER SHARPE.



LESSER SPOTTED WOODPECKER.

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