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486

THE
CABINET
OF
NATURAL HISTORY.

CONDUCTED BY THE
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M.R.I.A. F.R.A.S. F.L.S. F.Z.S. Hon. F.C.P.S. &c. &c.

ASSISTED BY
EMINENT SCIENTIFIC MEN.

ON
THE HABITS AND INSTINCTS
OF
ANIMALS.

BY
WILLIAM SWAINSON, A.C.G. F.R.S. & L.S.
HON. F.C.P.S. ETC., AND OF SEVERAL FOREIGN SOCIETIES.

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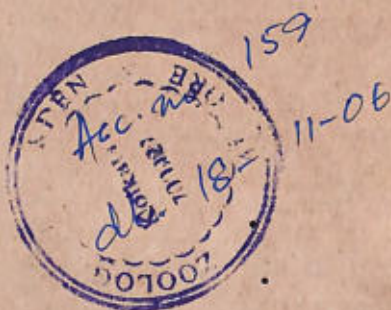
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of the young which are hatched from the other — was considered incredible, when first announced as a fact by this well-known traveller; but subsequent observations have, in this instance, and in many others, only proved his veracity. The number of eggs which the ostrich usually sits upon is ten. But the Hottentots, who are very fond of them, upon discovering a nest, seize fitting opportunities to remove one or two at a time: this induces the bird to deposit more; and in this manner she has been known, like the domestic hen, to lay between forty and fifty in a season. The pelican is stated to preserve her eggs from injury, by hiding them in the water until the fancied danger is removed.* The razorbill fixes hers on the smooth rock, with so exact a balance, that, if removed, and afterwards attempted to

be replaced, it is difficult, if not impossible, to adjust it safe in the same position.† Le Vaillant remarks, that the African *Anhinga* (fig. 2.), or darter, which is a completely aquatic bird, neverthe-



less builds its nest and rears its young on rocks and trees; yet the former is so constructed, that, at any moment of pressing danger, when the young are once able to swim, the mother can plunge them into the water beneath.‡

(20.) The expedients by which birds provide their food is often equally sagacious; none, however, show a more wonderful instinct in effecting this purpose, than those of the genus *Indicator*, or honey-guide. Dr. Sparman, the African traveller and naturalist, was the first who made this singular statement. He says, that, when

* Clark's Travels.

† Pen. Brit. Zool. vol. ii. p. 510.

‡ Le Vaillant's Travels in Africa, vol. iii. p. 184.

this bird discovers a nest of honey, it flies eagerly to the first person it can find, and by its chirping and fluttering invites him to follow, — faithfully leading him to the spot, watching whilst he takes possession of the treasure, and patiently waiting for that portion which is always left by the African hunters as a reward to their feathered guide.

(21.) The address which the secretary eagle evinces in fighting with a serpent, has been thus described by an eye-witness: — “The battle was obstinate, and conducted with equal address on both sides. But the serpent, — feeling the inferiority of his strength, — in his attempt to flee and regain his hole, employed that cunning which is ascribed to him; while the bird, guessing his design, suddenly stopped him and cut off his retreat, by placing herself before him at a single leap. On whatever side the reptile endeavoured to make his escape, his enemy was still found before him. Then, uniting at once bravery and cunning, he erected himself boldly to intimidate the bird; and, hissing dreadfully, displayed his menacing throat, inflamed eyes, and a head swelled with rage and venom (*fig. 3.*). Some-



times this threatening appearance produced a momentary suspension of hostilities; but the bird soon returned to the charge, and, covering her body with one of her

wings, as a buckler, struck her enemy with the horny protuberances upon the other, which, like little clubs, served the more effectually to knock him down as he raised himself to the blow: at last he staggered and fell: the conqueror then despatched him, and with one stroke of her bill laid open his skull."*

(22.) The instinct of the nestling cuckoo is not more remarkable than that of the parent. The Euro-



pean species (*fig. 4.*), as is well observed by White of Selborne, does not lay its eggs in other birds' nests indiscriminately, but, by a wonderful instinct, selects only those of soft-billed insectivorous birds, — such as the wagtails, hedge-sparrow, titlark, whitethroat, and red-breast, — to whom it can intrust the proper feeding of its progeny. The North American cuckoos, however,

being of a different species, more frequently lay their eggs in the nests of the cowpen birds (*Molothrus pecoris* Sw.), whose bills, from being larger and thicker than those of a sparrow, might lead to the belief that they fed their young upon that grain which the old birds are known to be fond of. It seems, however, that although this species, in their adult state, are granivorous, yet that they are also insectivorous, and feed their young with this latter aliment rather than with the former. Hence it is that the young cuckoo is still nourished with insects until it can fly, when it quits the nest and shifts for itself.

(23.) QUADRUPEDS claim our next attention. It is in this class, more than in any other, we find that kind of superior instinct formerly alluded to, which makes them not only the companion, but the friend, of man.

* Le Vaillant's Second Travels, vol. ii. p. 247.

The elephant, the horse, and more particularly the dog, afford familiar illustrations of that attachment towards mankind, implanted in their nature by Omnipotence, but withheld from nearly all other animals. The skill and ingenuity of quadrupeds are, in many instances, very great, particularly in some of the smaller kinds. The jerboa, the beaver, and the harvest mouse, are both architects and weavers; and the habitation of the latter ingenious little creature, according to White, is most artificially platted, being composed of the blades of wheat, perfectly round, and with the aperture closed in the nicest manner; the one he examined was "so compact and well fitted, that it would roll across the table without being discomposed, though it contained eight little mice that were naked and blind."*

(24.) The manner in which other quadrupeds preserve, and others obtain, their food, is indicative of this faculty. The fox, when possessed of a larger booty than it can at once consume, never allows itself to gratify its appetite, until it has secured the whole of its prize, by placing it in different holes, which it digs for the purpose, and which it endeavours to conceal by placing upon them a quantity of loose earth.† Some of the *Glîres*, or mice, provide a winter store of food; but, to prevent its premature decay, the animal will bring out his provisions, and spread them in the sun to dry. The Alpine hare is stated to cut down quantities of soft grass, and, after spreading it out for some time, collect it into heaps, which are then placed beneath overhanging rocks, in fissures, or under sheltering trees; and these winter magazines are visited so regularly, that they may be discovered by the beaten path of the animal over the snow. It has been related,—but we very much doubt the fact,—that the jaguar of America will stand in the water, out of the immediate course of the stream, and drop its saliva on the surface, so that it may draw the fish after it within its reach.‡ On the

* White's Selborne, vol. i. p. 59.

† Wood's Zool. vol. i. p. 45.

‡ Pen. Brit. Zool. vol. ii. p. 510.

other hand, it has been credibly stated that otters, when fishing, will so station themselves, as that one is above, and the other below, where the fish are most abundant; sometimes whistling, as a signal to each other, and persevering in the chase until the prey is obtained. * Something of this sort has been stated regarding the orang-outang, which has been affirmed to frequent the sea-coasts in search of shellfish; and having obtained one particular species of oyster, which is generally found upon the beach, instead of inserting its paw, which might be immediately crushed by the collapsing shell, it thrusts in a large stone, and then draws out its prey at pleasure. To this instance of instinct, however, we must withhold our belief: it is not only too rational, but there is nothing yet known, to make us believe that this quadruped feeds, in a state of nature, upon animal food.

(25.) The instinct which leads, as it has been alleged, certain animals to search for particular medicinal herbs, has been very generally believed, or, at least, propagated by the writers of popular and elementary Natural Histories; but we are somewhat sceptical in believing this alleged fact, notwithstanding the following statement by an author whose general accuracy there is no reason to doubt:—Ichneumons, observes captain Williamson, which are very numerous in India, are the natural enemies of serpents, which they attack without fear of their bulk or venom. They are remarkably quick in their motions, and by their activity and perseverance so worry a snake, that they generally become the conquerors. They are, however, sometimes bitten; but on such occasions "they hunt about among the common grass, and there find some antidote, of which having eaten, and rubbed themselves with by rolling on the spot, they return to the charge; never failing to scent the snake's course perfectly correct. It is a thousand pities," concludes our author, "that the antidote resorted to by these animals has never been ascer-

* Pen. Brit. Zool.

tained." This might be easily accomplished by any one killing an individual immediately after it has been fully ascertained to have resorted to this mode of cure, after having been injured by the serpent with which it may have fought.

(26.) The instinct of the black American bear, in procuring the acorns and chestnuts from the branches of particular trees, is worthy attention. To procure these fruits in greater quantities, the animal ascends the tree; and as his weight will not allow of his going far from the trunk, he breaks the branch on which he has observed the most fruit, by grasping it in one of his fore paws. "I have seen some of these branches," observes Michaux*, "of such a diameter, that the animal must have possessed an extraordinary strength to break them so effectually as to fall upon the ground." Another singular and almost incredible instance of adapting means to an end is mentioned by Plutarch, who writes: "When I saw a dog in a ship — the sailors not being present — dropping small stones into the oil which was in a jar but partly full, I was astonished at his conceiving and understanding the overflow which takes place when heavy bodies sink in the lighter."†

(27.) The contrivance of the elephant to raise himself from the bottom of a pit is conducted on the same principle as that pursued by Plutarch's dog. When the natives have discovered his capture, he is retained in the pit until they judge he is sufficiently tractable to be conducted forth. Large bundles of jungle grass are then thrown to him; and he is thus gradually raised to the surface, or, at least, to such an elevation as will enable him to step out. The sagacity of elephants on such occasions, or when bogged in swamps, is truly admirable. The cylindrical form of an elephant's leg — which is nearly of equal thickness — causes the animal to sink very deep in heavy ground, especially in the muddy banks of small rivers. When thus situated,

* Travels, p. 318.

† De Solert. Animalium, Opp. t. ii, p. 267, ed. Lut. Par. 1624. Shepp. Ant. Dr. 171.

the animal will endeavour to lie on his side, so as to avoid sinking deeper ; and, for this purpose, will avail himself of every means to obtain relief. The usual mode of extricating him is much the same as when pitted ; that is, by supplying him liberally with straw, boughs, grass, &c. : these materials being thrown to the distressed animal, he forces them down with his trunk, till they are lodged under his fore feet in sufficient quantity to resist his pressure. Having thus formed a sufficient basis for exertion, the sagacious animal next proceeds to thrust other bundles under his belly, and as far back under his flanks as he can reach : when such a basis is formed, as may be, in his mind, proper to proceed upon, he throws his whole weight forward, and gets his hind feet gradually upon the straw, &c. Being once confirmed on a solid footing, he will next place the succeeding bundles before him, pressing them well with his trunk, so as to form a causeway by which to reach the firm ground. The instinct of the animal, and probably the experience of his past danger, actuates him not to bear any weight, definitely, until, by trial both with his trunk and the next foot that is to be planted, he has completely satisfied himself of the firmness of the ground he is to tread upon. Indeed, the caution with which this, and every part of his conduct on these occasions, is marked, evinces how forcibly nature has impressed him with a sense of his great weight. The anxiety of the animal, when bemired, forms a curious contrast with the pleasure he so strongly evinces on arriving at *terra firma*.

(28.) In their various modes of defence, or avoidance of their enemies, quadrupeds, like other classes of animals, frequently display wonderful instinct. The jerboa makes a burrow under ground, at the end of which a store of herbs is safely deposited. The cavern has but one entrance ; but the wary inhabitant forms another, which reaches so nearly to the surface, that, in case of being taken by surprise, it can immediately burst through and escape. The chamois, and several other species of

antelopes, ill provided with defensive means, uniformly employ a sentinel, which, by a sharp hiss, advertises the herd of the approach of danger,—when all fly off with the greatest rapidity. The same habit is attributed to the wild horses of South America and Tartary. Several of the Brazilian monkeys have likewise a similar guard during the hours of repose; but whether Smellie* is correct in stating that, if they find their sentry has neglected his duty, they fall on and tear him to pieces, we had no means of discovering. It is interesting to observe the manner in which instinct will sometimes overcome a difficulty which might even puzzle a reasonable creature. It has been stated that, if two mountain goats encounter each other upon a narrow ledge of rocks, where to pass or to turn is utterly impossible, one will immediately lie down, while the other steps over its back. Nor is it less singular to remark the mode by which animals in similar situations communicate their wants and their distresses. An anecdote of this nature is told of a number of sheep, who surrounded a cow, as if they wished to bespeak her favour for a poor gravid ewe, which was unable to recover herself from her miserable situation, until the cow, advancing towards her, placed the tip of her horns beneath her side, and gave her a slight but dextrous toss, which instantly replaced the sufferer upon her feet. We must place this, however, among the questionable list of stories handed down of animal instinct.†

(29.) But the most astonishing development of instinct—at least, among quadrupeds—will be found in the following account of the decoy elephants of India, the fidelity of which may be fully depended upon, as the facts are well known to almost every one who has resided any time in India:—“The females selected for this extraordinary undertaking are always those uniting the qualities of great docility and affection to their drivers with a full-grown stature; for, without this

* Smellie, Phil. of Nat. Hist. vol. i. p. 409.

† Griff. Cuv. vol. iv. p. 37.

latter qualification, the animal cannot conceal her driver from the sight of the intended victim of her allurements, or, in the event of his being discovered, afford him protection. A particular time, however, is requisite for these operations; this is, during the rutting season, when the weaker males, having been driven away from their former herds by those of greater strength and courage, are wandering about singly in the woods, uttering 'disconsolate trumpeting,' the cause of which is well known to the experienced hunter. These bachelor elephants are called *sauns*; and, being considered very valuable, are especially selected for enticing. It is generally thought best to employ three females, called *koomkies*, in the capture of one *saun*, or wild male. Each of these is attended by a driver, or *mohout*, who is provided with a black blanket, and a small quantity of strong rope: the former is used to cover the driver, who crouches in such a manner as not to be easily distinguished from the female he rides upon. She, also, aids in this deception; for, if the situation is favourable, both she and her driver furnish themselves with green boughs, which the former carries in her trunk, playing with it in such a manner as to favour the concealment of the latter. When the party thus approach the male, it is usual for the drivers to dismount in some contiguous cover with their blankets and ropes, leading the females to the *saun*, towards which they proceed with the utmost caution. A most extraordinary scene then follows. The *koomkies* begin to caress their intended victim, as if with the utmost tenderness and affection; thus inflaming his passions to such a degree, as to blind him to what is going on. During this courtship, however, the females contrive to place themselves in such a manner as to favour the approach of their keepers, who, watching their opportunities, pass the ropes with wonderful dexterity round the fore legs of the infatuated lover, who is thus speedily secured. When a large tree is at hand, the females artfully lead the male towards it, in the first instance: thus the

approach of the keeper is not only greatly facilitated, but an opportunity is given of affixing to the hind legs of the *saun* a pair of wooden clasps, armed inside with spikes: these are joined to a strong rope, which is passed round the tree and made completely fast (*fig. 5.*).



During all this process, the conduct of the females is peculiarly artful. They not only exert themselves, with astonishing address, to divert the attention of their intended victim, and to cut off his view, downwards, by means of their trunks, but they even aid in effecting the ligatures therewith,—sometimes passing the rope, when the keepers might either be exposed to danger, or unable to reach it. It may be observed, that the spikes within the clasps above mentioned are so small, as only to inflict pain when the animal, finding himself captured, struggles violently to free himself from these shackles.

(30.) “Notwithstanding all these precautions, however, it sometimes happens that the enamoured male in some way discovers the presence of the keeper; in which case not even the caresses of his agreeable companions can control his violence. This is a severe trial on the fortitude and fidelity of the females, who have been known to expose themselves to the *saun's* utmost fury, while attempting to aid the escape of their keepers. If all goes well, however, so soon as the *saun* is secured, the whole party commence a retreat; since no-

thing further is requisite, after these measures have been taken, than to leave the captured elephant to expend his strength in vain efforts to regain his liberty. Awakening, as it would seem, to a full sense of the deceit that has been practised upon him, his fury becomes ungovernable: he destroys whatever may be in his way; tears up the tufts of grass by the roots; rends from the tree such branches as he can reach; and, eventually, straining to throw down the tree itself by his weight, or to pull it up with his trunk. In short, his whole powers are in action on this occasion; and it is only on being completely overcome with fatigue, and nearly dead from thirst, that he subsides into a sort of tranquillity." * We may pass over much that has been said on the preparatory measures adopted for reconciling the captive to his new situation, where he remains until he is sufficiently tamed to be led or driven to the premises occupied by the tame elephants. The same females and keepers who ensnared him are employed in this preliminary process. At first, he will only partake of water; but the impulse of nature soon operates,—and he is thus induced to pick at tender branches of plantain trees, sugar canes, &c. Thus subdued, he is taken, under charge of other elephants,—generally superior to himself in strength and bulk,—to the dwelling he is in future to occupy. Sometimes, however, when he is on his way, or, perhaps, on his legs being liberated, he will make a last and desperate effort to regain his liberty. When this happens, the conducting elephants, extending to the length of their tow ropes, urge forward as fast as may be practicable, while one or more sturdy males goad him behind with their tusks. This latter circumstance is not the least extraordinary part of the narrative;—for animals to be driven into confinement by those of their own species is unexampled, we believe, except in the case of the elephant.

(31.) Out of the many other curious anecdotes which

* Williamson's Indian Sports.

have been given of the sagacity of quadrupeds, we shall only add one more, which, as recorded of an animal considered as proverbially stupid, is proportionably singular. An ass, belonging to captain Dundas, R. N., was shipped on board a frigate proceeding from Gibraltar to the island of Malta. The vessel struck on some sands off the Point de Gat, and the poor ass was thrown overboard, the sea at the time running so high, that a boat which tried to reach the shore was lost. A few days after, however, this identical ass presented itself at the gates of Gibraltar, and hastened to the stable which it had formerly occupied. The fact was, that the poor animal had not only escaped safely from the waves, but actually travelled a distance of 200 miles through an intricate country, in a space of time which could not allow of his having even mistaken his road.*

(32.) A most singular instance of the instinct of a cat for discovering its home is too remarkable to be omitted, particularly as it occurred under our own observation. This cat was an excellent mouser; and the house of a neighbouring friend being greatly infested with rats, it was agreed that the animal should take up its residence for a time in his house, that it might be cleared, in some degree, of these troublesome pests. Pussy, however, had then a kitten about two or three months old; and as we thought she was more likely to remain in her new habitation, if she had her little one as a companion, both animals were sent; and, that the mother should not discover her way back, both were tied up in a sack, and in that state conveyed to our friend's house, a distance of near a mile and a half from Tittenhanger Green. The mother, finding herself with her kitten, and in a good hunting locality, made no effort to escape. To our utter astonishment, however, she made her appearance, next morning, at the breakfast-room door, at her usual hour! She had come—no one knew how—over fields and through coppices, as it was conjectured, early in the morning, by a route she never

* Kirby and Spence's *Introd. to Entomology*, vol. ii. p. 563.

could have traversed before, and without any other guide but — instinct. Having partaken of her usual breakfast from the hands of her young mistress, she was seen no more that day; next morning, however, she was again at her post; and these daily journeys were continued for more than a week. On mentioning this to our friend, he stated that he always missed the cat at his breakfast hour; but that, soon after, she regularly returned to her kitten, which remained quietly in the house during the morning visits her mother paid to her real home. Our cat, like all good mousers, is such a thief, that, not wishing to kill it, we have frequently tied it in a sack, and turned it loose at a considerable distance from home; but, somehow or other, she invariably finds her way, "through brake and through briar," to Tittenhanger Green, where she now is.

(33.) The instincts of insects are so singular, and yet so various, that a volume might be filled with this subject alone. A few instances, however, in this place, will be sufficient for our present purpose. The extreme perfection of instinct, unquestionably, lies in this class of animals. Kirby and Spence have well remarked, "What bird or fish, for example, catches its prey by means of nets as artfully woven, and as admirably adapted to their purpose, as any that ever fisherman or fowler fabricated? Yet such nets are constructed by the race of spiders. What beast of prey thinks of digging a pitfall in the track of the animals which serve it for food, and at the bottom of which it conceals itself, patiently waiting until some unhappy victim is precipitated down the sides of its cavern? Yet this is done by the larva or grub of the lion ants (*Ascalaphus Macleayanus* Guild., fig. 6.), and of the *Cicindela*,



or tiger beetle. Or, to omit the endless instances furnished by wasps, ants, the *Termites*, &c., what animals can be adduced, which, like the hive bee, associating in societies, build regular cities, composed of cells formed with geometrical precision, divided into dwellings adapted in capacity to different orders of the society, or storehouses for containing a supply of provisions?''*

(34.) In depositing their eggs, insects exhibit great sagacity,—always placing them in those substances, whether animal or vegetable, where the young progeny can best find nourishment. An unerring instinct leads them to select those only, which are proper for the future support of their young; while the care with which the caterpillar weaves itself a case, or burrows deep into the earth, preparatory to the change which nature ordains that it should undergo, can only be ascribed to the dictations of an impulse altogether superior and independent of the animal from whom it appears to emanate.

(35.) The nut weevil (*Curculio nucum* L., fig. 7.) is a striking exemplification of the first of these in-



stincts, or that which points out to insects the fitting place for the reception of their unborn progeny. The female, towards the beginning of August, while the nuts are yet soft and tender, carefully perforates the rind, and lodges an egg within the puncture: this operation is continued until her whole stock is exhausted; thus the maggots,

hatched from these eggs, feed upon the kernel which surrounds them; and, when the fall of the nut takes place, creep safely out of the little hole in the shell, and immediately burrows under ground, where each soon after casts its skin and becomes a chrysalis.† Again,

* Kirby and Spence's *Introd. to Entomology*.

† White's *Selborne*, vol. ii. p. 99.

there is another family of beetles, to which belongs the *Scarabæus Sacer* of Egypt (*fig. 8.*), which forms round pellets of dung, in the middle of which the female deposits her eggs; each of these is afterwards placed two and three feet deep in



the earth, where the grubs remain in safety until spring, when they dig their way to the surface. The parent insects unite their labours in rolling the balls, often to a considerable distance; and yet, arduous as is the task, they persevere till they have found a convenient spot for burying them.

(36.) The grave beetles (*Sylphidæ*, *fig. 9.*) are so called from their habit of interring the bodies of small animals, in which they afterwards deposit their eggs. Astonishing but well-authenticated accounts have been given of the sagacious industry with which these little creatures accomplish labours, which must be, to them, enormous. Among other experiments, a glass cucurbit



was half filled with earth, on which were placed four beetles and their young, and then, after being covered, it was lodged on the open ground: at the end of fifty days, the bodies of four frogs, three birds, two grasshoppers, one mole, the entrails of a fish, and part of the lungs of an ox, were buried by these indefatigable little creatures.*

(37.) The whole economy of bees, wasps, and ants, in their well-established and admirably conducted communities, presents one continued series of the most extraordinary instincts; but, as these are elsewhere described, we shall only advert to one part of the history of the last-mentioned little creatures, by which we learn

* Bingley's Animal Biography, vol. iii. p. 127.

that they have not only their menial servants, or slaves, always ready to perform their bidding, but that they have also their milch cattle, from whom they derive wholesome nourishment at pleasure. These kine are the *Aphides*, or plant lice, which, at certain seasons of the year, swarm upon the shoots of vegetables: these insects secrete a honey-like fluid, which they again eject, and which the ants can force them to yield by alternately patting their abdomen with their *antennæ*. Incredible as it may seem, there is yet reason to believe that these latter insects not only consider the *Aphides* as their property, but actually appropriate to themselves a certain number, which they inclose in a tube of earth, or other materials, near their nest, so that they may be always at hand to supply that portion of nutriment they may desire. The yellow ant pays great attention to its herds; plentifully supplying them with proper food, and tending their young with the same tenderness and assiduity which it exhibits towards its own.* Nor is it merely by these regular and uniform proceedings that insects display their sagacity; since, like some other animals, they will act under the influence of circumstances altogether novel and unforeseen, with a wisdom and an apparent intelligence, at first sight, equally curious and puzzling. On further observation, however, we find that this intelligence is *only apparent*; and that such actions, in fact, are merely the result of a *variable* or *contingent* instinct, arising from the same intuitive perception which prompts the more regular operations of animals. Intelligence, indeed, being essentially a free principle, could not be limited in its effects; and if, therefore, we were to allow any portion of it to brutes, we must cede it to them altogether; — a deduction plainly controverted by the fact, that, be the accidental appearances of rationality ever so great, animals are never raised by it to a level even with the most uncivilised human beings, who, being capable of reflection,

* Kirby and Spence's *Introd. to Entomology*, vol. ii. p. 90.

must ever hold over them an obvious and irresistible superiority.

(38.) The *Apis Muscorum* Lin., and some other species of humble bees, surmount their dwellings with a roof of moss: but M. P. Huber having placed the nest of these insects under a bell glass, and stuffed all the interstices with a linen cloth, the bees, being unable to procure their accustomed material, took the cloth; tore thread from thread; corded it, with their feet, into a felted mass; and applied it to the same purpose.* Bees close up the cells of their grubs, before the latter assume the *pupa* state. Bonnet inclosed a swarm in a flat glass hive, the form of which occasioned their cells to be less than their ordinary depth, so that, in a few days' time, he perceived, that, being too small for them to perform their usual manœuvres, holes were made in the lids, through which the grubs were projected. His curiosity was excited to see what the bees would do in this emergency; and he was greatly delighted, when he beheld them, without displacing a single grub, close the cells afresh, with lids more convex than usual, which at once gave the additional depth that was required.†

(39.) In other cases, bees have been known, after commencing their comb too near an adjoining one, apparently to discover their error, and to give the comb a gradual curvature, so as to resume the ordinary distance. But scarcely any instance of this adaptation of efforts to circumstances is more interesting than that narrated of a wasp by Dr. Darwin. Perceiving one of these insects upon his gravel walks, with a fly nearly as large as itself, he knelt down to watch its operations. To his utter amazement, he beheld it cut off the head and abdomen, and then take off its diminished load, and fly away. A breeze of wind, however, acting upon the wings of its mutilated burden, greatly impeded its progress; upon which it again alighted, deliberately sawed off first one and then the other of its encumber-

* Kirby and Spence's *Introduct. to Entomology*, vol. ii. p. 477.

† *Ibid.* vol. ii. p. 483.

ing parts, and then pursued an easy unobstructed course with the remainder.*

(40.) Under the head of instinct, we may here notice a most singular story of bees, related by Stedman. We should not have given it place, but for the general accuracy of this traveller, and from the very pointed manner in which its veracity is vouched for. It will certainly amuse the reader, if it fails to convince him that bees know those who live about their nests. "On one occasion, I was visited, at my hut, by a neighbouring gentleman, whom I conducted up my ladder; but he had no sooner entered my aerial dwelling, than he leaped down from the top to the ground, roaring like a madman with agony and pain; after which he instantly plunged his head into the river. I soon discovered the cause of his distress to be an enormous nest of wild bees, or *wassee-wassee*, in the thatch, directly above my head, as I stood within my door; when I immediately took to my heels, as he had done, and ordered the slaves to demolish them without delay. A tar mop was now brought, and the devastation just going to commence, when an old negro stepped up, and offered to receive any punishment I should decree, if ever one of these bees should sting me in person. 'Massera,' said he, 'they would have stung you long ago, had you been a stranger to them; but they being your tenants, and allowed to build upon your premises, they assuredly know both you and yours, and will never hurt either you or them.' I instantly assented to the proposition; and, tying the old black man to a tree, ordered my boy Quasco to ascend the ladder quite naked; which he did, and was not stung. I then ventured to follow; and I declare, upon my honour, that even after shaking the nest, which made its inhabitants buzz about my ears, not a single bee attempted to sting me. I next released and rewarded him for the discovery. This swarm of bees I afterwards kept unhurt as my body-guards. They have made many overseers take a desperate leap for my

* Kirby and Spence's Introd. to Entomology, vol. ii. p. 522.

amusement; as I generally sent them up my ladder upon some frivolous message, when I wished to punish them for injustice and cruelty to the negroes,—which was not seldom. The same negro assured me that on his master's estate was an ancient tree, in which had been lodged, ever since he could remember, a society of birds, and another of bees, who lived in the greatest harmony together. But should any strange birds come to disturb or feed upon the bees, they were instantly repulsed by their feathered allies; and if strange bees dared to venture near the birds' nests, the native swarm attacked the invaders, and stung them to death. He added, that his master's family had so much respect for the above association, that the tree was considered as sacred." *

(41.) Spiders evince an admirable instinct in the arrangement of their webs, and in the entrapping of their prey. One species particularly, termed by Latreille *Mygale camentaria*, closes the entrance of its retreat with a door formed of particles of earth cemented by silken fibres, and closely resembling the surrounding ground. This door, or rather valve, is united by a silken hinge to the entrance, at its upper side, and is so balanced, that, when pushed up, it shuts again by its own weight. In the forests of Brazil, we once met with a most interesting little spider which sheltered itself in the same manner. Its case was suspended in the middle of its web. Upon being disturbed, the little creature ran to it with swiftness. No sooner had it gained its retreat, than the door closed, as if by a spring, and left us in silent admiration—too great to lead us to capture the ingenious little creature for our collection.

(42.) Memory, as well as instinct, appears to be given to animals, as necessary for their wellbeing. Instances of this may be witnessed almost daily by every one among domesticated animals, besides the various and well-attested evidences of the same afforded by those which have had no intercourse with man. An

* Voyage to Surinam, vol. ii. p. 246.

interesting incident of this kind is told by Mr. Corse (himself an eye-witness of the transaction), in the *Phil. Trans.* "An elephant, which had escaped, and which was subsequently captured in company with a herd of wild elephants, after an interval of eighteen months, was recognised by one of the drivers. When any person approached the animal, he appeared wild and outrageous as the other elephants, and attempted to strike the person approaching him with his trunk, until an old hunter, riding boldly up to him on a tame elephant, ordered him to lie down, pulling him by the ear at the same time; upon which the animal seemed quite taken by surprise, and instantly obeyed the word of command with as much quickness as the ropes with which he was tied permitted, — uttering, at the same time, a peculiar shrill squeak, through his trunk, as he had been formerly known to do. By this circumstance he was immediately recognised by every person who had been acquainted with his peculiarity."

(43.) A similar instance of the powers of memory evinced by an elephant is given by Williamson, as a fact well known in Bengal at the time, and attested by the signatures of several gentlemen, who were eye-witnesses to the occurrence. An elephant, that had been some years domesticated, got loose during a stormy night, and rambled into his native jungles. About four years afterwards, when a large drove had been captured in the *keddah*, the keeper of the lost one, along with others of the natives, had ascended the barricade of timber by which it was surrounded, to inspect the new guests: among them, he fancied he recognised his former charge; and, though ridiculed by his comrades, he called to the elephant in question by the name it had formerly borne. To the wonder of all present, the animal came towards him; the man, overjoyed at the event, got over the barrier, and, ordering the elephant to lie down to be mounted, he bestrode its neck as in former times, and exultingly led it forth, to the admiration and surprise of all present. Another in-

stance of recollection in this quadruped must not be omitted here. An officer in the Indian army, who was quarter-master of a brigade, found it needful to put a heavier load than usual on a very large elephant, called the *Paugul*, or fool; but he soon intimated that he was only disposed to take his usual load. The officer, seeing the animal repeatedly shake off the superabundant portion, lost his temper, and threw a tent pin at the animal's head. Some days after, as the latter was going with others to water, he happened to pass the officer, whom he very deliberately lifted up into a large tamarind tree, leaving him to cling to the boughs, and to get down as well as he could. And this brings us to notice an instance of generosity manifested by this very individual, which, together with a small female, was subsequently under the command of captain Williamson, and both animals were used to carry the tents of the party. "Unluckily," observes the captain, "after the first day's march, we found that the female was rather overladen, and began to gall, but we could not get the *Paugul* to carry one ounce more than his first day's burden; the feet of the little female, however, becoming very sore, the animal relaxed from his obstinacy, and generously took as much of her burden as gave her relief during the rest of the journey."*

(44.) The dog is scarcely inferior to the elephant in powers of memory, as the following instance will evince:—A spaniel belonging to the Rev. H. N. , being always told he must not follow his master to church on Sundays, used to set out long before, and lie concealed under the hedge, so near the church, that at length the point was yielded to him. The fact, that dogs clearly distinguish the return of Sunday (no doubt, by the different habits of that day), has been attested to me by the distinct observations of several families.†

(45.) A very intelligent writer‡ observes, that "this

* Wilk. vol. i. p. 243.

† Shephard's Autumn Dream, p. 171.

‡ Mr. French, in Zoological Journal.

animal memory, however, differs from that of man, inasmuch as the former cannot possess the power of calling up ideas at pleasure, which would be, at once, to grant them reflection; those of the past being evidently spontaneous, and excited by present sensations, or other circumstances, independent of any proper will of the animals."

(46.) We may term that to be *false* instinct, which impels an animal to perform an act diametrically opposite to that which it would do, were it gifted with the slightest degree of reason, or of the reflective or discriminative power consequent thereon. Innumerable instances might be cited to illustrate this fact, afforded by animals which, in other respects, evince a very high development of instinct. The buffalo of India, in its attacks upon the tiger, which is its deadly enemy, conducts its assaults with a degree of address and subtlety which the utmost effort of reason could not surpass; and yet, from the following anecdote, the very same animal appears to be sometimes so stupid, as not to know what he is fighting with. — "As I was hunting with a party near Daudpore, a hog that we were chasing led us, through a heavy cover, into a plain thinly overspread with water, where, about a hundred yards to the left, we suddenly saw a herd of wild buffaloes. We still, however, pushed on after our game, but not without observing that the animals were throwing out signals for a general attack. A servant, who happened to be upon a grey horse, attracted the attention of three of the herd in particular, which galloped after him. The poor fellow was extremely terrified,—as, indeed, we all were,—and roared out lustily for that assistance which, unfortunately, we could not give him. His horse was not less frightened, and made every exertion; but it did not appear he would have succeeded in his flight, had not the buffaloes confined their attention to the man's turban, which was red, and which, upon being called to by us, he had thrown from his head. We had the pleasure to find this device

fully successful; the buffaloes amused themselves with tossing the turban about, till it had opened to its full length, which might be from eighteen to twenty yards, which they then proceeded to rip into pieces with their horns,"—as if by this latter act they had achieved the conquest of their enemies. The same unaccountable instinct, we believe, leads nearly all the different species of oxen to evince the most inveterate antipathy to anything of a red colour; and it is a remarkable fact, that the same is manifested in their representatives among the feathered creation,—namely, the gallinaceous birds. It is well known that, in many parts of England, flocks of turkeys are driven forward merely by a piece of red rag fastened to the end of a long stick, since it is found that their repugnance to this odious colour makes them, to avoid it, urge their pace forward. Of the same nature as the foregoing, we may again advert to the false instinct of the domestic hen sitting over, and turning, with her usual care, a clumsy imitation in chalk of her own egg.

(47.) Stedman relates of the *peccaries*, or wild hogs of Guiana, which live in herds of about three hundred in the thickest parts of the forest, that they always run in a line, the one closely following the other; but that, when the foremost or leader is shot, the line is instantly broken, and the whole herd is thrown into confusion. For this reason, he adds, the Indians take care, if possible, to knock their captain on the head before the rest; after which the others even stand still, stupidly looking at one another, and allow themselves to be killed one by one,—of which I have been a witness. They do not attack the human species, nor make any resistance at all, like the European wild boar, when wounded, as some authors have erroneously asserted. In Surinam, the names of *pingo* and *crass-pingo* are given to two species of the peccaries most common there; while another is called by our author the Mexican hog.*

* Stedman, vol. i. p. 369.

(48.) We shall now proceed to treat of the varied economy and instincts of animals under distinct heads, arranging those belonging to each class or division separately, that the reader may more clearly discern the respective peculiarities of each.

CHAP. II.

ON THE SENSES OF ANIMALS.

ON THE DIFFERENT SENSES AS DEVELOPED IN ALL THE CLASSES OF ANIMALS. — GENERAL REMARKS ON THOSE OF THE VERTEBRATED DIVISION. — VITALITY OF ANIMALS. — FASCINATION OF SNAKES.

(49.) THE variation in the senses of animals is very great, being regulated by the nature and habits of the species; some requiring the especial aid of those powers, which, to others, would be useless. Beautifully, indeed, are the wants and the capabilities of all adapted to each other, and most wisely and accurately are the latter fitted to the former by INFINITE WISDOM; nothing which is serviceable being withheld, while nothing which is useless is ever granted; so that, throughout creation, the nicest balance, the most perfect adjustment, the most exact conformity, are preserved, equally conducing to the happiness of the creature, and the exaltation of the Creator.

(50.) Among the lowest forms of animal life, but particularly in water, are myriads of minute atoms, which the eye, unaided by the microscope, cannot even discern; but which are then seen to be endowed with vitality,—"frail, indeed, almost without consistence, and yet living and highly irritable." It is

obviously impossible, however, to determine the extent of their sensations. Among these, the *Vorticella Convallaria* is one of the most elegant species of this class; the body of which, formed like a bell-shaped flower, is perfectly transparent. The *Vorticella rotatoria*, or wheel animal, belongs to the same genus; and it is so called from the similitude of the head, in some positions, to a pair of toothed wheels in rapid motion. This creature is gifted with such an amazing power of revivescence, as to return to active life after being stretched out, and apparently dead, for many months.* The *Triscoda Sol* is so termed from its bearing the appearance of a sun, being a little globe or ball covered with long diverging rays. It is of a remarkably inactive nature, affixing itself to the stem of some small water plant, and occasionally moving at the rate of about a quarter of an inch in an hour. Its size may be considered as gigantic for one of the animalcule tribe, — being equal to that of a small pin's head.

(51.) *Zoophytes* are not supposed to possess any sense, save that of touch, which, Cuvier remarks, in them, is so extremely delicate, as to be acted upon by light alone.† Polypes are certainly impelled to seek the sustenance necessary for their support (in the places to which they may be affixed) by the expansion of their several parts; and many of them sensibly contract upon collision with any other body. They have also, as is well known, the singular power of reproduction, in so extraordinary a degree, that, if cut into many pieces, each division, in a few days, will become a perfect being. Animal flowers, or sea anemonies, exhibit an evident sensibility to light, — a fact clearly demonstrated by various experiments made by the abbé Dicquemaitte upon the *Actinia Anemonoides*, or purple sea anemone. Hughes, in his *History of Barbadoes*, also, tells us, that whenever his fingers approached within two or three inches of the *Actinia Calendula*, or sea marigolds, in his attempt to

* Shaw's Zoological Lect. ii. p. 220.

† Cuv. Anat. Comp. vol. ii. p. 302.

pluck them from the rock to which they were fixed, they instantly shrunk back into their respective cavities.

(52.) Among the shelly *Mollusca*, the organs of sensation first began to show a higher state of development. The animal of the *Solen*, or razor shell, like all the headless or acephalous *Mollusca*, is without any visible head or eyes; and yet, on the slightest touch of the sea sand around the spot in which it is always buried, it withdraws its long fleshy tubes into its shell, and sinks to the lowest depth of its cavity. The earth-worm is no less alive to the least vibration of the element in which it lives. On mild damp evenings, during the greater part of the year, after sunset, these animals may be seen in gardens, protruding so far from their holes, that it would, at first, seem that they had actually quitted them: at such times they appear stretched at full length, and motionless, as if they were basking, not in the sun, but in the dew. If the observer walk very softly, he may approach within a foot or two of the worms, without disturbing them; his ordinary tread will make those nearest him disappear almost instantaneously; but, if he stamp hard upon the ground, the same effect will be produced upon all those that are on the surface for the distance of fifteen or twenty feet from him. In the cephalous *Mollusca* we first begin to



discern the vestige of eyes, as in the slug and the snail; for we consider it beyond doubt that the black points

which terminate the tentaculæ of the animals, are incipient developments of these organs (*fig. 10.*). It has been generally supposed that, in this order of the *Mollusca*, the eyes were merely rudimentary; but the recent knowledge that has been gained of the animal inhabitants of the wing shells (*Strombidæ*), shows that this idea is erroneous. The eyes of the genus *Pteroceros* have beautifully coloured irides; and those of the large pink-mouthed *Strombus*, so often seen as chimney ornaments, have been described to us, by a gentleman recently returned from the West Indies, as large, brilliant, and as fully developed as those of the *Cephalopoda*, or cuttlefish. Among the testaceous univalve shells, as well as in the slugs, the mouth and lips are fully developed; and as some of them live upon animals, some on vegetables, and others — as the large garden slug — on both, it follows that their sense of taste is as perfect as in most other animals. The *Cephalopoda*, from connecting the *Mollusca* to the *Vertebrata*, are still further organised, — since it is among these that the first rudiments appear of the organs of hearing.

(53.) Chelonian reptiles next succeed in the scale of animal life; and the tortoise, being the first development of the vertebrated structure; is eminently distinguished from those hitherto noticed, by possessing the organs of smelling; so that it thus exhibits the union of all the five senses. It does not, however, appear to be gifted with acute sensation; but is, perhaps, more than any other vertebrated animal, tenacious of the vital principle; a fact proved by the many cruel and disgraceful experiments of Redi, — one of which consisted in the extraction of the entire brain from the head; after which operation the animal walked about as before; and though it afterwards closed its eyes, and never again opened them, it yet survived for the space of six months. Differences, indeed, although much slighter in degree, will be found among every separate genus with regard to their physical sensibility. Even animals

which have an affinity to each other, considerably vary in this particular ; so that a slight wound in the body is sufficient to kill a panther, or leopard, while a cat will recover from broken ribs and a fractured skull.

(54.) Among lizards, the chamæleon is most remarkable for the peculiar formation of its eyes, which are so covered with a granulated membranaceous skin over the eye-ball, that only a narrow horizontal slit, "through which the bright pupil, as if bordered with burnished gold, is seen." The structure of the eyes, also, is such, that the creature can look at the same moment in different directions, — one moving while the other is at rest, or looking towards one, while its fellow is gazing in an exactly opposite quarter. A similar structure appears to exist in some few other genera of reptiles, as in *Lyriocephalus*, or the lyre-headed lizards, and in the genus *Pedalion* among the fishes, where, according to the observations of Guilding, the eye is even more conical than in the chamæleons.

(55.) The sense of *hearing* among snakes and lizards is not only very perfect, but is much more highly developed, in one sense, than in any other class of animals. We allude to the well-known and remarkable fondness which the serpent is known to possess for music. Whether this had been discovered in the primitive ages of the world to belong to them in a natural state, or whether the inspired writers alluded to those artificial modes of teaching these reptiles to move to the sound of music, still practised by the jugglers of India, it would be difficult to determine. The simile that has been used of the serpent "refusing to hear the voice of the charmer, charm he never so wisely," was, probably, intended to allude to their artificial movements, as to a circumstance familiarly known among the eastern nations ; for it is not to be supposed that the Psalmist would have cited an illustration, which could otherwise have been only known, if at all, but to very few persons. With regard to the effect of music upon these reptiles, we cannot state anything from

personal observation, having been, generally, more desirous of avoiding them, than of ascertaining their habits. But with lizards we have made several amusing experiments. The elegant little species commonly called the *Lacerta agilis*, although rare in Britain, is found in such abundance in the South of Europe, that hundreds, on a fine sunny day, may be seen in a single walk, basking on the stones and walls, or pursuing their search after insects. In Sicily and Malta they are particularly numerous, and very beautiful. The habit they have of turning the head on one side, and some vague recollection of a story, in the *Arabian Nights*, about an attentive lizard, first induced us to try what effect the humming of a song would have upon these creatures, — and it was, really, most entertaining. The little reptile, instead of running away with its usual swiftness, would remain perfectly still, inclining its head on one side, as if to drink in every intonation. The softer and more plaintive was the tune, the more intense was the attention it evinced; and if a whistle was substituted for a hum, it would suffer itself to be approached so near, that any one unacquainted with its astonishing swiftness would fancy he could capture it with his hand. This curious fact, once discovered, often proved a source of much amusement. Often, after a long ramble, spent in sketching or botanising, we used to repose in a shady spot, among the rocks, and charm these pretty little creatures so successfully, that we have known them even to come out of their holes, and thus form a little audience. On such occasions, they sometimes stand remarkably upright upon their fore legs, the hinder ones lying almost flat upon the ground: the same attitude they also assume when reconnoitring; but then the head is never turned on one side, as if for the purpose of accurately hearing. The same experiments were frequently made upon the smaller lizards of Brazil, which, more or less, exhibited the same fondness for tunes. Every one is aware that this is equally evinced by birds; but we believe that

nothing of the kind has yet been observed among quadrupeds.

(56.) The effect of music upon snakes has been attested in modern times by the author of the *Oriental Field Sports*, who observes, that, "when snakes are known to infest particular places, the *cunjoors*, or snake-catchers, are called in. These people, by smelling at the different burrows, at once discover which are inhabited. Taking care to keep out of sight, they play on an instrument not unlike a hautboy; and having scattered some scents on the floor, the snake soon comes forth: another of the party, watching his opportunity, seizes the delighted reptile by the tail, and rapidly slipping the other hand up to its neck, holds it firm: the musician then puts away his pipe, and, taking a pair of pliers, soon disarms the reptile of its poisonous fangs. Thus even the formidable *Cobra di Capella* becomes changed from a dreaded enemy into an innocent instrument of display, and is taught to obey the commands of its dexterous captor."

(57.) That there is a peculiar sort of fascination in the eyes of snakes, which not merely affects animals, but man, may be gathered, incidentally, from various authors. Among these, we may cite the following passage from Stedman: — "One morning, awakening by daybreak in my hammock, the first thing that I saw, on looking up, was a snake, about two yards long, hanging with its head downwards, like a rope, and straight above my face, from which he was not one foot distant, while his tail was twisted round the rafters under the thatch. Observing his eyes bright as stars, and his forked tongue in agitation, I was so distressed, that I scarcely had power to avoid him; which, however, I did, by running out. After this, I heard a rustling in the dry thatch, where the negroes attempted to kill him, but in vain, — he having escaped."* The same writer gives another instance of this power in the rattlesnake: he says, — "Mr. Francis Rowe, of Philadelphia, informed me, that, riding out one morning to visit a friend, his

* Voyage to Surinam, vol. i. p. 374.

horse refused to go forward, being terrified at a large rattlesnake that lay across the road. Mr. Rowe, having heard of its power of fascination,—in which he was a believer,—alighted to lead the animal round it; but during that time, the snake, having coiled himself up, sounded its rattle, and stared him so full in the face, and with such fire in his eyes, that a cold sweat broke out upon him; thus, while he durst neither retreat nor advance, he imagined himself gradually riveted to the spot. ‘However,’ continued he, ‘my reason remained; and my resolution getting the better of my alarm, I suddenly approached him, and with one stroke of my cudgel knocked out his brains.’” It is clear, from this anecdote, that a deficiency of natural courage in the narrator was not the cause of the previous fascination he experienced; for, had that been the case, instead of using the “cudgel” to destroy the animal, he would have used his legs to have run from it. “As for the stories,” continues our author, “of its causing mice, squirrels, and birds to run into its mouth, I reject them as fables,—the supposed charm consisting of nothing more than this;—that the poor animals, finding themselves surprised by the impending danger, are seized with such a trepidation and fear, that even the use of their limbs forsakes them, and they are riveted to the place till they die; or, in the act of leaping, they are seized by their enemy.”

(58.) One of the most celebrated travellers and naturalists now living, has thus described the fascinating powers of a serpent, witnessed by himself in Southern Africa:—“I saw,” says he, “at the brink of a ditch, a large snake in pursuit of a field mouse. The poor animal was just at its hole, when it seemed in a moment to stop, as if unable to proceed, and, without being touched by the snake, to be palsied with terror. The snake had raised its head over him, opened its mouth, and seemed to fix its eyes steadfastly upon his intended victim. Both animals for a while remained still; but as soon as the mouse made a motion, as if

he wished to escape, the head of the snake followed the movement immediately, as if to arrest the little animal's course. These movements continued four or five minutes; but my approach put an end to it. The snake then hastily seized upon its prey, and glided away with it into a neighbouring bush, where I in vain endeavoured to discover and destroy it. I think it may be a question whether the poisonous breath of the reptile might not really have had the effect of paralysing the limbs of the mouse, rather than that its inability to move proceeded either from the fixed eye of the snake, or the apprehension of inevitable death." *

(59.) BIRDS are in the possession of all the senses; but that of vision is of the first importance, both in the discovery of their prey, the avoidance of their enemies, and as the unerring guide of their migrations. It is, therefore, singularly exquisite, particularly in the vultures; and these birds will soar to amazing heights, and dart through the air with a rapidity which would confuse, or altogether destroy, a vision less perfect than their own. The owl is generally thought an exception to the common rule, — most of the species being unable to sustain the glare of day, although amid the darkness of night they can see far better than the rest; but this defect — if defect it may be termed — is compensated by peculiar quickness of hearing, and, no doubt, of smell, by both of which he is enabled to hunt by night, as others do by day. All birds, indeed, possess these senses in considerable perfection, and by the latter many are enabled to scent their prey at vast distances, and to shun some of the numerous dangers which surround them.

(60.) The sense of *touch* is supposed, in the higher classes, to be seated in the villous surface of the skin; but, in birds, it is probably confined to the feet and bill. This is particularly apparent in rapacious birds, which use their feet in seizing and retaining their prey; while in those — such as ducks, snipes, and woodcocks — which push their long bills into the mud, the

* Lichtenstein's Travels, p. 221.

point of the mandibles is not only comparatively soft, but is often covered with a very thin membranous skin, which evidently implies considerable sensibility.

(61.) The senses in QUADRUPEDS are developed in very different degrees. That of feeling, as in mankind, is seated beneath the outward skin, and is disseminated in various proportions throughout the whole animal world; but many — like the elephant, the rhinoceros, and still more the armadilloes — are covered with a thick and impenetrable case, which protects the more sensitive parts, and secures the greater portion of their bodies from injury. The touch of the former of these animals — of which his trunk appears to be the principal instrument — is exquisitely delicate; and he is also possessed of a quick ear and an acute smell; — the first leads him to delight in the sound of music, to which he is frequently brought to move in cadence; while, as an equivalent for an imperfect sight, the ear is endowed with a very acute sense of hearing. The scent of the American bison is said to be so keen, that it is difficult for either men or dogs to get near him, excepting on his leeward side; while the camel, by the perfection of the same sense, is enabled, while wandering over the sandy and parching deserts in which he so often ranges, to discover the vicinity of water at the distance of a mile.

(62.) The sense of *hearing*, in many quadrupeds, is particularly keen, and seems to be given more especially to the herbivorous tribes: thus the elk, although not remarkably swift, is enabled to avoid its enemies by an unusual keenness in its perception of sounds. The same delicacy of hearing is well known to be possessed by the stag; while the chamois, and the beautiful antelopes of Africa, more highly gifted than either, add to these an unusually penetrating sight. Hares and rabbits, more especially, must possess this faculty highly developed, since they are provided with long ears which convey sounds on the principle of the speaking trumpet; while their large and prominent eyes are constructed to

receive the rays of light from all quarters. The fox is enabled, by its scent, to know its prey at the distance of two or sometimes three hundred paces; and daily proofs are afforded that the dog has the same power; — since he will not only discover game at considerable distances, but has been known to track his master's footsteps through a populous city, or to follow the course of unknown feet for miles.

(63.) The horse, the most noble of our domestic animals, has each of the senses in great perfection; and, like the owl and the cat, can distinguish objects in the dark. In opposition to which may be placed the porcupine, whose organs, with the exception of that of smell, seem singularly obtuse.

(64.) The senses of the common mole are exactly adapted to its wants; and the nice balance preserved between the wants and the senses of animals is in no creature more remarkable. Being destined to remain always under ground, it has little occasion for sight, and we therefore find that its powers of vision are very limited; its eyes are not only enveloped in fur, but furnished with a muscle which enables the animal to withdraw or to employ them as circumstances may prompt; while it is amply provided with the means of scent and hearing, which, in its peculiar situation, are of far more importance than sight. It has been stated that the *Mus Typhus*, or blind rat, found in the southern parts of Russia, is absolutely deprived of sight, — having only two small rudiments of eyes situated under the skin, and scarcely discernible.*

(65.) The scent of the rhinoceros is so remarkably keen, that they know, even at a distance, whether any man is coming towards them; and, on the first suspicion of such an enemy, they betake themselves to flight. It is only by approaching them against the wind, or to leeward, that the hunter can expect to get within gunshot: in doing this, he must move cautiously

* Shaw's Zoological Lect. i. p. 105.

and silently, so as not to make the least noise among the bushes, otherwise their hearing is so exceedingly quick, that they would instantly take alarm, and move far away to some more undisturbed spot; or, becoming furious, pursue their enemy, — whose only chance of escape, when the enraged animal makes a run at him, is to spring suddenly on one side. Yet the sight of the rhinoceros, notwithstanding the perfection of his scent and hearing, is very imperfect, — probably on account of the excessive smallness of the aperture of his eye, which only measures one inch in its greatest length.*

(66.) The sense of *smell* in the kangaroo must be marvellously acute, if the following whimsical anecdote be not exaggerated. It is part of the relation of a New Hollander's hunt after this interesting animal, and is given in the words of the narrator.† “He is now almost within reach of his victim, and in another step he will discharge his unerring spear; but it is arrested. Suddenly he sees the kangaroo, with her short fore hand-like paw, kill one of the large flies which had settled on some vulnerable part of her skin. She scents the blood; and, with an anxious gaze, soliloquises, ‘White fellow’s bullock all about.’‡ She then resumes her food, but with more anxiety, and taking a longer hop, so as to come near her young one. Suddenly she again erects herself, kills another fly, smells the blood, and seems to say, ‘Black fellow all about.’ As instantaneously as sight, the hunter perceives the new discovery she has made, and his spear falls short of his victim only by the distance of her first bound; having, in this brief moment, pouched her young, and commenced her flight into the depths of her native solitudes.”

(67.) Monkeys possess the sense of touch in a very perfect degree; and this, not only in their four feet, all of which perform the office of hands, but in the long

* Burchell's Travels, vol. ii. p. 72.

† A Month in the Bush of Australia, by an anonymous author.

‡ Meaning, we presume, that the white man's oxen were not far off.

prehensile tails, which distinguish nearly all the American species. The skin of this member, on its under surface, is entirely naked, and endowed with such sensibility, that it is used by the animal as a fifth hand. It is a well-known fact, that, at the moment of their death, if they happen to be shot in a tree, they coil their tail round the nearest branch, and there remain, after life has departed from the body. The *Ursus lotor*, or raccoon, appears to enjoy the same sense in an exquisite degree, — examining everything very carefully with its paws. But, in this particular, no creatures seem to equal those of the *Vespertilionidæ*, or bat family, which need not collision with any object, to be advertised of its vicinity; but which, if blinded, will guide themselves through the most winding and complicated passages, without once hitting the walls, or striking against any impediment which may seem to obstruct their progress.

(68.) In FISHES, the organs of the senses are developed under some peculiar aspects. Of their eyes, it has been asked, “Why is the crystalline so round, but to compensate for the refraction of the rays of light?” — thus enabling these animals to see, even through so dense a medium as that which surrounds it. This is, in truth, one of those wonderful provisions made for the particular necessities of every living thing. Another is exemplified in the common eel, which bores cavities in the sand and mud at the bottom of the water; the eye is, therefore, supplied with a hard and transparent membrane, which it can draw over the pupil at pleasure, — thus effectually guarding these organs from injury. The ear of fishes, being far less complicated in its structure than that of other animals, naturalists have therefore been led to conclude that the sense, of which this is the organ, must be proportionably weak. We are also induced to suppose that the power of taste is likewise very imperfect: this idea is further strengthened, by the habit, which is almost universal among fish, of swallowing their food in an entire state, — that is, without

mastication. Some of the *Spari*, indeed, and the whole of the *Plectognathes*, or cheloni-form fishes, live upon crabs and shellfish; and hence we find, among the former (*fig. 11.*), regularly formed grinding teeth: but, in all cases, the tongue—the great organ of taste—seems slightly de-



veloped,—at least, in comparison to what we see among quadrupeds; while the sense of touch is, in all probability, still more imperfect. Nevertheless, as the devouring of their appropriate food must be a pleasure to every animal, we are at a loss to conceive how this can arise, except through the medium of a corresponding faculty of taste.

(69.) The eyes of frogs are large and bright, and they are defended by a moveable membrane, well adapted to preserve them from those injuries to which, from their peculiar mode of life, they would be particularly liable.* The ears, as Ray observes, are extremely small; yet, as they answer one another at great distances, by croaking, they are, probably, provided with a sufficient portion of the hearing faculty.

(70.) In taking a general survey of the development of the senses in the vertebrated circle, which we have now gone through, we plainly perceive that there is a gradual progression, which commences with the tortoises, or *Chelonides*, among the reptiles, and reaches its height among the *Mammalia*. From this point, again, there is as gradual a descent towards the fishes, until we see all the imperfect senses of the reptiles in the class of *Amphibia*. This circular gradation in physical qualities is in complete unison with the succession of these groups in their organic structure; so that we find the highest point of perfection to which the senses are carried, precisely among those animals which, as being most complicated in their structure, stand at the head of the whole class. The progression of the senses, in

* Ray's Wisdom of God, p. 165.

fact, is as circular as that of their natural affinities. If, however, we were to single out any one particular sense, and then expect, as a matter of course, to find it most conspicuous among quadrupeds, we shall, probably, be disappointed. It is not by such a criterion that we are to judge of the perfection just mentioned, as belonging to quadrupeds; but rather from these animals being gifted with a greater proportion of all the five, than falls to the lot of any other division of the vertebrated circle. Take, for instance, the faculty of sight, and there can be no question that it has been given to birds in a much higher degree than quadrupeds; and this, for special reasons;—the objects which the great majority feed upon are small; they are often to be distinguished while the bird is traversing the air, and they are to be searched for with great assiduity. This last condition, indeed, is imposed upon quadrupeds; but then these latter are aided, in a great measure, by a high power of smelling, — which birds obviously do not possess. “A hawk,” observes Buffon, “during its aerial soaring, will discern a lark upon a clod of earth, coloured almost exactly like itself, at twenty times the distance at which a man or a dog can perceive it. A kite, having soared to an elevation beyond our ordinary vision, can distinguish lizards, field mice, and small birds, and select those upon which he chooses to pounce.” This great extent of sight is accompanied with a corresponding degree of precision; for the organ being at once both extremely elastic and extremely sensitive, the eye becomes round or flat, is covered or uncovered, contracts or dilates, and speedily and alternately assumes all the forms necessary to adapt itself to every degree of light or distance. “Moreover,” continues the same author, “as the sense of sight is the only one which produces the ideas of motion—the only one by which the degrees of space which are traversed can be compared,—and birds being, of all animals, the best adapted for motion,—It is not surprising that they possess, in the highest degree of certainty and perfection, that sense

which should be their principal guide. The swiftness with which a bird can fly, may indicate the extent of its reach of vision ; not, however, absolutely, but relatively. A bird, whose flight is quick, direct, and sustained, may certainly be supposed to see further than another which moves more slowly and obliquely. It is, indeed, obvious that, if nature had ever produced birds with short sight and rapid wing, they must have soon perished from this contrariety of qualities—one of which not only hinders the exercise of the other, but exposes the individual to an infinite number of risks. From all this we may perceive that the birds whose flight is shortest and slowest, are also those whose power of vision is the least extended." It is not a little remarkable, that birds form the only class of vertebrated animals which do not present us with a single example of the visual organs existing in a merely rudimentary state. Among quadrupeds, we have the mole, the *Ornithorhynchus*, or ducksbill, and several of the *Glirés*, or mouse tribe, with the mere rudiments of eyes. The same partial blindness occurs among fishes in the apodal order, as also in the class of *Amphibia* and of reptiles ; but nothing analogous to these instances is found in the class of *Aves*. We conclude, therefore, that the sense of sight is more developed in this, than in any other of the vertebrated circle.

(71.) Sight, however, is but one of the five senses ; and although so highly developed in birds, these animals do not exhibit a corresponding degree of perfection in the others. That of smell, indeed, must be very acute among the toucan family, and is probably equally so in the vultures ; for the first have to scent out the nests and eggs of birds, upon the last of which they chiefly feed ; while the latter are well known to be guided by the smell of decomposing animal substances from a vast distance, notwithstanding some plausible theories to the contrary : but, in other respects, the smell of the majority of birds seems to be very imperfect, because their great power of vision and locomotion renders it

unnecessary. Their touch is still more defective,—since they have, in fact, no organs (like the fleshy tongue and the naked muzzle of quadrupeds) adapted for conveying this sense directly to their apprehension; the feet, more properly, being mainly intended for support, although we may naturally suppose the soles possess a slight degree of sensibility. Their power of hearing, again, although superior to that they possess of touch, is manifestly inferior to what is enjoyed by quadrupeds; for, although the owls are remarkably gifted in this respect, the ears of all other birds are small, and are without that external appendage for facilitating the transmission of sound into the tympanum, which is so very general among the *Mammalia*.

(72.) If we turn to quadrupeds, however, we perceive, not the pre-éminent development of any one sense, but an equal one of all. Their sight, although inferior to that of birds, appears, nevertheless, superior to that of all the other *Vertebrata*,—fishes, probably, excepted—as the wandering life of that class assimilates them very much to birds; while in their sense of touch, of taste, and of hearing, there is every reason to believe they surpass all others of the vertebrated animals. These comparisons, therefore, establish our proposition,—namely, that, in every pre-eminently typical group, we find a union of all the higher qualities shared by others of its own circle, although each quality is not in the same proportion as may be found within the same range. Of the senses of fish and of reptiles, we know too little, indeed, to judge of what may be *their* peculiar gifts; but, if we may be guided by many analogies presented by the leading facts of animal economy, we should be disposed to conclude that they each possessed some one sense preponderating over the others, just as we have shown in the class of birds. We shall now proceed to point out a few of the most prominent and remarkable instances in the senses of annulose animals.

(73.) All *Insects**, properly so called, possess the

* Our definition of a true insect, as opposed to that of some modern

five senses in great, although not in equal, perfection. It was, indeed, formerly doubted whether they are endowed with that of hearing; but it seems now satisfactorily established that they are; although it still remains a matter of dispute to what organs their *antennæ* and to what their *palpi*, are appropriated. Messrs. Kirby and Spence seem to think that the primary functions of the *antennæ* are, to be the medium of a sense, at any rate, analogous to hearing; but they also imagine that, by these instruments, they are enabled to discover those alterations in the weather, which to them are so important, and which they seem so readily to perceive;—bees, particularly, being evidently advertised of the approach of a shower, when we can perceive no indications of it; and hastily returning to their hives in time to avoid its approach.†

(74.) The sense of *touch*, in insects, supposed to reside in their *antennæ*, must be of the greatest delicacy. These organs may also be the primary means of communication with their own species; for, when a queen bee is removed from her hive, those of her attendants who first perceive her loss have been seen to apply their *antennæ* to any of their fellow bees whom they may chance to meet, crossing them one over another, and striking them lightly; while the hurry and anxiety immediately displayed by those to whom the disastrous intelligence has been conveyed, has clearly indicated its melancholy nature.‡ The sense of *touch* must be peculiarly delicate in insects, especially in spiders, from the nicety with which the majority fabricate their fragile webs.

(75.) The *eyes* of insects, excepting those of the order *Crustacea*, or crabs, do not turn in their sockets, like those of most other animals: but what is denied in motion, is amply compensated in number; for in

writers, is, that it is an annulose animal furnished with articulated legs. This, in fact, corresponds with the opinion of Linnaeus. Spiders and crabs are therefore but divisions or orders of true insects.

† Introduction to Entomology, vol. iik. p. 245.

‡ Phil. of Zool. vol. i. p. 298.

one fly alone there have been reckoned no less than 16,000 eyes; in a *Scarabæus*, 6362; and in a butterfly, 34,650! These are, of course, no other than



the interspaces of those crossed or scored divisions which any one will perceive upon looking at a common house fly, through an ordinary magnifier (*fig. 12.*). Each of these, it has been shown, performs the office of a single eye, although they are collected into two packets, corresponding in outward appearance to the ordinary pair of eyes of vertebrated animals. Spiders, however, have theirs differently constructed. In ordinary instances, they consist of eight, placed at various and unequal distances on the crown of the head, or thorax; but some species from Cuba have only two; and all are destitute of the reticulations above mentioned.

(76.) The *vital principle* in some insects appears to be equally strong with that exhibited by the zoöphytes, and many of the tortoises. La Vaillant informs us, that, while residing at the Cape, he took a large red-winged locust, "opened its belly, and pulling out its intestines, filled up the cavity with cotton, and in that state fixed it to the bottom of a box with a pin, which passed through its thorax. It remained there five months; and at the end of this period, our unfeeling traveller asserts, that it still moved its legs and antennæ."* We cannot approve, indeed, in a general way, of such cruel experiments upon living creatures; yet we feel not sorry that, in this instance, it has been made,—since, with other facts we shall here notice, it will show that practical entomology is not attended with that suffering to the insects captured, which has been charged upon its pursuit. Those well-known lines of Shakspeare,—

—The poor beetle that we tread upon,
In corporal suffering, feels a pang as great
As when a giant dies,—

* Travels in Africa, vol. iv. Introduction.

have contributed in no small degree to strengthen popular error, which assigns to the insect world the same degree of feeling as is enjoyed or suffered by vertebrated animals; — an error which we shall take this opportunity of endeavouring to remove. It must be obvious to every reflecting mind, that the higher and more complicated is the degree of organic structure, the more delicate, also, is the nervous sensibility residing in the corporeal frame. From this theory, founded upon anatomical facts, into which we need not enter, it necessarily follows, that insects, from being less organised than vertebrated animals, would be much inferior to them in that nervous delicacy from which proceeds the sense of pain; while, on the other hand, and arguing on the same principle, they would experience corporeal suffering much more than the soft and often headless *Mollusca*. This, indeed, cannot be doubted by any one who is acquainted with the reproductive power — and who is not? — possessed by so many of the latter animals. The vitality of the *Acrita*, or animalcules, is, perhaps, more extraordinary than that possessed by any other animals. Many of the aquatic sorts are well known to be raised, as it were, again to life, after they have, to all appearance, died, by merely pouring a few drops of water in the vessel which contained them. The body of a polype may be cut in every possible direction, the parts dissevered and scattered, and yet these grievous wounds, — any one of which would prove the death of an insect, — so far from having a similar effect upon the polype, becomes, in fact, an artificial mode of reproduction: each fragment is a germ of life; and becomes, in due time, a perfect progeny to the parent. Ascending higher in the scale of being, we find this power diminishing. Reproduction in the testaceous *Mollusca* is apparently confined to the growth, only, of certain members that may, from accident or design, become mutilated. If one of the tentacula of a snail, for instance, is cut off, the wound will not only heal, but a new one, in process

of time, will become developed. It is well known that crabs and spiders voluntarily cast away their feet under the impulse of fear, or they are easily torn from them by those who attempt their capture; and yet this loss, which to us would be certain death, seems to them a matter of no considerable moment: they are as active, the instant after they undergo the loss, as they were before; and nature, in a short space of time, supplies the deficiency with a new limb. Every schoolboy knows, from his own experience, that in attempting to catch a crane fly, or "old father long legs," in other words, a *Tipula* (fig. 13.), one half of its legs may, prob-



bably, remain in his hand, while the insect will fly away with the rest. What vertebrated animal could do this? A leg torn from a bird, a lizard, or a quadruped, would certainly be followed by its death; for this is frequently the result even

of a serious fracture or other injury to those limbs.

(77.) The vitality of insects is shown by numberless other circumstances. Beetles that accidentally fall into water, will remain alive in that element, long after they have exhausted all their strength in efforts to escape: they are apparently dead; but, upon being taken out and placed in the sun, they revive to their wonted activity: the same resuscitation is observed in flies drowned in wine. We frequently find beetles still living, after one half of their body has been accidentally crushed by the heedless foot of the passenger, or actually picked out by some bird which had not finished its meal. It is related by some entomological writer, — (we forget where the passage occurs), — that the large dragon flies, probably of the genus *Eshua*, are so voracious, and so little susceptible of pain, that, upon his turning

its long slender body to the mouth of one he had captured, the insect actually began to prey upon itself ! Another (the late Mr. Haworth) mentions a curious circumstance of the sexes of a species of moth being both stuck with pins in his store-box, when the male made such vigorous efforts to gain possession of his companion, that it actually got loose from its impalement. Every entomologist has experienced the extreme difficulty with which most of the large full-bodied moths are killed ; and that they will still continue to exhibit signs of life, after it might be almost literally said that every bone of the body has been broken and crushed. These facts, with numerous others which will occur to every naturalist, place the fact beyond doubt, that insects are not only endowed with a far greater portion of vitality than are vertebrated animals, but that they are almost devoid of the sense of pain, — or, at least, it would be felt in a very slight degree, — under inflictions which, to the warm-blooded tribes, would prove the most excruciating tortures. In all this we see not only a wise but a most merciful provision of their Creator. Insects, above all other animals, are exposed to the greatest casualties, not merely from ordinary vicissitudes, but to others of a peculiar nature. The felling of a tree is sufficient to destroy whole communities, to whom it is a home, giving shelter and food to thousands ; while the burning of a forest or the herbage of a plain is the destruction of millions on millions. It deserves to be remembered, also, that one such accident is far more depopulating to the insect world, than all the captures that an entomologist would make for the purposes of science during a lifetime. It is further ordained that insects should be the food of nearly three fourths of the whole feathered creation ; and that numerous tribes of their own class derive their entire sustenance from preying upon those that are weaker or differently organised. Hence it is that their Creator has mercifully withheld from them that sense of pain and suffering which is so prevalent

among animals of a higher order, whose lives are, in all probability, much longer; but who feel, at their death, an agony which is really quite unknown to the "poor beetle that we tread upon."

(78.) To intestinal worms and radiated *Mollusca*, which, in their capacities, approach very nearly to animalcules, we can ascribe no sense save that of touch, as it is the only one which has yet manifested itself to naturalists; and thus does the harmonious scheme, exhibited by the animal creation, terminate at the point from which it commenced: the vast circle being formed of various others, linked and adjusted with the nicest skill, and the wisest and most beautiful arrangement.

CHAP. III.

ON THE PASSIONS OF ANIMALS.

(79.) THE diversity of dispositions observable among the human species, and the variety of passions which agitate the breast of man, have been subjects of curious speculation, which long stimulated the inquiries and employed the thoughts both of philosophers and moralists. But let us not suppose that these passions are altogether confined to our own species. Very many of them, on the contrary, are common to the generality of animals; and we find some among the brute creation in a very high degree susceptible both of love and hatred — fear and tenderness — gratitude and anger. They do not, indeed, possess the same means of expressing their feelings; but though, perhaps, less varied and eloquent than ours, they have still a language of their own, entirely suited both to their nature and necessities; and no attentive observer can have watched them, without having perceived the mutual recognition

of each other's wants and feelings, which is implied both by voice, look, and action. In many cases, however, this communication is, doubtless, carried on in a way which we cannot comprehend, and by tones which we are at a loss to interpret. But those intonations in the voice, which we may not be able to catch, are perfectly understood by the animals themselves. It is well known that the ewe and her lamb can distinguish each other, even in the most numerous flocks; and that, when separated for a time, and again turned loose into the field, the latter instantly recognises the well-known voice of its dam, and skips joyfully up to her the instant it hears her bleat.

(80.) The various emotions and desires which these signs and sounds so faithfully express, deserve a full consideration; for they open a more interesting view of the animal world, — unlocking, as it were, the bosoms of its mute inhabitants, and giving a fresh insight into their nature and characters. We see impressed upon them feelings of the most amiable nature; and we behold them obeying the calls of affection, and with tender care devoting their whole attention to the nurture and preservation of their offspring, exerting all their skill and summoning up all their powers in their service. We discover them, also, in many instances, giving the most affecting proofs of connubial attachment, and exhibiting a faithful love “even unto death;” while in others we view them actuated by an apparent sense of benefits received, from which man might too often learn that lesson of gratitude which his perverse nature has failed to teach him. This intuitive tenderness in the brute creation, however, is also mingled with passions of a darker hue, whose violence is unchecked by reflection, and unrestrained by the mild dictates of religion, — although even these, by the wise ordination of Providence, are subjected in some cases to the dominion of man; matter submitting to the domination of mind, and instinct yielding to reason.

(81.) Among those classes of animals which approach nearest to the vegetable creation, we can, of course, detect few indications of feeling of any kind; and the most inferior tribes we must therefore pass over. In the *Cephalopoda*, or cuttlefish, it has been remarked, that the male not only is always seen by the side of the female, but, when attacked, it displays an obstinate gallantry in her defence, worthy of the days of Don Quixote, and frequently insurmountable, excepting by his own destruction.*

(82.) Among reptiles, one species of the tortoise, the *Testudo caretta*, is exceedingly bold and fierce, — attacking its adversaries with its feet and strong jaws with the utmost vigour. The crocodile, though very voracious, does not appear to be an untameable animal, — instances having been quoted of its becoming tame, and in some degree gentle to its keeper. The male of the common Iguana is stated to exhibit a warm attachment towards the female, whom he will — though usually of a gentle disposition — defend with the most obstinate fury. The nimble and the green lizards are both peculiarly gentle in their dispositions; and the green lizard of Carolina, we are told, “has every quality that can delight the eye, or interest the beholder in its favour,” — being at once beautiful, active, useful, patient, and industrious. Most of the venomous serpents — particularly the *Cobra di Capello*, or hooded snake — are extremely irritable and revengeful: but others, like the boa tribe, and most of the innoxious genera, are at once courageous and peaceable; powerful, indeed, when assailed, but never attacking except from necessity.

(83.) In BIRDS, the passions are much more acute and perceptible. It is when we enter the umbrageous woods, and look around amongst its feathered inhabitants, that sounds of joy and indications of love open before us. A thousand varied notes — and some of the sweetest melody — reach our ears; while all — from the soft cooing of the dove, to the cackling of the com-

* Bingley's Animal Biography, vol. iii. p. 545.

mon hen — express some latent feeling of tenderness or fear, hope or expectation. The turtle dove woos his bride with his plaintive song, placing himself in the most winning attitude, and overwhelming her with caresses; while the little love-parrot sits beside his mate, and feeds her by disgorging into her bill. If one dies, the other is impressed with the deepest sorrow, and seldom survives its beloved partner. Many of the parrot family are well known to evince a strong and



lasting affection towards each other. Bonnet mentions the mutual affection of a pair of those called love birds (*fig. 14.*), who were confined in the same cage. At last, the female falling

sick, her companion evinced the strongest marks of attachment: he carried all the food from the bottom of the cage, and fed her on her perch: and when she expired, her unhappy mate went round and round her, in the greatest agitation, attempting to open her bill and give her nourishment. He then gradually languished; and survived her death only a few months.

(84.) It is in the parental character, however, that birds evince their strongest feelings. It is in this capacity that every nerve is exerted, every power employed, every sacrifice cheerfully made. Self seems no longer to be considered, danger no more dreaded; and death itself is braved, if it secure the safety of their young. The timid hen, casting away her fears, appears with a new spirit when surrounded by her youthful progeny; and she assumes an air of courage and defiance which evinces a determination to assault any enemy who may approach. The most feeble birds, at the season of incubation, assault the strong and fierce; the weakest will assail the most powerful. It is a well-known fact, that a pair of ravens, which dwelt in a cavity of the rock of Gibraltar, would never suffer a

vulture or eagle to approach the nest, but would drive them away with every appearance of fury.* — The missel thrush, during the breeding season, will fight even the magpie or jay.† And the female titmouse will frequently allow herself to be made a prisoner, rather than quit her nest; or, if she herself escape, she will speedily return, menacing the invaders by hissing like a snake, and biting all who approach her: this we have ourselves experienced. The artifices employed by the partridge, the lapwing, the ring plover, the pewit, and numerous other land birds, to blind the vigilance and divert the attention of those who may come near their little ones, is equally curious. The partridges, both male and female, conduct their young out to feed, and carefully assist them in their search for food; but, if disturbed in the midst of this employment, the male, after first giving the alarm by uttering a peculiar cry of distress, throws himself directly in the way of danger, and endeavours, by feigning lameness or inability to fly, to distract the attention and mislead the efforts of the enemy, — thus giving his mate time to conduct her little brood to a place of security. “A partridge,” says White, “came out of a ditch, and ran along, shivering with her wings, and crying out as if wounded, and unable to get from us. While the dam feigned this distress, a boy, who attended me, saw the brood, which was small and unable to fly, run for shelter into an old fox’s hole under the bank.” — The lapwing pushes forward to meet her foes, employing every art to allure them from the abode of her young: she rises from the ground with a loud screaming voice, as if just flushed from hatching, — though, probably, at the same time, not within a hundred yards from the nest: she afterwards whines and screams round the invaders; and invariably becomes more clamorous as she retires further from the nest.‡ — The ring plover will flutter along the ground as if crippled; and, if pursued, will

* White of Selborne.

† Montague.

‡ Bingley’s Animal Biography, vol. ii. p. 479.

hasten to a short distance, stretch out its feathers, and appear to "tumble heels over head," till it has enticed its enemy to a distance*; while, on similar occasions, the pewit resorts to the same expedient of appearing wounded, as soon as it perceives the approach of a stranger. — Sheldrakes are equally ingenious: during the period of incubation, which lasts thirty days, the male keeps watch on some adjoining hillock, which he only leaves that he may satisfy the calls of hunger, or occupy the post of the female while she quits it for food. After the young are hatched, the parents lead, or sometimes carry them in their bills, towards the sea; and if, interrupted in their progress, it is said that they employ numberless arts to draw off the attention of the observer.†

(85.) The eider duck, and some other birds, pluck the down off their own bodies, to shelter and comfort their helpless young. Others will voluntarily undergo the pains of hunger for the same object; refusing to leave their nests, until perfectly exhausted for want of sustenance: while some, again, are carefully provided with food by their mates,—most of whom, like the sheldrake, watch somewhere near, to ward off, or to give timely notice of the approach of, danger, and to while away the time by his song. — The blue-bellied parrakeet is an instance both of parental and connubial attachment. This bird, like the eider duck, lines its nest with the down stripped from its own breast; and La Vailant informs us that it receives the most assiduous attentions from the male during the whole progress of nidification, — both afterwards uniting to display the same affection towards their young; — these latter, for the first six months after they are hatched, are frequently seen seated by the side of their mother, while her faithful partner places himself close by, and, if unable to reach the little ones, he gives their food to her, and she distributes it to her progeny. Innu-

* Montague's Orn. Dict. vol. ii.

† Bewick's British Birds, vol. ii. p. 343.

merable instances may be quoted of other birds which train their young in a manner equally indicative of parental love. Thus, some of the eagles take out their young, before they are fully grown, on purpose to teach them the arts necessary for securing their prey. The female lark conducts hers, to exercise their powers of flight,—herself fluttering over their heads, directing their motions, and preserving them from danger. Even the butcher-bird, or common woodchat shrike, continues her regard for her offspring even after they have attained maturity; while the latter reward her care, by assisting her in providing for the support of all, until the following spring.* We may close these familiar instances of parental tenderness, exhibited more particularly by our native birds, with the following anecdote, recorded by White of Selborne:—“The



common fly-catcher (fig. 15.) (the *Stopa-rola* of Ray) builds every year in the vines that grow on the walls of my house. A pair of these little birds had, one year, inadvertently placed their nest

on a naked bough,—perhaps in a shady time, not being aware of the inconvenience that followed: but a hot sunny season coming on before the brood was half fledged, the reflection of the wall became insupportable, and must inevitably have destroyed the young, had not affection suggested an expedient, and prompted the parent birds to hover over the nest all the hotter hours, while, with wings expanded, and mouths gaping for breath, they screened off the heat from their suffering offspring.”—The courage of the drongo shrikes, found in Africa, is not less striking than that of their natural allies or prototypes, the tyrant shrikes of America. “This bird,”

* Wood's Zoology, vol. I. p. 319.

observes Dr. Burchell, "is remarkable for its boldness : whenever hawks or ravens approach its nest, it flies out upon them with incredible fury, and drives them away with a harsh angry noise,—attacking the intruder on its dwelling in the rear, and pursuing him to a considerable distance. That a bird, not much larger than a swallow (*fig. 16.*), should have courage to attack another so many times larger, and that, too, a hawk, is a singular fact, but not more



extraordinary than the evident fear and precipitation with which its enemy hastens to get out of its reach."*

(86.) Birds, however, like men, experience other, besides the gentler, passions. The fierceness of the rapacious order is well known ; and the obstinacy with which combats are carried on, even by domestic fowls, is known to every one : but who would suppose that the smallest of all the feathered tribes — the humming birds — would exhibit the most violent, though, at the same time, ludicrous paroxysms of rage. Pennant, when speaking of the *Trochilus colubris* of North America, observes, "The most violent passions sometimes agitate their little breasts : they have often dreadful contests, when numbers happen to dispute the same flower : they will tilt against each other with such fury, as if they meant to transfix their antagonists with their long bills." It may be truly said, that these little creatures are sadly prone to quarrel over their cups — not of wine, but of flowers. We have frequently seen four or five engaged in a flying fight, when disputing the possession of a flowery tree in the forests of Brazil. At such times they fly so swiftly that the eye can scarcely follow them. The violent quarrels of sparrows — particularly in the pairing season — is familiar to most of

* Burchell's Travels, p. 440.

our readers ; but, although desperate for the moment, they appear to be soon reconciled.

(87.) The lion, although subject to fits of ungovernable rage, is not, like the tiger, habitually cruel, and destructive from mere wantonness. Its disposition, indeed, in some instances, has been generous, and even capable of the strongest attachments. This has been proved by the fact of one of these animals living for a considerable time in perfect amity with a dog, which was thrown into its den at the Tower : while another anecdote has been told of a female lion, which was attended by a negro, who had reared her, and which became so fond of her keeper, that, when he quitted Exeter 'Change, she pined away, and soon afterwards died.* Different species of the bear are remarkable for the strength of their parental affection. An interesting instance of this was witnessed by the crew of the *Carcase* frigate, which some years ago proceeded on a voyage of discovery towards the North Pole, when an old bear was attracted, with her cubs, by the smell of a sea-horse, which had been killed some days before, and the flesh of which she carefully divided between her young ones, reserving but a small portion for herself. "As she was fetching away the last piece, the sailors levelled their muskets at the cubs, and shot them both dead ; and in her retreat they wounded the dam, but not mortally. It would have drawn tears of pity from any but unfeeling minds, to have marked the affectionate concern expressed by this poor beast during the last moments of her expiring young. Though she was herself dreadfully wounded, and could but just crawl to the place where they lay, she carried the lump of flesh she had fetched away, as she had done others before, tore it in pieces, and laid it before them ; and when she saw they refused to eat, she laid her paws first upon one, and then upon the other, and endeavoured to raise them up ; — all this while, it was pitiful to hear her moan. When she found she could not stir

* Bingley's Animal Biography, vol. i. p. 244.

them, she went off, and, when she got to some distance, looked back and moaned; and that not availing her to entice them away, she returned, and, smelling round them, began to lick their wounds. She went off a second time as before, and, having crawled a few paces, looked again behind her, and for some time stood moaning. But still her cubs not rising to follow her, she returned to them again, and with signs of inexpressible fondness went round, pawing them, and moaning. Finding, at last, that they were cold and lifeless, she raised her head towards the ship, and uttered a growl of despair, which the murderers returned with a volley of musket balls. She fell between her cubs, and died licking their wounds." * The males are said frequently to evince equal attachment to their mates; and Mr. Hearne relates that he has, himself, seen one of these, after the female has been killed, come and put his fore paws over her, and allow himself to be shot rather than desert her remains.† Even the wolf is susceptible of parental love; and this creature, so dreadful to other animals, pays the most unremitting attention to its offspring, — preparing their nest by plucking the hairs out of their own body, — mixing them with a bed of moss, — and disgorging its food to afford them tender meat. The timid prudence of the fox disappears when she has the character of a mother to sustain, — in the support of which she shows herself fearless and courageous. The domestic hog, although, apparently, a selfish, and, to us, rather a disgusting animal, is by no means devoid of natural affection: on the contrary, if a male and female be inclosed in the same sty while young, if the latter be deprived of her companion, she will pine with, and sometimes, as it has been said, "die of, a broken heart."‡ The affection of the female opossum is aided by the pouch which Nature has so curiously contrived within herself, and into which the young litter fly to shelter themselves from any ap-

* Phipps's Voyage to the North Pole.

† Hearne's Voyage, p. 386.

‡ Bingley's Animal Biography, vol. i. p. 513. — This may be questioned.

proaching danger; a habit, in fact, belonging not merely to all marsupial or pouched quadrupeds, but to certain fishes of the genus *Syngnathus*, and probably to the opossum shrimps. The common roebuck, without having a similar hiding place for her little ones, yet, in moments of danger, carefully conceals them in a thicket, and then suffers herself to be chased.*

Monkeys are peculiarly affectionate to their young; — they tend and watch them in the most singular manner, and appear to pursue a plan both as to their nurture and education. They not only procure every possible comfort for their little ones, but they also preserve amongst them a due share of discipline, and seem even to hold them in subjection: they appear to watch their antics with great delight; but if, while wrestling with each other, they become violent or malicious, immediately springing upon them, seizing their tails with one paw, and administering correction with the other; nor, if they elude the parent's grasp, will they make any show of rebellion, but rather approach in a wheedling and caressing manner, as if seeking a reconciliation.† Lichtenstein observes, that the affection of the African elephants for their young is very great. He had been assured by an old hunter, who witnessed the fact, that the female elephant will take up her wounded calf in her mouth, and run away with it, just as we may suppose a cat is in the habit of doing with her kitten.‡ A singular instance of the affection of animals for others of their own kind, is the following: — The Rev. Mr. S——, of M——, Denbighshire, had a favourite Newfoundland dog, who lived at large, partook of the best of everything, and exercised his power with great mildness. He was seen, more than once, leaping the gate which separated the yard of the house from the farmyard, and carrying large bones, that had been given him, to a sporting dog who was tied up in the stable.§

* Shaw's Zool. vol. iv. p. 294.

† Bingley's Anim. Biog. vol. i. p. 87.

‡ Lich. Trav. p. 214.

§ Sheppard's Autumn Dream, p. 171.

(88.) Generosity is not unknown even among jackals,—for we may surely give that epithet to the assistance which they will occasionally afford to a brother in distress. A Mr. Kinlock, well known at the time in India as an excellent sportsman, having one morning chased a jackal which entered a thick jungle, found himself under the necessity of calling off his dogs in consequence of an immense herd of jackals which had suddenly collected on hearing the cries of their brother, which the hounds were worrying. They were so numerous, that not only the dogs were defeated, but the jackals absolutely rushed out of the cover in pursuit of them; and when Mr. Kinlock and his party rode up to whip them off, their horses were bitten, and it was not without difficulty a retreat was effected. The pack of hounds was found to have suffered so severely as not to be able to take the field for many weeks after. A hunted jackal seems to be impressed with the instinct, that, if he only get in the vicinity of his brethren, he is certain of their help; and so surely do they rely upon this, that they often shape their course in that direction where they know other jackals are to be found.

(89.) The marine tribes are no less distinguished



for parental affection than the land quadrupeds. The females of the Arctic walrus (*fig. 17.*), if attacked on the ice, always first secure the safety of their young, by casting them into the sea; and then, returning to the enemy, they give vent to their rage. If, however, they lose their lives in the defence of their offspring, the latter

will not be induced to quit the inanimate remains.*

The sexes of the common whale evince an equal attachment to each other. Anderson, in his *History of Greenland*, informs us, that some fishermen having struck one of two whales, a male and female, that were in company together, the wounded animal made a long and terrible resistance, and upset a boat, containing three men, with a single blow of its tail: its companion fully seconded its efforts; and when at length the poor creature sunk under its wounds, the other, with tremendous bellowing, stretched itself upon its dead associate, and shared its fate. The dolphin (*Delphinus delphis*) carefully suckles and tends its young, carrying them gently under its pectoral fins, sporting with, and assiduously exercising them in swimming. The male, also, attaches himself for life to his female companion, and becomes her most zealous guardian and protector.*

(90.) Filial affection is less common among quadrupeds, and, indeed, all animals, than that evinced by the parent. There is, comparatively, little appearance of this feeling on the part of the young; and when the parents have once reared them to maturity, a separation usually ensues. But with the American bison this is not the case; and the following affecting trait, related by Mr. Turner, who resided for some time in America, proves that the attachment of the dam is reciprocated by her offspring. "Whenever," he observes, "a cow bison falls by the hand of the hunters, and happens to have a calf, the helpless young one, far from attempting to escape, stops by its fallen dam, with signs expressive of strong natural affection. The dam thus secured, the hunter makes no attempt on the calf (knowing that to be unnecessary), but proceeds to cut up the carcase; then, hanging it on his horse, he returns home, followed by the poor calf, which thus instinctively attends the remains of its dam. I have seen a single hunter ride into the town of Cincinnati, followed in this manner by three calves, all of which had just lost their dams by this cruel hunter."

* Griffith's Cuvier, vol. iv. p. 452.

(91.) The courage of some quadrupeds, particularly when under the influence of parental affection, is most remarkable: in such circumstances, nothing daunts the mother in the defence of her offspring; and she will then boldly attack a ferocious animal, which at other times she herself would flee from. Among quadrupeds, this is very conspicuous in the Indian buffaloes, which, as an eye-witness remarks, scent a tiger very quickly, and by their snorting and agitation soon communicate the alarm to the whole herd. A calf will now and then straggle—when, of course, he runs a risk of being carried off: if, however, the little one's voice be heard, or the mother suspect any danger, nothing can exceed her uneasiness; the signal is given to all, and no time is lost in attacking the savage marauder. Even a single buffalo will not hesitate, under such circumstances, to rush at a tiger; whence we may judge of the spirit and impetuosity with which a whole herd proceed to the charge. The herdsmen are so fully satisfied on this point, as to feel no doubt of their own safety, so long as they continue with their cattle. Few accidents, under such circumstances, ever happen: the herdsmen generally remain seated on their buffaloes, driving them to the best grass, and, by their usual calls, keeping all within a proper compass. They usually graze their beasts during the night,—often in the midst of gloomy covers, in which tigers abound,—yet without apprehending any danger.

(92.) Quadrupeds, more than any other animals, attach themselves strongly to the human species. The dog is a familiar instance of this; and forcibly did the indefatigable Dr. Burchell feel the value of this mute but honest friend, when, wandering over the vast plains of Africa, he turned towards his dogs to “admire their attachment,” and, harassed and distressed by the conduct of his followers, resorted to them as his only friends, and “felt how much inferior to them was man when actuated only by selfish views.” Even the poor ass (*Equus Asinus*) is not only a pattern of meekness and

submission to the scorns and buffetings of this world, but is susceptible of great attachment towards its master, whom it will scent at a considerable distance, distinguish in the midst of a crowd, faithfully follow, and even caress him. Innumerable instances of this attachment may be quoted.

(93.) Quadrupeds are susceptible of many of the softer emotions ; and of this, many interesting instances are upon record. The docility and amiable qualities of the elephant are well known ; while the perfect subjection into which it can be brought towards a creature so inferior in bodily strength as man, is as admirable as it is extraordinary. In their wild state, elephants are very sociable, — always marching in large troops, — the oldest being in the front, the young and sickly in the centre, and the middle-aged making up the rear. Mr. Bruce gives a striking instance of the affection of a young elephant for its mother, as exhibited in a hunt, in which the dam being severely wounded, it rushed impetuously out of the thicket, in which it had taken shelter, upon the men and horses ; and he adds, “ I was amazed, and — as much as ever I was upon such an occasion — afflicted, at seeing the affection of the little animal in defending its wounded mother, heedless of its own life or safety. I therefore cried to them, for God’s sake to spare the mother ! — but it was then too late ;” and the young elephant, he tells us, fell a victim to its filial affection.

(94.) Quadrupeds, more than any other animals, display the ungovernable passions of anger, hatred, cruelty, and revenge ; and at these times are often formidable enemies, not only to each other, but to mankind in general. The whole of the carnivorous animals, whose lives are supported by blood, naturally exhibit the most savage dispositions. It has been aptly said of the tiger, that it is fierce when unprovoked, and “ cruel without necessity.”* The wolf is of a rapacity which nothing can satisfy. The panther (*Felis pardus*) is much more

* Smet, Phil. vol. i. p. 373.

dreaded at the Cape of Good Hope than the lion; for, whereas the latter always gives notice of his approach by terrific roarings, the former steals treacherously on his prey, and bears it away before any one is aware of his approach.* The same author declares of the rhinoceros, that he carries on his manœuvres in the same wary and dexterous manner,—being “once a traitor whom nothing betrays, an assaulter whom nothing terrifies, and a fury whom resistance renders implacable.”†

(95.) The savage disposition of the Indian rhinoceros is well illustrated by the following anecdote‡:—Two officers, belonging to the troops quartered near Patna, went down the river to shoot and hunt. One morning, near daybreak, when they were about to set off on their day's hunt, they heard a violent uproar, and, on looking out, found that an immense rhinoceros was goring their horses—both of which, being fastened by their head and heel ropes, were, consequently, unable either to escape or to resist. The servants were so terrified that they took to their heels, and concealed themselves in the neighbouring jungle. The gentlemen had just time to climb up into a small tree, when the furious beast, having killed the horses, turned its rage upon their masters. They were barely out of his reach, and by no means exempt from danger,—especially as he assumed a threatening appearance, and seemed intent on their downfall. After keeping them in dreadful suspense for some time, and using some efforts to dislodge them, seeing the sun rise, he retreated to the forest; not, however, without occasionally casting an eye back, as with regret, at leaving what he wanted the power to destroy. This savage individual continued, for some time after, to infest the country, so as to render the roads impassable. In consequence, however, of a handsome reward being offered, he was at length killed by an adventurous native,—being shot with a large gun that carried an iron

* *Le Vaillant's Travels in Africa*, vol. i. p. 63.

† *Ibid.* vol. iv. p. 236.

‡ *Williamson's Sports*.

ball ; not, however, before many travellers and villagers had fallen victims to his ferocity.

(96.) Ounces, leopards, conguars, lynxes, weazels, polecats, and, indeed, all the carnivorous animals, however small, are extremely fierce by nature ; and even the wild cat of Britain has all the dangerous qualities, in a less degree, of its kindred species. The hamster rat (*Mus Cricetus*) is said to attack every creature that comes in its way, without reference to their size or superiority ; to be the victim of the blindest rage ; and to allow himself to be beaten to pieces, rather than submit. He even wars with his own species, without excepting the females ; and their battle terminates only with the death of one of the combatants, which, afterwards, serves as a repast to the cruel victor. The *Myrmecophaga jubata*, or great anteater (*fig. 18.*), is,



although a harmless animal when unmolested, stated to be an unrelenting foe when once it gets its enemy within its reach ; it is then said to fix its claws firmly into the sides of its antagonist, and will suffer itself to be destroyed sooner than relinquish its hold, even of a dead adversary.

(97.) Cowardice, which, in man, is the usual accompaniment of an ungenerous, or an ignoble spirit, is equally conspicuous in such brutes as are the most treacherous and bloodthirsty. "Persons unacquainted," observes Williamson, "with the true character of the tiger, would expect to see him (in those fights which are sometimes exhibited in India, between this animal and the buffalo) attack his adversary as soon as he entered the area ; — but, no ; as soon as the buffalo

makes his appearance, the tiger — which, perhaps, till then, does not betray any marked apprehension, or, probably, seems to menace the spectators, swelling his fur, and showing his teeth, or occasionally snarling and lashing his sides with his tail — all at once sinks into the most contemptible despondency. He sneaks along under the palisade, crouching, and turning on his back to avoid the buffalo's charge. He tries every device his situation will admit; and often suffers himself to be gored, or to be lifted from his pusillanimous attitude, by the buffalo's horn, before he can be induced to stand on the defensive. When, however, he really does summon up courage to oppose his assailant, he displays wonderful vigour and activity, although he is generally conquered.

(98.) The *Phoca Ursina*, or ursine seal, according to Pennant, is the victim of a blind jealousy, which leads him to fight his companions, and even to immolate his females, if the latter are in any way interfered with by the former. Each seal has from eight to fifty females, over whom he exercises the greatest tyranny; though, at the same time, he exhibits the fondest affection for his young — standing resolutely on the defensive, if they are attacked, while the mother carries them away in her mouth. But should she chance to drop them, he instantly leaves his enemy, directs all his wrath upon her, and beats her violently on the stones until he “leaves her for dead. As soon as she recovers, she comes, in the most suppliant manner, to the male, crawls to his feet, and washes them with her tears: he, in the mean time, stalks about in the most insulting manner; but, in case the young one is carried off, he melts into the deepest affliction.”*

(99.) That the passions of animals may be excited, both for evil as well as for good, by artificial means, is evinced by the training of elephants, and even oxen, for war. Le Vaillant † purchased one of the latter,

* Pen. Hist. Quad. vol. ii. p. 529. — This account we suspect to be somewhat exaggerated.

† Second Travels, vol. ii. p. 158.

which he describes as remarkable for his elegant form as for his gigantic size, — being the most beautiful of his species he had ever seen. Its head was majestically armed with two immense horns, which retired from each other, with the utmost symmetry, to form two perfect semicircles, their summits being suddenly bent forwards, leaving a space of four feet eight inches between them: they had been made to grow in this figure by the owner, who highly prized the beast. These oxen, trained thus, appear to be changed in their very nature; although, of course, the most ungovernable are selected for this purpose. Being driven on against the enemy, they become furious at the sight of the adverse host; rush on the men, trample them under their feet, gore them with their horns, and pursue them in their flight, till they have deprived them of life. They are also employed in defence of flocks and herds.* Naturally courageous, they are not only capable of repelling wild beasts, but they even venture to attack them; so that a hyæna, however hungry, will never come near a flock guarded by two or three of these formidable animals, — a number of which, as our traveller asserts, will even make head against a lion.

(100.) That animals, naturally of a most fierce disposition, may, in some measure, be domesticated, is well known; and, perhaps, no instance upon record is more remarkable than that which is now, or was lately, before the public, in the exhibition of M. Van Amburgh. It would be very interesting to know by what means the natural craving for blood, in such beasts of prey as lions and tigers, has been overcome, or kept in abeyance, by this ingenious person. But, although the accomplishment of so difficult a task is highly to his credit, and appears to Europeans a perfect novelty, it has long been practised, with nearly equal success, upon the royal tiger, by the fakirs, or mendicant priests, in various parts of Bengal.† These appear to follow

* Le Vaillant's Second Travels, vol. ii. p. 178.

† Williamson's Oriental Sports, vol. ii. p. 34.

their master on most occasions, and to be completely under his authority. But then they are rarely, if ever, fed with meat; their nourishment consisting almost entirely of boiled rice and *ghee*. Raw meat is well known to render the tiger bloodthirsty, and seems to awaken its dormant ferocity: every latent propensity to destruction is thus called forth into action, and the whole deportment of the animal changes. Boiled meat is known to be equally nutritious; and when mixed, as is always done in feeding dogs in India, with boiled rice, it is found to render them far more tractable. "These eleemosynary tigers," observes captain Williamson, "range at large, but they do not stray far from their keepers. I confess that one, which I visited at Colgong, rather disturbed my mind, by a peculiar fierceness in its eyes, which, although I knew the animal to have been perfectly harmless for several years, seemed to denote an inward wish by no means favourable to my safety. There is, in short, a very peculiar appearance in these animals, at the sight of a stranger, which seems inseparable from the tiger's nature. The fakir seemed to possess ample authority over the tiger in question, which certainly manifested no dislike to his visitors; but the animal paced slowly round us, with a seeming inquisitive air, creating sensations not of the most pleasant nature. He was not, indeed, very large, but could with ease have destroyed the whole party. This fakir used to walk, almost daily, in the town, accompanied by the tiger, which apparently created no alarm among the inhabitants, who seemed to have full confidence in his innocence. His master, however, interdicted all persons from touching the animal; a caution which, probably, tended much to preserve its inoffensiveness.

(101.) Fishes, in general, are no doubt influenced, in some degree, by the same passions as other animals; but the element in which they live opposes an insuperable bar to investigations on this part of their history. As none of this class suckle their young, so the

latter, from the moment of their birth, are entirely independent of their parents, and capable of providing for themselves. Nothing, therefore, calls for the exertion of the parental feeling; and, as fishes prey chiefly upon one another, and some species are continually at war with others, the lives of all may, as far as we can conjecture, be considered as a constant "scene of hostility, violence, and invasion." The great white shark (*Squalus Carcharias*), and nearly the whole of the extensive family to which it belongs, are particularly distinguished for their rapacity. The wolf-fish (*Anarrhicas Lupus*, fig. 19.), although much smaller, is yet, from



its ferocity, as terrible to the smaller tribes of fish, as the animal from which it derives its name is to those on land. Its jaws are armed with strong cutting teeth in every direction; so that it could snap off the finger of an incautious person immediately. The sword-fish is possessed of uncommon fierceness; and never encounters a whale, without instantly attacking it.

(102.) Insects exhibit various passions; and these are not only manifested in their actions, but expressed by gestures and noises, no doubt well understood by themselves. The sounds they emit are, indeed, sometimes caused by their various motions or employments; but many are the expression of their own peculiar feelings. Thus, numerous beetles, when alarmed, utter a shrill cry, which has been compared to the feeble chirp of birds. The humble bee, if attacked, will give vent to the harsh tones of anger; and the hive bee, under the same circumstances, emits a shrill and peevish sound, which becomes doubly sharp when it flies at an enemy or intruder. A number of these insects, being

once smoked out of their hive, the queen, with many of her followers, flew away : upon this, the bees which remained behind immediately sent forth a most plaintive cry ; which was succeeded by a cheerful humming, when their sovereign was again restored to them. The passion of love, too, as well as fear, anger, and rejoicing, seems, in insects, as in birds, to come forth in song. The grasshopper and *Cicadae* (*C. Italica*, fig. 20.) tribes



are particularly famed for these amorous ditties, which are often so loud, monotonous, and deafening, in warm countries, during the meridian heat, as to produce anything but pleasure. These sounds, however, proceed alone from the males ; the females not*possessing that particular apparatus (*a*) by which they are produced.

(103.) The affection of insects for their young is very conspicuous ; but in the care which they take to lay their eggs in such substances as will afterwards afford them fitting sustenance, we shall discern more the effects of instinct than of maternal affection. Many instances, however, may be adduced, in which this natural passion is in operation. The mason wasp of Europe and America (*fig. 21.*) insinuates a living caterpillar into the cell in which it deposits its egg ; in the course of a few days, it incloses another in the same way ; and thus continues these supplies of food until the young one has attained its full growth. The common earwig

hatches her eggs in the same manner as a hen, and broods over her progeny with affectionate assiduity,—continuing frequently in the same sitting posture for hours.



Baron de Geer, finding one in this position, removed it into a box, in different parts of which he scattered the eggs. The mother, however, speedily carried them in her jaws into a heap, and sat

on them as before.* The mole cricket (*fig. 22.*), an in-



sect by no means uncommon in this country, forms a cell in the moist earth for the accommodation of her eggs, which she afterwards carefully closes,—stationing herself close to the entrance, to prevent the access of enemies. It has been said, indeed, that nothing can exceed the care of these insects in the preservation of their young. Wherever a nest is situated, fortifications, avenues, and intrenchments surround it; there are, also, numerous meanderings which lead to it; and a ditch encompasses the whole, which few other insects are capable of passing.† A species of field bug found in this country (*Cimex griseus*), brings up her family,—which generally consists of thirty or forty young,—leading them about as a hen does her chickens, and

* De Geer, vol. iii. p. 262.

† Bing. Anim. Biog. vol. iii. p. 270.

never leaving them for a moment. De Geer having disturbed one of these families, which inhabited the branch of a birch tree, the mother showed every symptom of excessive uneasiness; and, far from attempting to escape, she continued close to her little ones, incessantly flapping her wings, as if to preserve them from danger.* The care which is taken of, and the attention which is paid to, the young, by such insects as live in societies, is well known; but it is not, perhaps, so generally understood that, among ants, as soon as ever the female has begun to lay her eggs, she tears off the four wings by which she had, before, been enabled to fly gaily through the air,—but which are, now, an impediment to the discharge of her maternal duties,—and devotes herself, in future, to the increase and preservation of her family. M. P. Huber was, several times, a witness of this extraordinary proceeding. He describes the manner in which these courageous insects stretch their wings in various directions; and, after sundry violent contortions, at length get rid of their incumbrances.† If an ant's nest should be disturbed, the whole community may be seen instantly flocking towards a heap of little white oblong bodies, the safety of which they put every nerve in motion to secure. These bodies are the embryo young; and, as a proof of the devoted attachment which is exhibited for them, an observer, on one of these occasions, having cut an ant in two, the mutilated animal, far from ceasing its exertions, actually contrived to convey ten of these white masses safely into the interior of the nest, before itself expired.‡

(104.) Insects experience anger as well as love; and, surprising as it may seem, their little bodies can be exercised in cruelty. The orator mantis (*Mantis Oratoria* Lin.) is of so unnatural a disposition, that, if in a state of captivity, it will actually destroy and devour its own species,—fighting with the utmost fury, until death

* Int. to Ent. vol. i. p. 361.

† Huber, p. 109.

‡ Int. to Ent. vol. i. p. 366.

shall terminate the battle. "Roesel, who kept some of these insects, observes that, in their mutual conflicts, their manœuvres very much resemble those of hussars fighting with sabres; and sometimes one cleaves the other through at a single stroke, or severs the head from the body."* The manners of the scorpion (*fig. 23.*) are equally fierce and revolting. Not only is it



dangerous to its enemies, but terrible to its own species; so that, out of one hundred of these insects, which Maupertuis inclosed together in a vessel, such was the bloody scene that ensued, that, in a few days, only fourteen remained alive, having killed and devoured the rest of their companions. Spiders, also, appear to be subject to violent paroxysms of anger; their mutual encounters being long and obstinate, whenever two of equal size meet each other,—neither of them being found to yield. Leeuwenhoek watched a conflict of this description between two large spiders, both of whom grappled together furiously with their fangs, till one of them lay dead upon the spot,—its body being as wet with the blood flowing from the wounds received, as if water had been poured upon it.† Yet, although thus ferocious in their combats, they are anxiously alive, to the preservation of their young, and will leave no means untried to secure it. One species, the *Aranea saccata* Lin., lays her eggs in a little silken bag, attached

* Shaw's Zool. vol. ii. p. 119.

† Leeuwenhoek, vol. i. p. 38.

to the extremity of her body ; and this treasure she carries about with her everywhere, appearing in the greatest distress if in any way deprived of it. By way of experiment, Bonnet delivered up this precious burden to that cruel insect the ant lion ; when the distressed mother, far from deserting her charge, made the most extraordinary efforts to recover it, — persevering, regardless of her own danger, and resolutely remaining on the spot, in spite of every effort to force her to leave it. * Crabs appear to be naturally quarrelsome animals ; and the combats carried on by the common species, particularly, are obstinate and vindictive. Their large and often deeply-toothed claws are most offensive weapons, with which they can easily tear off the legs of their own kind, as well as inflict severe injury on their other enemies.

(105.) On reviewing the preceding anecdotes, collected from creditable authorities, it results, that all animals gifted with locomotion are subject to modifications of the same passions as alternately sway the human mind. The parental instinct of affection is, perhaps, the strongest, or, at least, the most universal ; because this is the most important for the future preservation of the species, — without which, supposing it did not exist to the extent it actually does, the world would, eventually, be depopulated of its animal inhabitants. The opposite feelings, of ferocity, anger, or vindictiveness, arise, on the other hand, from different causes, which it is not difficult to analyse. Such predatory or carnivorous animals as the beasts and birds of prey are naturally cruel ; for that food which is alone congenial to their nature, could never be obtained, were their dispositions otherwise. With the majority, however, hunger is the inciting cause for bringing these passions into action ; just as injuries are with those of a milder nature. It is said that the lion never attacks its prey from sheer wantonness, — without being propelled to destroy it from the cravings of appetite : and,

* Int. to Ent. vol. I. p. 363.

although the tiger's thirst for blood has been generally stated to be insatiable, it can scarcely be supposed that it would destroy, without, in the first instance, being urged on by hunger. Nevertheless, there certainly appears an unaccountable vindictiveness in certain rapacious animals, when surrounded by their weaker foes or their favourite game. Wolves and wild dogs, on getting among a flock of sheep, will wound or kill many more than they could possibly devour: and the great-footed hawk of America, on darting into a flock of ducks, will strike down, right and left, more than a dozen of their number; and, ultimately, fly off with perhaps only one or two. The weazels and ferrets have the same propensities in regard to rabbits and rats; and the Egyptian ichneumon is universally described as a most destructive creature, carrying on a war of extermination among the reptiles of its own country. No such habits, however, with the above exception, belong to the generality of carnivorous birds, — at least, so far as we yet know; for, although the shrike appears to kill more than it eats at one time, the remainder of its game is stuck upon a thorn, or sharp-pointed twig, only to be devoured at leisure.

(106.) The next head under which we may class the violent or injurious passions of animals, is that of *jealousy*. This is always confined to the male sex; and is an instinct implanted in them by Providence, by which a permanent good is gained to the whole community, by the injury, or perhaps sacrifice, of a few. It is well known that the males of nearly all quadrupeds, during the season of courtship, however peaceably they may live together at other times, are then actuated by the most violent and deadly feelings of jealousy towards each other; so much so, indeed, that desperate, and often fatal, combats take place between them, for the possession of the females. It often happens, particularly among the antelope family, that the young males, in the first place, separate themselves, or are driven away from the herd, as if by the common con-

sent of all parties — yet without receiving any injury from their seniors. No sooner, however, are they departed, than the elder males commence vindictive battles among themselves: the weaker and the more aged are thus killed or driven away; and the most powerful only being left with the females, the continuance of the race, in all its purity and vigour, is thus wisely provided for and accomplished. We suspect the same takes place, though less generally, among birds; and, perhaps, the sharp running battles, so constantly witnessed in the spring, among a party of sparrows, may be attributed to the same causes. At all other seasons, it deserves especial remark, that every animal, when in a state of nature, and unprovoked, looks upon one of its own kind more as a friend than an enemy. Provocation, or some inciting cause, is necessary to commence a quarrel, in all but the worst dispositions. Dogs, indeed, frequently fall out and fight, apparently without a cause; but this is in their domesticated state; and, besides, we do not yet know, and probably never shall, the different causes of offence which the brute creation may take from each other.

(107.) *Self-preservation* is the last head to which we may refer all the remaining evil passions of the brute creation. The most peaceful and gentle of animals have this instinct implanted at their birth, and generally have the means given for the preservation of life, — whether these means are offensive or defensive. The North American bears, unless pressed by extreme hunger, will rarely assault a traveller who refrains from molesting them. Mr. Drummond, in his excursions over the Rocky Mountains, had frequent opportunities of observing the manners of the grisly bears (*Ursus ferox**); and it often happened that, in turning a point of a rock, or sharp angle of a valley, he came suddenly upon one or more of them. On such occasions, they reared on their hind legs, and made a loud noise. He kept his ground, however, without attempting to

* Northern Zoology, vol. i. p. 27. pl. 1.

molest them ; and they, after attentively regarding him for some time, generally wheeled round and galloped off ; though, from their known disposition, there is little doubt but he would have been torn in pieces, had he lost his presence of mind, and attempted to fly— or, it might have been added, attacked the bears. This anecdote shows also that some animals, on ordinary occasions, have a sort of respect for man, when he does not confess his weakness. Notwithstanding all that has been said of the savageness of the rhinoceros, it does not appear that its rage and vindictive powers are put forth otherwise than in self-defence ; so that it is somewhat inconsistent to give such epithets to that resolute courage which would be extolled in man under similar circumstances. The anteaters and the sloths of America are among the most timid of animals ; and yet, when their life is at stake, the wounds which they inflict with their claws, and their pertinacity in retaining their grasp, would lead many people to term them savage and vindictive. All animals, in short, that have been furnished with means of defence against their enemies, use those means to the best advantage ; and, therefore, strictly speaking, we cannot attribute to them, on such occasions, any of the malevolent passions, which more properly belong to their assailants ; — they merely exert those powers, for the preservation of their own lives, which have been given them for that especial purpose.

CHAP. IV.

ON THE MOTIONS OF ANIMALS.

(108.) *THE motions or actions* of animals are almost as various as their make and appearance, and are generally indicative of a wisdom and intelligence which can

spring from no other than a Divine source, and which is impressed upon all the productions of Omnipotence. The number and perfection of these motions are alike worthy of observation; a peculiar organisation being given for each species, comprising the most complicated yet exquisite machinery, and remarkable for equal strength and flexibility. Their structure, too, is always precisely adapted to the necessities of the animal for which it is formed;—those furnished with destructive weapons, or which are gifted with extraordinary skill or power, being generally found to be much slower in their movements, than others of a weaker-kind; while those—such as worms, caterpillars, &c.—whose food is nearest at hand, and who are not, therefore, compelled to make any wide range in search of provision, are incapable of that rapid motion which distinguishes others not provided in a similar manner.

(109.) The locomotive powers of animals are nicely proportioned to their size and structure. A flea, for instance, can leap some hundred times its own length; but, were an elephant, or any other large-bodied animal, to possess the same elastic power, its weight would prove its destruction, and it would be immediately crushed to pieces. Upon the same principle, some creatures—as worms, spiders, &c.—are enabled, by their comparatively small specific gravity, and by the softness of their texture, to fall without injury from heights which would be fatal to those of a heavier construction.* Striking, indeed, and numerous are the proofs of this wise and perfect adaptation of want with power—means with a contemplated end; and, as we proceed with our inquiry, we shall find that there are, perhaps, few things in the arrangement of the animal kingdom more really deserving our attention, than the subject immediately before us.

(110.) The motions of animals are necessarily active—as walking, leaping, flying, or swimming. In a passive state, they either stand, roost, or repose on the

* Smell. Phil. vol. i. p. 78.

ground. All these states are subject to different modifications ; and these several peculiarities it will now be our business to detail.

(111.) The minute tribes forming the *Acrita* may be first noticed ; and, here, how endless is the diversity of motion among a class of beings scarcely perceptible to our vision, and infinite numbers of which mock the most ingenious efforts of art to discover. The motions of those animalcules which are unattached, are singularly varied ; and, among these, we may notice two species of *Vorticella*—the *rotatoria* and the *convellaria*. The latter, to the naked eye, has the appearance of a small white speck ; but, when examined through a microscope, it resembles a small bell-shaped flower : it is seen, every now and then, to contract its stem, with a kind of convulsive motion, into a spiral form ; and again returning, in a short time, to its former length.* The *Vibrio Proteus*—an animalcule found in the slimy matter which coagulates upon the side of a vessel, the water in which has been impregnated with some animal or vegetable substance—will swim about with great vivacity. Sometimes it makes a stop for a minute or two, and stretches itself out, apparently in search of prey. When alarmed, it immediately draws in its neck, becomes more opaque, and moves sluggishly. It will then, perhaps, instead of its former long neck, push out a kind of wheel machinery, the motions of which draw a current of water, and along with this, probably, its prey. Withdrawing the wheel, it will sometimes remain almost motionless for one or two seconds, as if weary ; then, protruding its long neck, will often resume its former agility, or adopt, in succession, a multitude of different appearances.† The *Volvox Globator* moves its little body over and over, spinning like a top, or sometimes moving calmly along without turning round ; while the *Volvox Bulla*, which is scarcely visible to the naked eye, presents, under the microscope, a series of movements of the most curious and unceasing variety.

* *Blag. Anim. Blag.* vol. iii. p. 490.

† *Id. ibid.* p. 493.

(112.) The locomotive powers of zoophytes are, in general, exceedingly limited. Very many of them are firmly fixed to stones, or rocks, from which they never move; and their movements are, consequently, restricted to those *tentacula*, or feelers, with which they seize upon passing objects for food. Many polypes do this in a rapid and violent manner; but the process of swallowing or absorbing this nourishment is carried on in a much slower way; while the amazing contractile and extensile power which they possess, enables them to devour animals much larger than themselves. The *Actinæ*, or sea anemones, are said to have a very slow progressive motion, which is supposed to be performed by the base being loosened from the place to which it was fixed, — the *tentacula* being employed as so many legs. These *tentacula* are, indeed, peculiarly important auxiliaries to this tribe; and Mr. Hughes, while observing one of these singular creatures in the island of Barbadoes, noticed four dark-coloured threads, somewhat resembling the legs of a spider, which rose from the centre of the animal, with a quick spontaneous motion from one side to the other, and which he conceived to be arms, or feelers which closed like forceps to secure and retain the prey.* In several sponges, a considerable motion has been observed; and Mr. Ellis assures us that one of the cock's-comb sponges (*Spongia cristata*), which was taken off the rocks near Hastings, in Sussex, on being put into a glass vessel of sea water, could be perceived to suck in and squeeze out the water "through the rows of holes or little pores along the tops, — giving evident signs of life."†

(113.) The most perfect or typical of bivalve shells are free, and are thus endowed with locomotion; but several families are firmly fixed to other substances. Among these latter are the edible oyster, and other species of the same group. The abbé Dicquemaire, however, informs us that the common oyster occasionally moves itself by resorting to the singular ex-

* Ellis's Hist. of Zool. p. 8.

† Ibid. p. 186.

pedient of ejecting water with some force out of its shell ; by which means it is enabled either to throw itself forward, or to start off in a lateral direction. He says " that any person may amuse himself with the squirting and motions of oysters, by putting them in a plate placed in a horizontal position, which contains as much water as is sufficient to cover them."

(114.) The common muscle has, "for an instrument of motion, a tongue, or foot, capable of considerable elongation, and also of being shortened into the form of a heart. When it feels inclined to change its place, it thrusts the foot out of the shell, and raises itself on its edge ; then, by raising this to as great a distance as it will extend, it uses it as a kind of arm, drawing the body up to it ; and thus it proceeds until it has found a convenient situation. If the muscle be inclined to make this its residence, the instrument of its motion is now put to a very different employment, — in opening those silken threads that fix it firmly to the spot, and, like a ship at anchor, enable it to brave all the agitations of the water." *

(115.) The common cockle (*Cardium edule*, fig. 24.)



above all other bivalves, has the power of locomotion most developed. By means of the large triangular foot which is so perceptible when the shell is opened,

* Anim. Biog. vol. iii. p. 567.

it not only digs into the sand, but is likewise enabled, by the great power of inflection which is vested in this instrument, to draw the glutinous matter which proceeds from it into threads, and thus to secure itself in its position.*

(116.) Among univalves, the *Helices*, or snails and slugs, have a different mode of progression; the disk of the belly, the sides of which are often dilated, compensates for the absence of feet, and enables the animal to glide along in the way that almost every one has witnessed; while the glutinous slime which is emitted by its body, enables it to adhere firmly to even the smoothest surfaces. The *Cephalopoda*, or cuttlefish tribe (fig. 25.), are supplied with numerous arms, all liberally furnished with cups, or suckers; and by these they seize their prey, perform the most important movements, and attach themselves to rocks with such a strong adhesion, that it is often more easy to tear off the arms, than to separate them from the substance to which they are affixed. Many are furnished with two triangular fins, one on each side the body, which give them the power of passing as rapidly through the water as ordinary fishes. There is reason to suppose that the arms above alluded to likewise perform the office of feet, by which means these singular animals can crawl at the bottom of the sea: hence



the scientific name they have acquired of *Cephalopoda*, signifying a head surrounded with feet. These, the *Pteropoda*, and *Heteropoda*, are the only *Mollusca*, tes-

* Anim. Biog. vol. iii. p. 450.

taceous or naked, which do not absolutely crawl on their belly; and who are, consequently, provided with locomotive members particularly designed for this purpose.

(117.) All *reptiles* have the power of locomotion; and yet some possess, and others are altogether destitute of, feet: in this latter case,—as seen in the whole of the snakes,—their movements are performed by an undulating motion, known to every one, but which may be thus defined;—it consists in bringing up the tail towards the head, by bending the body into one or more curves; then resting upon the tail, and extending the body; thus moving forward, at each step, nearly the whole length of the body, or one or more of the curves into which it was formed.* The progress of serpents is often very rapid,—so much so, indeed, as to enable them sometimes to overtake a man. This is, indeed, not a little surprising, in an animal that is absolutely destitute of feet: there is reason to believe, however, that the broad transverse scales, which are on the belly of all such serpents as move rapidly, materially assist them, not merely by their smoothness, but by their edges coming into contact with the surface over which the animal glides, and thus aiding it in propelling the body forwards. Nor is the motion of these reptiles confined to the ground; for they not only climb trees in a spiral direction, but absolutely swim with inconceivable facility, although unprovided with fins, or any members analogous thereto. Instances have been recorded, of the common snake having been met with, more than once, in the open channel between the coast of Wales and the island of Anglesea,—as if they had taken their departure from the former, in order to reach the latter place. In India, however, there is a distinct family of venomous serpents, forming our *Hydrophida*, whose tails are so much compressed as to resemble an oar. These reptiles live only in the water; but they swim with the head just above the surface,—since their respiration is very different from that of eels, which, in

* Phil. of Zool.

outward appearance, they so much resemble. The land tortoise, although provided with feet, is proverbial for the sluggishness of its motions: this is chiefly owing to the situation of its legs, which, being placed very much towards the sides of its body, are so wide apart as to create considerable awkwardness of movement.

(118.) The whole order of *lizards*, with the exception of the *chamæleons*, are so extremely quick and rapid in their evolutions, that it is almost impossible to catch or overtake them before they reach a place of shelter. The *chamæleons*, on the contrary, are particularly slow: they may be almost said to take their food without the trouble of hunting for it, — at least, so far as their locomotive powers are concerned. The habits of one of these singular animals, we had the opportunity of observing while in Malta, — having procured it from Egypt: it merely removed from one station to another in the room, according as the rays of the sun entered the casements, and attracted the flies; these it would catch only by darting out its long tongue, — the animal, in all other respects, remaining quite motionless: on such occasions, it usually assumed the tint of the object nearest to it. Alligators and crocodiles, although capable of walking slowly upon land, move in the water — to which their webbed feet, and long compressed tail, are so well adapted — with considerable speed, darting along with great velocity when about to seize their prey, — although somewhat embarrassed by their large size, when they attempt to turn suddenly round. Even reptiles can boast several species possessing the power of flight; the flying lizards of India, of the genus *Draco*, being provided with membranaceous wings projecting from each side of the body, which enable them to fly from one tree to another in search of food, — something in the same way as the flying squirrels of America.

(119.) Birds are the most highly gifted of all animals, in their powers of locomotion: these consist of

flying, swimming, walking, running, and diving ; and are performed in very different ways and degrees.

(120.) Flight is, to most birds, of the utmost importance, and has been thus ingeniously described : — “ When a bird is on the ground, and intends to fly, he takes a leap, stretches his wings from the body, and strikes them downward with great force : by this stroke they are put into an oblique direction, partly upwards, and partly horizontally forwards. That part of the force tending upwards, is destroyed by the weight of the bird ; and the horizontal force serves to carry him forward. The stroke being completed, he moves up his wings, which, being contracted, and having their edges turned upward, meet with very little resistance from the air. When they are sufficiently elevated, he makes a second stroke downwards, and the impulse of the air again moves him forward. These successive strokes act as so many leaps. When the bird wants to turn either to the right or left, he strikes strongly with the opposite wing, and this impels him to the proper side. The tail act slike the rudder of a ship, except that it moves him upward or downward, instead of sideways. If the bird want to rise, he raises his tail ; and if to fall, he depresses it : whilst in a horizontal position, it keeps him steady.”*

(121.) The modes of flight in birds are, perhaps, as numerous as the families into which they are divided ; so that a few of the most conspicuous need only be mentioned. The greater part of the birds of prey (*Raptores*) soar to an amazing height, as if a certain elevation was necessary for them to discover their prey : when that is discerned, they suddenly dart down almost perpendicularly upon their victim. Buzzards, says White, sail round in circles, with wings expanded, and motionless : it is from their gliding manner, that the former are still called, in the North of England, *gleads* ; — from the Saxon verb, *glidan*, to glide. The kestrel, on the contrary, has a peculiar manner of

* Bing. Anim. Biog. vol. i. p. 23.

hanging in the air in one place; his wings all the while being briskly agitated: hence the common name of *wind-hover*, given to it in some parts of England. Hen harriers fly low over heaths or fields of corn, and beat the ground regularly, like a pointer, or setting dog, — a fact also observed by Dr. Richardson in the harriers of Arctic America, and which is in perfect unison with their analogy to the swallows. Owls move in a buoyant manner, as if lighter than the air, — an effect in some measure produced by the singular structure of their wings. There is a peculiarity belonging to ravens, that must draw the attention even of the most incurious: they are often seen, when flying in company, as if amusing themselves, by striking and cuffing each other on the wing, in a kind of playful skirmish; and, when they move from one place to another, frequently turn on their backs with a loud croak, and seem to be falling to the ground. This singularity has been accounted for on the supposition that they are then scratching themselves with one foot, and thus lose the centre of gravity. Woodpeckers, and some other birds, fly by opening and closing their wings at every stroke; and so are always rising and falling in curves. Magpies and jays are also slow flying birds, and make their way something in the same manner. Pigeons — and particularly the sort called *smiters* — have a way of clashing their wings, the one against the other, over their backs, with a loud snap: another variety, called tumblers, receive this name from a habit they have of turning themselves in the air. The speed with which pigeons fly, particularly those denominated, and sometimes used, as carriers, is well known. An instance is recorded in the *Annual Register* for 1765, of one which travelled no less than seventy-two miles in two hours and a half. The whole of the humming-birds, although they fly not to great distances at one time, yet glance through the air with the velocity of a meteor; and, probably, for the time, fly swifter than any birds in creation. From their small size, the eye cannot follow their course

but for a short distance ; and the motion of the wings is so rapid, as to be imperceptible to the closest observer. Geese, and cranes, and most wild fowl, move in figured flights, the flock being generally arranged in a triangle ; but the individuals often change their position. In these, and most of the wading genera, — as the sandpipers, &c., — the tertial quills are very long, and the primaries pointed ; — a structure which enables them to cut through the air, probably, with greater facility. Dabchicks, moor-hens, and coots, on the contrary, are feeble-flighted birds, which merely skim the surface, and fly with their legs hanging down. This originates not only in the shortness of their wings, but in their very forward position, by which they are placed as much out of the true centre of gravity as are the legs of auks, divers, and even of the coots themselves ; that is, they are placed far *behind* the equilibrium of the body. There is no imperfection, however, in these birds ; because their uncommon aptitude in diving amply compensates for the slight development of their wings ; and they so seldom venture beyond the margin of their watery haunts, that they are rarely left without instant means of escape from their enemies.

(122.) The greatest powers of long-sustained flight, however, are given to the natatorial and the fissirostral types, or the oceanic birds and the swallows, — but for very different purposes. The food of the first is to be sought for at a great distance from land ; their prey, which consist entirely of marine or oceanic animals, are constantly shifting their quarters ; and it is, therefore, necessary that their pursuers should be such perfect flyers, as to be continually on the wing, either following or seeking them. Added to these reasons for the superior flight necessary to aquatic birds, it will be remembered that they are exposed, on the unsheltered bosom of the ocean, to far more violent storms than are encountered by their brethren on the land : hence, were they not endowed with far more muscular strength of wing, they would inevitably perish, either by being

blown completely out of their native regions, or be exhausted by fatigue before they could reach a place of shelter. The genera which comprise the albatrosses and the frigate-birds stand at the head, in this respect, of the aquatic order, and show us a remarkable development of flight. The manners of the latter we never saw to more advantage than in the magnificent harbour of Rio de Janeiro. It was, indeed, an imposing sight, to contemplate half a dozen of these aerial birds soaring in mid air, and then, in an instant, as if shot, falling down with a splash into the sea upon a shoal of fish. At other times, during a storm, they soar to such a height, that, notwithstanding their size, they appear but as specks in the firmament: all their powers of motion, in fact, seem to be concentrated in their wings; for the feet are so short and weak (as in nearly all of the same order), that, when upon the ground, they may be approached with ease,—for they can scarcely walk, and take a long time, comparatively, to mount on their wings. The tropic-bird flies as high as the frigate-petrel; but its range is more confined to certain latitudes, and its wings are not more developed than those of an ordinary gull. All these birds occasionally, in calm weather, rest themselves, after the buffetings of a storm, on the sea; but they are obviously not qualified, from the smallness of their feet, to make much way by swimming.

(123.) The flight of the typical swallows, as well as of the goatsuckers, is, perhaps, more rapid than that of the oceanic birds; but we question, notwithstanding their migrations, whether it is so long sustained, although it is obviously accompanied by much greater muscular exertion. The flight of the albatross and the frigate-bird is accomplished with scarcely any motion of the wings: they may be said to balance themselves in the air, rather than to use the ordinary exertion attendant upon flying: neither do they make those rapid evolutions which characterise the land birds we are now speaking of. Flight, in the swallows, is confined to

that period of the day when they feed ; for, at other times, it is a common thing to see them perched upon naked branches of trees : but the frigate-birds are always upon the wing ; they, as well as the albatross, are often met with many hundred miles from any land. Furthermore, the one pursues or hunts after the flies on which it feeds ; the other rather watches for the appearance of fish near the surface, while soaring in mid air, and then only pounces or drops on its prey. It is interesting to notice these variations in the habits of two families of birds, totally different from each other in general structure and habits, and yet possessing in common a superiority of flight over almost all others of their own class.

(124.) To some few genera of birds, the powers of flight are either partially or totally denied : these are chiefly found among the rasorial groups, and some few of the aquatic order. In the first, we have the different ostriches of the Old and the New World, as well as the emu of Australia, in all which the wings are merely rudimentary ; and although of some little assistance in aiding their running, cannot raise the bird above the level of the ground. Yet here, again, we see the wise provision made by their Almighty Creator, in insuring the safety of birds whose wings are useless. In the frigate pelicans, just mentioned, we have an example of the highest development of wing, joined to feet of the most imbecile and abortive structure. In the ostrich, on the other hand, these gifts are exactly reversed ; the wings are, in a manner, useless ; while the feet, strong and robust, more resemble those of a horse than of a bird, and enable the ostriches to course over their native plains at so prodigious a rate, that a horseman is often obliged to give up their chase in despair. The whole structure, in short, of these birds, as regards locomotion, is formed for running instead of flying ; while the great elevation of the head, occasioned by their very long neck, enables them to discover, on the level plains to which they confine themselves, the ap-

proach of an enemy at a very considerable distance. No birds can be more unlike each other, than an ostrich and a penguin; yet they agree in some very remarkable particulars: both have wings incapable of flight,—those



of the penguin (*fig. 26.*) having much of the appearance of fins, or paddles; and both owe their safety, not so much to these members, as to their feet. This, at first, seems impossible; since the feet of the penguin are remarkably short, while those of the ostrich are quite the reverse. To explain this, however, it must be remembered that the penguin swims with the velocity of an arrow: its feet,

which barely enable it to stand upright upon the shore, are particularly formed for swimming; while the two short wings, of no more use to the bird, for the purposes of flight, than those of the ostrich, become powerful instruments, like a pair of oars. The bird, in fact, may be said to possess four fins; or, at least, four members which perform that office so effectually, that its rapidity of motion has been said to be prodigious. The last of the semi-apterous genera we shall notice is that of the *dodo*, a bird now extinct, but of which the foot and bill still exist in the British Museum. The former of these relics shows how little this bird was capable of running; and to this peculiarity, joined to an equal feebleness of wing, may, probably, be attributed the extirpation of the most anomalous bird—it such a term can be allowed—that has ever existed in the memory of man.

(125.) A short enumeration of the other motions of birds will conclude our remarks upon this class. The faculty of *diving*, like *swimming*, is confined to two of the orders only, — the *Grallatores*, or waders, and the

Natatores, or swimmers. In the former, these motions are only occasional ; while, in the latter, they are constant and habitual. The most expert divers, perhaps, are such as have remarkably short wings,—as the auks



and grebes (*fig. 27.*) ; next to which come the divers, properly so called, together with the coots and ducks. The swans and geese rarely immerse more than their head and neck in the water ; while the sea ducks, particularly the genus *Clangula*, are much more expert at diving than those genera which frequent freshwater rivers. In *hopping*, there are no such marked instances as occur

both among quadrupeds and annulose animals ; since this motion is never, we believe, carried further than what is seen in the sparrow, and such other perching birds as live both among trees and upon the ground. The most expert climbers are the parrots and woodpeckers ; while the swiftest walkers and runners are of the rasorial and the grallatorial orders.

(126.) Quadrupeds can produce, in their different orders, examples of all the five principal kinds of motions formerly mentioned ; although, as in the class of birds, no instance occurs of any one being so highly gifted as to unite them all. Most of the larger animals are slow in their general movements, — particularly those endowed with extraordinary strength ; thus, the elephant, though he certainly can run with speed, turns and manœuvres with the greatest difficulty. The *Ursus Arctos*, or common bear, is sluggish and heavy : the sharpness of its claws, however, enables it to climb trees with great dexterity, either in the pursuit of prey, or for the avoidance of its enemies. The *Rhinoceros bicornis*, though he may be termed swift for his amazing size, is rendered unwieldy by his great weight, and by the shortness of his legs : and both the dromedary and camel are decidedly

slow ; although, when used as beasts of burden, their strength and perseverance compensate in a great degree for their want of speed. Denon tells us, that, when first mounted on one of these animals, he was fearful that the swinging motion which accompanies their usual high trot would have thrown him over the creature's head ; but, when firmly fixed, he soon found that there was no danger of such a catastrophe : on the contrary, his situation, on the whole, was an agreeable one. " It was," he says, " entertaining enough to see us mount our beasts. The camel, who is so deliberate in all his actions, as soon as the rider leans on his saddle, preparatory to mounting, rises very briskly, first on his hind, and then on his fore legs : the rider is thus first thrown forward, and then backward ; and it is not until the fourth motion that the animal is entirely erect, and the rider finds himself firm in his seat."

(127.) Some quadrupeds, on the contrary, unite both strength and agility. Among these, the American bison is conspicuous. This animal is so strong, that sometimes, when pursued, it has been known to knock down trees, as thick as a man's arm, in his flight ; and yet so quick as to plunge even through deep snow faster than an Indian can run upon it in snow shoes.* " To this," observes Mr. Hearne, " I have been an eye-witness many times ; and once had the vanity to think that I could have kept pace with them ; but, though I was at that time celebrated for being particularly fleet in snow shoes, I found that I was no match for the bisons, notwithstanding they were then plunging through such deep snow, that their bellies made a trench as large as if many heavy sacks had been hauled through it." That invaluable animal, the horse, is still more celebrated for its fleetness ; and there is one instance upon record of a racehorse (Childers) which passed over eighty-two feet and a half of ground in a second of time. The ass, in its wild state, is remarkably fleet ; though all celerity appears to desert it when subjected

* Bing. Anim. Biog. vol. I. p. 476.

to labour. The zebra, or some kindred species, was probably the wild ass of the Scriptures, and confirms, at the present day, all that has been intimated of its celerity. But the most remarkable property of the domestic ass is, the skill with which it descends precipices almost impassable to the horse; conducting the traveller in safety over passes of fearful declivities, and avoiding, with the most astonishing dexterity, the obstacles which beset its path. "When they come to the edge of one of these descents," we are told, "they stop of themselves, without being checked by the rider; and, if he inadvertently attempt to spur them on, they continue immovable. They seem, all this time, ruminating on the danger that lies before them, and preparing themselves for the encounter. They not only attentively view the road, but will sometimes tremble and snort at the danger. Having prepared for their descent, they place their fore feet in a posture as if they were stopping themselves; they then also put their hinder feet together, but a little forward, as if they were about to lie down. In this attitude, having taken a survey of the road, they proceed forward." The reindeer is almost proverbial for its swiftness, — a quality which renders this animal of the utmost importance to the winter-bound Laplander, whom it conveys in a sledge, over vast wastes of ice and snow, with a speed and precision truly admirable. A couple of reindeer, yoked to one of these carriages, have been stated to travel 112 miles in a day. They are also said to swim with such rapidity, that a boat with oars can scarcely keep pace with them.

(128.) Monkeys, of all quadrupeds, are the most expert climbers; their four feet being, in fact, so many hands. With the exception of the baboons, the shape of the whole of this tribe is particularly slender; and they are thus calculated, in every way, for performing those feats of agility which every one has witnessed in our menageries. The typical perfection of quadrupeds, as in birds, consists in the highest development of the

prehensile faculty ; and this is given to several of the American monkeys in an extraordinary degree : their long tails are used as a fifth hand ; and are twined round the branches of trees, when they are climbing, with such tenacity, that, on the animal being shot, it will hang by its tail, long after it has lost the power of grasping with its hands. Several other genera possess the scansorial or climbing faculty in a greater or less degree, but all are inferior to the monkeys. The form of the bear, for instance, is heavy and clumsy to a proverb ; and yet these animals, however awkward they shuffle along on the ground, are well known to climb with no inconsiderable degree of activity. Some of the American porcupines do the same ; and these are the only animals, besides the monkeys of the same continent, that are also furnished with long prehensile tails adapted for this purpose. The only indigenous quadruped, which possesses this faculty to any extraordinary degree, and whose life may be said to be spent upon trees, is the squirrel. A more beautiful and interesting little animal does not exist ; but, because they feed upon the nuts of our wealthy proprietors, either they, or their gamekeepers, equally ignorant, denominate them *vermin* ; and it is, unfortunately, a common practice to shoot them, with the same determination of extirpating the race, as is pursued against weazels, stoats, and rats. If this unfeeling and barbarous custom goes on much longer, the most beautiful of our indigenous quadrupeds will become in another century extinct. Several of the species found in North America, have, in some degree, the power of flying, in addition to that of climbing : hence their common appellation of flying squirrels. This term, however, must be understood in a very limited sense : their flight, in fact, is nothing more than a leap ; but, owing to the expansive skin which partly connects the fore and the hind feet, sufficient resistance is offered by the air to support the animal, and an additional impetus is thus given to its leap, which is often made

between two trees, or branches, several yards asunder. The flying phalangers of Australia are similarly constructed, and make prodigious springs — often of ten or twelve yards — from branch to branch.

(129.) Jumping or hopping is no uncommon mode of progression among the gliriform or mouse-like animals. In this respect, the motions of the jerboa (*fig. 28.*)



are extremely interesting. It may almost be said to have but two feet; for the fore pair are chiefly used as hands, — while the animal almost always stands on the hind pair only. Its general mode of progression is by hopping; but, if pursued, it betakes itself to such vast and quickly repeated leaps, as soon to convey it out of the reach of any common enemy. The kangaroo proceeds

in the same manner; and has been said to spring over more than twenty feet at a leap, besides being able to rise to the height of nine feet or more in the air. Leaping is highly developed in the family of antelopes, — particularly such as live in mountainous regions. The chamois (*fig. 29.*) scrambles



amid the inaccessible rocks of the Alps, with an agility which often baffles the quickest eye, — always moving in an oblique direction,

and frequently, in its descent, appearing to throw itself down precipices which appear almost perpendicular. The smallest horizontal ledge or abutment of the rocks is sufficient to afford it a footing; and in this manner it will often foil the most daring hunter. The *Capra Iber*, however, is even said to exceed the activity of the chamois; as it is affirmed to mount similar precipices by leaps, or successive bounds, of nearly five feet,—thus gaining the summit of a rock of fifteen feet by three of these airy springs, during which it scarcely appears to touch the spot on which it descends, merely, as it should seem, to be repelled, and again thrown off into the air. “We have seen it,” observes major Hamilton Smith, “leaping down a precipice, — sliding first the fore legs down the steep, while, with the spurious hoofs of the hind feet, it held the edge of the rock with firmness, till the centre of gravity was lowered as far as possible; then, bounding forward, by a jerk of the body during the descent, turn the croup under, and alight on the hind feet first, with such apparent ease, that the fore feet dropped close to the hinder, and all expression of effort vanished.”*

(130.) The common mole is an instance of great peculiarity both of organisation and motion, as well as of that beautiful adaptation of power to necessity, so observable throughout nature. As it is destined to be the constant inhabitant of a subterraneous abode, a variety of motions were unnecessary; — a peculiarity, however, was called for by its mode of life, and this has been accordingly given: its principal occupation, burrowing, is provided for by a pair of short and extremely broad fore legs, much resembling, in general shape, the human hand, the palms of which are turned outwards; and by this singular formation the mole is enabled to dig away the earth before it with the greatest facility; while its hind feet, which are much smaller, are employed in throwing back the previously excavated earth. The beaver is another instance of a

* Griffith's Cuv. vol. iv. p. 283.

motion almost unique among animals. In the construction of its remarkable dwelling, it was necessary that the soft mud and clay which it employs should be rendered compact: hence it is supplied with a broad and powerful tail, which is used in the same manner, to accomplish this object, as is a trowel in the hands of a bricklayer. As we shall have to mention other singularities of this interesting animal in another place, it will be sufficient to allude, at present, to its power of swimming with the greatest facility. The hedgehog, and a few other quadrupeds of the same type, present us with a sort of motion only to be found among them, and certain insects which they represent. As they have but little speed to escape from their enemies, they are not only covered with defensive spines, but have the power of rolling themselves up like a ball; and, by erecting the bristles with which they are covered, present themselves, armed at all points, to their enemies.

(131.) The only quadrupeds, however, which really fly, are the bats; they compose a large family, scattered over all temperate and tropical countries, and varying, according to the species, from the size of a kitten to less than a harvest mouse. We have already had occasion, under the head of Instinct, to speak of the astonishing powers they possess in directing their course through the most perplexing windings; while their flight, when pursued without such impediments, is well known to be as swift, if not more so, than swallows. A popular belief was long held, that these animals could not mount into the air, if once they came upon a flat surface; but this error was long ago refuted by White of Selborne, who says that one he had in confinement "rose with great ease from the floor," and "ran with more despatch than I was aware of, but in a most ridiculous and grotesque manner."* We can confirm the latter, but not the former, statement. Two bats, of the common species, which we

* Nat. Hist. of Selborne, vol. i. p. 57.

had alive, in our possession, at different times, always raised the body in a semi-perpendicular position, by grasping hold of some object, before they took to flight; while their motion, or walk, upon a level surface, so far from exhibiting any degree of "despatch," was remarkably slow; and they seemed to move their legs in a forward direction with the same sense of pain as is experienced by the sloth, under similar circumstances. Bats have another peculiarity, alike unknown among other animals, excepting a genus of birds (*Colius*). When at rest, either during the day, or the period of hybernation, they suspend themselves, with their heads downwards. If we consider the general construction of these animals, it appears highly probable that this is the position they always assume, in a state of nature, previous to the opening of their wings for the purpose of flight: the wings, in fact, being part of the fore legs, are thus as free as those of a bird, and are ready for instant expansion, without having first to loosen their hold of any substance.

(132.) Almost the only motion of fishes is that of swimming; and this has been justly said to be nearly the same kind of action in water, as flying is the air. Some of the organs employed for this purpose resemble, in their mode of action, the oars of a boat,—particularly the pectoral and the ventral fins, while the tail, in its office, and even in its shape, may be termed the rudder. The exact use of the dorsal and anal fins has not been clearly ascertained. They would seem intended chiefly to preserve the fish in a perpendicular position, as well as to cut the water, both above and below, to facilitate the progress of the fish; and they may, probably, perform both these purposes: and yet it has been observed by Mr. Yarrell, that some fish, from which he removed the dorsal fin, and placed afterwards in water, did not appear to feel any sudden injury from the deprivation. The muscular force of the tail is very great, and acts like the handle of the rudder. It is astonishing with what velocity some of the larger fish

dart through the water. The speed of the white shark (*Squalus Carcharias*) is said to be so great, that nothing can hope to escape it by flight. There is an interesting and well-executed print commemorating the following anecdote of the latter:—"Sir Brooke Watson, when in the West Indies, as a youth, was swimming at a little distance from a ship, when he saw a shark making towards him. Struck with terror at its approach, he immediately cried out for assistance. A rope was instantly thrown; and even while the men were in the act of drawing him up the ship's side, the monster darted after him, and, at a single snap, took off his leg." This story has been generally told in proof of the rapidity of swimming possessed by the sharks in general; but it merely establishes the fact, which no one would think of questioning, that a shark can swim faster than a man. We have, in the Ichthyological volumes of this series, already said so much on the swimming of fish, that it is unnecessary to treat the subject at much length in this place. It may be observed, however, as a general law, that the most rapid swimmers are such as have the pectoral fins either very large, or sickle-shaped: the former may be compared to such birds as fly very rapidly, but for a short distance. Of this description are the different kinds of skates and thornbacks, as well as the whale family of rays (*Raidæ*); which, although they remove from place to place, or dart upon their prey, with the velocity of a meteor, nevertheless watch for its approach, on the bottom of the sea, in a state of quiescence. The *Scomberidæ*, or mackerel, which family includes the tunny, bonito, and those large fishes so often met with round vessels in the Atlantic and Pacific Oceans, have the



30

pectoral fins more or less falcate (*fig. 30.*), as is the

shape of the wings in the humming-birds; and they also possess a degree of rigidity, from the rays being close together, which is very unusual in other tribes. Now, the effects of this peculiar sort of fin are very remarkable: they are analogous to the wings of birds; and give to the tunny, and the different bonitos, a speed which is almost incredible. We have often watched them in the Pacific, from the sides of a vessel which was going at the rate of ten miles an hour; and yet, notwithstanding this speed, the bonitos would play round it as if it was immoveable. One moment, they would be at the stern; while the next, with a few prodigious darts, they might be seen playing round the head, as if in mockery of the slowness of the vessel, and rejoicing in their own superiority. The great size of the pectoral fin in the gurnards (*Triglidae*), as it has been supposed, is for the purpose of supporting their large heads, — they being what are called ground fish, or swimming very near the bottom of the sea; but this, we think, is very questionable.

(133.) Many fishes can leap above the surface of the water; and among these, perhaps, the salmon (*fig. 31.*)

31



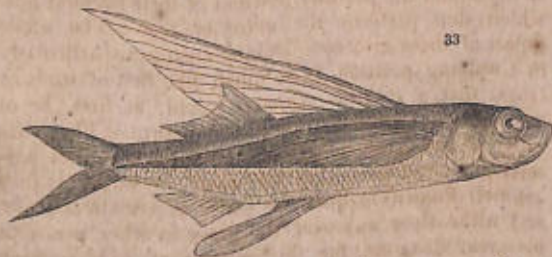
is most conspicuous, or, at least, the best indigenous example. Although usually inhabiting the ocean, they advance up the rivers at certain seasons of the year (in common with many others), for the purpose of depositing their spawn; if, on these occasions, they find themselves opposed by any unexpected obstacle, they overcome it by taking the most astonishing leaps. Thus, on the river Liffey, in Ireland, there is a cataract about nineteen feet in height: over this the fish will fre-

quently spring at a bound; though, sometimes, the weaker individuals are forced to repeat the effort many times before they are successful. These leaps appear to be accomplished by a sudden jerk which is given to its body, by the animal, from a bent into a straight position. The elastic power of the *Gasterosteus aculeatus*, or three-spined stickleback (*fig. 32.*), is, per-



haps, still more wonderful: this creature, which is seldom more than two inches long, having been known to leap a foot and a half — which is at the rate of nine times their own length — in perpendicular height from the water.*

(134.) *Flying* seems not altogether denied to this class of animals, if we admit that the spring of the *Exoceti*, or flying fish (*fig. 33.*), is, as we have else-



where† stated our reasons for believing, compounded of both motions. It may be as well, however, to state to the unscientific reader, that these *wings* are nothing more than large pectoral fins, which exceed the average length of such fins in ordinary fishes so much, that

* *Anim. Biog.* p. 40.

† *Classification of Fishes*, Vol. I.

they generally reach to the tail. We believe these fishes are also very rapid swimmers; not merely from this extraordinary development of the pectorals, but also from their peculiar wedge-shaped body, so well calculated to cut through the water, and to get beyond the reach of their numerous enemies.

(135.) To include *walking* on land, and *climbing* up trees, as among the actual motions of this class of animals, will, no doubt, somewhat surprise many of our readers; yet there are not wanting several fishes which perform these apparently *unnatural* feats.



The frog-fish (*fig.*

34.) of the Asiatic islands and the southern hemisphere can not only live several days out of the water, but can crawl about the room in which they are confined; this latter facility originates from the great strength and the peculiar position of their pectoral fins, which thus perform the office of feet. The whole aspect of these grotesque-looking creatures, particularly in a walking position, is so much like that of toads or frogs, that a careless observer would, at first, be at some loss to determine their real nature. The generality of the freshwater eels, although, from not possessing ventral fins, they are unable to walk, yet they are well known to quit the water at certain seasons, and make their way over the grass to other ponds, at no great distance, for the purpose of seeking fresh habitations, or depositing their spawn. Nearly all the Indian *Ophiocephali* (freshwater fishes, not unlike our sea mullet), crawl from tank to tank, or from ponds that are nearly dried up, to others, which, by a wonderful and incomprehensible instinct, they seem to know to be full. Such an unusual circumstance as a

fish crawling upon dry land, has naturally excited the superstitious Hindoos to believe that they fall from heaven. The *Percu scandens* (fig. 35.), which be-



longs to the same natural tribe as the last (*Spirobranchidæ* Sw.), quits the water, and ascends the roots and branches of the mangrove trees,—an effort it accomplishes by using its ventral fins as little feet: it is not clear, however, what purpose it has particularly in view, in thus quitting an element it is obviously designed to inhabit; yet, that these terrestrial expeditions are perfectly natural to them, is proved by the fact of the whole of this tribe, having a particular organisation. By this, a provision is made for retaining a sufficient quantity of water in the gills, in order to keep them in a state of moisture while the fish is out of water.

(136.) The progressive motion of frogs and toads, in their adult state, is by leaping; and the bull frog of Carolina, particularly mentioned by Catesby, is very remarkable for the length and rapidity of these springs. The tadpole of these two families are well known to resemble fish externally, and to live, like them, entirely in the water: they are much more active in this state; constantly moving their little tails with a rapid vibratory motion, and swimming in shoals, on a sunny day, round the ponds which have been their birthplace.

(137.) But it is among the class of Insects that we find concentrated all those various motions that are but

partially scattered among other animals. Cuvier has truly remarked*, that they exhibit those of every other species of animal,—such as walking, running, and jumping, with quadrupeds; flying with birds; gliding with the serpents; and swimming with the fish. Hence, it is not poetical to assert that “the universal movement of these restless little creatures” gives “life to every portion of our globe, rendering even the unfrequented desert interesting.”† This feeling was felt by the venerable Derham, when he expatiates on “the admirable mechanism in those that creep; the curious oars in those amphibious insects that swim and walk; the incomparable provision made in the feet of such as walk or hang upon smooth surfaces; the great strength and spring in the legs of such as leap; the strong-made feet and talons of such as dig; and, to name no more, the admirable faculty of such as cannot fly, to convey themselves with speed and safety, by the help of their webs, or some other artifice, to make their bodies lighter than the air.”‡ To attempt a description of all the different motions discernible in this innumerable class of animals, would here be impossible; for it would be interminable. “How wonderful are thy works, O Lord! The earth is full of thy riches!” When, on a bright summer’s day, we look around and see the air, the earth, the waters, nay, every pendant leaf and blooming flower, instinct with life, and teeming with creatures, each of whom has habits and movements peculiar to itself, how should our minds be struck with astonishment, and warmed with gratitude to that overruling Power, in whose sight this globe is but a grain of sand, yet whose watchful care is over the least of his creatures!

(138.) Different motions belong to each of those states through which most insects pass before they reach maturity. In the larva or caterpillar form, none are more curious than the jumping, although footless,

* Anat. Comp. vol. i. p. 154.

† Int. to Ent. vol. ii. p. 271.

‡ Derham, Physico-Theo.

maggots, — one species of which is found in our richest cheeses, and produces a little black fly (*Tephritis putris*). These creatures appear to accomplish their enormous leaps somewhat in the same manner as salmon, by taking the tail in the mouth, and then suddenly letting it go again. Swammerdam assures us, “that he beheld one, which, was not more than the fourth part of an inch in length, jump out of a box six inches in depth; which is as if a man, six feet high, should raise himself in the air, by jumping, 144 feet!”* The mode by which the caterpillar of the common cabbage butterfly climbs is very singular. It may be often seen ascending wells, or even the slippery glass of our windows; and, on careful examination, it will be seen that they leave the mark of their track behind them; if this track be again examined through a microscope, it will be found to be nothing less than a rope ladder, formed of silken threads, which the insect spins in its progress. Other caterpillars resort to the same contrivances for suspending themselves in the air; as may be readily discovered by merely shaking the branches of an oak or other tree, in summer, when numbers of these little larvæ will cast themselves down by means of a hair-like thread, up which they can again climb, so soon as all appearance of danger is at an end. In their pupa state, nearly all the most typical of the *Ptilota*, or four-winged insects, are quiescent; but those of the *Hemiptera*, *Hymenoptera*, and *Neuroptera*, are as active as the larvæ, and chiefly differ from them in having the rudiments of wings.

(139.) Perfect insects†, or those with four wings, employ various methods of ascent. Some climb by means of their claws; others, by soft cushions, composed of hairs, thickly set upon the under side of the claw joint;

* Lat. to Ent.

† As we have employed this term occasionally in our former volumes, without, for particular reasons, defining its extent, we shall now intimate, that in our entomological volumes we shall regard the *Ptilota* as composed only of the following five orders, each being furnished with four wings, — namely, the *Lepidoptera*, *Hemiptera*, *Hymenoptera*, *Coleoptera*, and *Neuroptera*.

while others, again, as the common fly, are enabled, by the peculiar formation of their *tarsi*, or claws, to effect, in an instant, what philosophers accomplish with vast comparative care and labour—they produce a vacuum, which will allow the pressure of the atmosphere to retain them on the plane of position.*

(140.) Some insects run with amazing velocity. Any one who has watched the proceedings of a colony of ants will be aware of this. “M. Delisle observed a fly, so minute as to be almost invisible, which ran nearly three inches in a demi-second, and in that space made 540 steps; consequently it could take 1000 steps during one pulsation of the blood of a man in health; which,” adds Mr. Kirby, “is as if a man whose steps measured two feet should run at the incredible rate of

more than twenty miles in a minute!”

Some of the swiftest runners are the *Cicindelidæ* (fig. 36. *a*), and other predacious beetles;—the former, especially, makes its way with great rapidity, from occasionally



using its wings;—while the slowest are the *Cassidæ* (*b*), or tortoise beetles,—apt representatives in this, as well as in form, of their namesakes, the chelonian reptiles.

(141.) The power of *leaping* is possessed by some insects in a much higher degree than is to be met with in any other class of animals,—that is, if we estimate the distance they leap in relation to their size. Thus, it is commonly supposed that a flea (fig. 37.) will clear, at a single jump, a space equal to 200 times its own length. It has been thought that a grasshopper will do nearly the same, even without the assistance of its wings; but we do not believe this probable,—since these insects,

* Int. to Ent. vol. ii. p. 322.

when adult, according to our own observations, in-



variably fly at the same time. There is, however, a whole family of little beetles (*Halticidae*, fig. 38.) which make as prodigious leaps as the flea, which they resemble so much in size and colour, that the species indigenous to this country are known to the farmers of some districts by the same name as their prototypes: their hinder thighs (a), in conformity with this habit, are of a most disproportionate strength and thickness, appearing as if swollen.

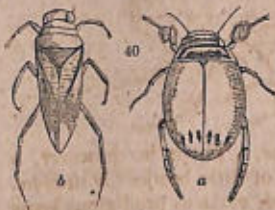
Among the apterous class, we have also several genera of leapers, such as the *Podura*, or spring-tail (fig. 39.), and a whole division of crustaceous insects, which abound

under sea-weed on almost every shore, and are familiarly known by the name of sand fleas.

(142.) The different flights of insects would fill a volume with a subject we can here but slightly glance at. In point of celerity, many insects fly much quicker than any birds, when we take into account their very inferior size. It has been calculated that the common house fly, in its ordinary flight, makes with its wings about 600 strokes, which convey it five feet, every second. But, if alarmed, their velocity can be increased six or sevenfold, or to thirty or thirty-five feet in the same period.*

* Int. to Ent. vol. II. p. 332.

(143.) Many of the aquatic insects are excellent swimmers and expert divers; of which the *Dytiscidæ*, or water beetles (*fig. 40. a*), and the *Notonectidæ*,



or boat flies (*b*), are notable examples. Others either live entirely beneath the surface, or, like some of the *Nepidæ*, or water scorpions, and other hemipterous genera, walk slowly on the surface, with the same care as they would pursue a similar

motion upon land. Some of the grasshopper tribe burrow in the earth, — particularly the *Gryllotalpa*, or mole cricket, which, like its namesake, is furnished with palmated feet formed nearly on the same model, and which perform the same office. Others of the same order, but with different shaped instruments, bore, like the house cricket (*Achetra campestris*), through the thickest walls, by mining their laborious way through the interstices of the bricks or stones.* Innumerable hosts, in the larva state, eat their way in solid timber, either growing or dead: so that there is scarcely any animal or vegetable substance which does not furnish the means of showing a new modification in the actions of these little creatures.

(144.) Insects have also their motions of gaiety or sport: among these, none seem to vie in their singularity with the choral dances which so many of the *Diptera*, and some of the *Neuroptera*, maintain in the air; in which, however, it has been observed, the males alone are engaged. These dances are kept up at all seasons of the year; only that in winter they are confined to the robust *Tipulidæ*, or gnats, which, however small, are often seen in a sunny day of December, when snow is on the ground, sporting as merrily as in the spring. Sometimes these insects look like moving columns, —

* Int. to Ent.

"each individual rising and falling, in a vertical line, a certain space, and which will follow the passing traveller, often intent upon other business, and all unconscious of his aerial companions, for a considerable distance." Mr. Kirby further remarks, "that the smallest *Tipulidæ* will fly unwetted in a heavy shower of rain, as I have often observed. How keen must be their sight, and how rapid their motions, to enable them to steer between drops bigger than their own bodies, which, if they fell upon them, must dash them to the ground!"*

(145.) The little water beetles of the genus *Gyrinus*



(fig. 41.), so frequently seen on the surface of freshwater ponds in a bright summer's day, are as joyous a race as their brethren the gnats. The rapidity with which they skim in undulatory circles is not less admirable than the precision with which they thread the

mazes of their aquatic dance, so as never to encounter, and seldom to touch, each other. Their flattened and oar-



shaped hind feet are peculiarly adapted for these exercises; and they continue their diversion for hours with unwearied gaiety. They are the only instance of coleopterous insects swimming on the surface of the water; for the *Dytiscidæ* (fig. 40. a), which are predacious, merely rest there motionless, with their heads downwards, in order to watch for their prey beneath. They are,

in short, the fissirostral or aquatic type of the predatorial family (*Predatores* Sw.), and, like them, dart upon their prey from a fixed station. Some of the hemipte-

* Int. to. Ent. p. 367.

rous insects (*Hydrometra Stagnorum* Fab., fig. 42.) sport also on the surface, much in the manner of the *Gyrinus*.

(146.) In the apterous class of insects, none are more remarkable than the spiders: they can walk, like flies, against gravity, — but by what particular means appears uncertain. They are expert climbers, ascending and descending by means of a secretion of which they can make use at pleasure, and which they form into a silky thread, up and down which they travel at will. But the most singular of all their movements is that which they accomplish by means of those gossamer webs, which, on a bright summer's day, we sometimes see floating and sparkling in the sunbeams. These, for a long time, excited the curiosity and stimulated the conjectures of naturalists; but they are now ascertained to contain spiders, which, by the assistance of these little air balloons, are wafted from place to place, travelling in these airy chariots with perfect ease and rapidity. Lister informs us that the height to which spiders will thus ascend is prodigious; and he himself, from the top of the highest steeple in York Minster, beheld these floating webs far above him. Of one particular species he says, — “Certainly this is an excellent rope-dancer, and is wonderfully delighted with darting its threads; nor is it only carried in the air, like the preceding ones, but it effects, itself, its ascent and sailing; for, by means of its legs closely applied to each other, it, as it were, balances itself, and promotes and directs its course no otherwise than as if Nature had furnished it with wings or oars.”*

(147.) The crustaceous order of insects†, or the crabs, have mostly eight legs and two claws, with which their principal motions are accomplished. The latter are especially their weapons of attack and defence, and are wonderfully powerful. Lobsters, on the contrary, have a very strong tail, which assists them both in

* De Araneis, p. 85.

† This we consider as the aquatic type of the *Aptera*, according to the natural system.

swimming and leaping,—in the latter of which they are very expert. But the most remarkable circumstance in the motions of both these animals is that by which, at stated periods, they change their shells, or, in case of accident, cast off their injured claws, which are quickly replaced with fresh ones. Before the latter operation is effected, the animal, it is said, appears to suffer pain; it then moves its claw, for some time, from side to side, holding it afterwards perfectly steady, when it will suddenly give a gentle crack and drop off,—not, as it has been stated, at the joint, but in the smoothest part of the limb.*

(148.) There is a peculiarity of motion in certain apterous insects, which is without parallel in any other class of animals; we allude to the constant practice of the great majority of crabs, and of a few of the spiders, of always walking sideways, instead of with their head towards the point to which they are proceeding. This they do, not slowly, as one would expect from their thick body and heavy claws, but sometimes with amazing rapidity. We well remember the amusement we derived, when in Brazil, from running after a particular species of crab, one of whose claws was almost as big as its whole body: they lived in little holes in the sand, and, at the ebb of the tide, would come out by dozens to seek their food from among the wreck* which had been left; yet they were so wary, that, although they would venture more than fifteen, or even twenty, yards from their burrow, we never succeeded in catching one. They shuffled off sideways towards their hole the moment they espied us, holding up their gigantic claw, at the same time, as if it was of no weight. Thus intimidated from seizing the creature, and not wishing to deprive it of life, even had we the power (which, from its agility, was very questionable), every one of them got safe to its hole, before we succeeded in intercepting its retreat.

* Anim. Biog. vol. iii. p. 381.

(149.) Of the radiated animals, little can be said: the motions of the *Echinidæ*, or sea eggs, are effected by means of the movable spines with which their shells are furnished, and which, although short in that part which reposes upon the ground, are yet so numerous as to effect this object: these animals, however, move but very little, as they prefer remaining in the little clefts and hollows at the bottom of the sea. The *Asteridæ*, or star-fish (*fig. 43.*), are much more active animals;



the numerous soft suckers by which the mouth and the centre of these rays are furnished, seem to enable them to change their habitation more frequently. There is reason, also, for believing that several of those whose rays or arms are very long and slender, can use these members to swim with: they are, at all events, highly flexible; and star-fish of this form are not unfrequently met with at such a distance from land, and where the sea is so deep, that they must either have been drifted with sea-weed, or have used their arms as swimmers. It frequently happens, also, even on the British coasts, that great numbers of star-fish are cast upon the shore at a single ebb of the tide, as if a company of them had been thus wrecked,—while, at other times, not one is to be seen for weeks. On returning again to the *Acrita*, or polypes, by means of the intestinal worms, we see

all the preceding modes of locomotion gradually disappear: these latter animals have merely the power of moving in a serpentine manner, something like earth-worms, but with this difference,—that, as their body is not capable of the same contraction, it always remains of undiminished length.

CHAP. V.

ON THE MEANS OF DEFENCE POSSESSED BY THE ANIMAL KINGDOM.

(150.) IN no part of the economy of the animal world is the protecting care of the Almighty Creator more apparent, than in the means he has given to his creatures for self-preservation. Nor is the exertion of these means less extraordinary than their infinite variety. So far as is necessary for the support of life, the propagation of its kind, and the right employment of those defences with which it has been endowed, the instinct of every animated being is as perfect as if it was gifted with the reasoning powers of man. It would not, indeed, be difficult to cite rare and isolated exceptions to this axiom; for when we see that man himself is perpetually doing violence to his own reason,—committing acts of folly, if not of crime, which his better judgment,—his internal monitor,—tells him to be wrong. — we cannot expect that the animal creation is not to share in this mutability; or that it did not participate in that universal degradation which sin brought into the world. Both, as coming from the centre of perfection, must have originally been perfect; for He, who is perfection, cannot be the author of imperfection: of this, both reason and revelation abundantly assure us. God saw his work, “and, behold, it was very good.”

(151.) The power of defence enjoyed by animals against their enemies is obviously given to them for self-preservation, and is peculiarly adapted to meet those exigencies which every species, either by its economy or its structure, is more especially exposed to: hence, we might almost say that these powers or properties are infinite, inasmuch as their modifications are innumerable. They seem, however, to be all referable to three great classes. The first are active: these consist in the exertion of force, by which assaults are made by weapons or instruments possessed by the animal itself, and requiring his active exertion in their use; and such powers may obviously be employed either in offensive or defensive warfare. The horns and the teeth of quadrupeds, the stings and jaws of insects, and the poisonous fangs of reptiles, are of this description; for none of these would be conducive to the purposes for which they were given, without the voluntary exertion of their possessor. The second class of defences are strictly *passive*; they are as effectual, in most cases, as the first, but they require no exertion of the animal to bring them into operation. We accordingly find that it is generally to the weakest and most helpless beings that these protections are given. The thick hide of the elephant protects him from those hosts of blood-sucking flies which are the pest of tropical climates. The spiny hides of the hedgehog and the porcupine, the stinging hairs which envelop many caterpillars, and the disgusting stench from the body of the turkey vulture, are a few out of innumerable instances of that *passive* defence we are now speaking of. But there is still another property, which will by no means come under either of these definitions, although it has obviously been bestowed with the same merciful design; we allude to that astonishing vitality possessed by such beings as are most exposed to injuries, and by which life is not only supported without food for an amazing length of time, but dislocated portions grow and become new animals. These wonderful phenomena will be treated

of under this chapter, and we shall now consider each of these subjects distinctly.

(152.) For active defences, the most obvious instruments which have been furnished to animals are horns or other protuberances, jaws armed with teeth, or stings concealed in the body: but life is protected and safety insured by other qualities and by other properties; — thus, many have the power of ejecting from their bodies a volatile liquor, which is in the highest degree offensive; others, by their superior swiftness on the ground, outstrip their pursuers: some tribes seek safety by their faculty of climbing; others, by diving into water; and others, again, by flying into the air. There are, moreover, not a few, who, at the appearance of danger, pretend to be deprived of life, and counterfeit death with so much cunning, as to deceive even man himself. All these, however, are active operations, implying a perception of danger, and an instinct that it is to be avoided by bodily exertion. Nevertheless, we see that the first qualities may be employed both offensively and defensively; while those which regard the safety of the individual by flight deserve, more properly, to be discussed, in detail, when we inquire into the *motions* of animals.

(153.) QUADRUPEDS furnish us with some of the most striking instances of that powerful defence which the animal world is able to make, whether for self-preservation or for offensive warfare. The whole order of the *Feræ*, or carnivorous beasts, are provided with formidable teeth and acute claws; with these natural weapons they not only defend themselves, but inflict death upon all other animals they are able to cope with, and to conquer man himself: when to these is added great muscular strength, and no ordinary degree of swiftness, we at once perceive the highest development of natural defensibility. A lion or a tiger comes into the field like a warrior armed at all points, — before whom, man, in his natural state, would flee in terror, while every beast of the field would shun

the combat. All animals furnished with teeth, use them, instinctively, to bite their opponents, although their primary use is obviously to masticate their food; but it is only in the carnivorous tribe, where to these weapons we find added retractile claws, which, when not used, are drawn into the skin (like a pair of scissors contained in a sheath), and are thus preserved in all their sharpness. Among the *Quadrumanæ*, or monkey tribe, we find, as in man, no natural weapons of defence; but they are endowed with a cunning, a quickness, and an agility, rarely equalled, and never surpassed, by any other quadrupeds. Besides great muscular strength, which enables them to take prodigious leaps, they have the faculty of climbing in an extraordinary degree. By exerting both these, they escape from the carnivorous quadrupeds which infest their native regions; and, leaping from bough to bough, will pass through the most entangled forests with greater swiftness than an ordinary horse would travel on a turnpike road. The apes upon the rock of Gibraltar, although close to the town, can never be approached by the most cautious sportsmen; they climb, with the greatest facility, among frightful precipices, where neither dogs nor men can follow; and thus their preservation is effected by the possession of one single faculty. These habits of climbing belong to nearly all the lemurs: while such as are very slow secure themselves by day in holes, and only venture forth by night. Bats, in like manner, are nocturnal; but their want of defensive weapons is compensated by ample wings. with these they are secure from all terrestrial foes; and they venture forth, with their companions the goatsuckers, at an hour when all the denizens of air, including the diurnal rapacious birds, have long retired to rest. Thus we find that safety is provided for the weakest animals as effectually as for the strong, although by modes the very reverse of each other.

(154.) In the order of ungulated or hoofed quadrupeds (*Ungulata*), we find the means of self-pre-

servation particularly varied. At the head of this division stand the ruminating animals, which include the oxen (*Bovidæ*), the antelopes (*Antelopidæ*), and the stags (*Cervidæ*). Here we trace the same provident care of Nature, but manifested in a totally different way. In addition to great swiftness, as a means of avoiding danger, these animals have the means of repelling it when at hand. Their heads are furnished with strong pointed horns, by which they can not only rebut their adversary, and keep him at bay, but even toss him in the air, and pierce him to death. The power of the bull and of the cow is well known, even in the domesticated races; how much more formidable, therefore, are these animals in a wild state! The white Scotch *Urus*, although living in a half-domesticated state in some of the northern parks, is on this account so dreaded, that accidents are perpetually happening to the keepers, and few choose to run the risk, by possessing such dangerous animals, of hazarding human life. The buffalo of the Cape of Good Hope is as dangerous an animal to meet with, in its native forests, as either the lion or the tiger. The long, twisted, and pointed horns of the *Damalis orcas* and *carina* (H. Smith), — the eland of the Dutch colonists, — are sufficient to pierce through the body of a man by one thrust of their powerful possessors. The bisons and the buffaloes are all dangerous; and even the horns of the goat can inflict severe wounds. We may hazard the assertion, as a general observation, that the antelopes, in proportion to the smallness of their horn, seem endowed with an additional degree of speed. The roebuck (*Capreolus Europæus*) and the chamois are proofs of this: the horns of both are but ill calculated for vigorous defence, yet both these animals are proverbial for their swiftness; while the latter is so celebrated for its agility in climbing the most inaccessible precipices, that it far exceeds, in this respect, even the ibex. It is singular that among ruminating animals we often find that one sex is provided with horns, and the other not. To

compensate, however, for this apparent deficiency in the power of self-defence, we observe that the males protect the females, — and thus evince a degree of conjugal affection which is scarcely apparent in any other order of quadrupeds, — excepting, indeed, when defending their own progeny. From the ruminating tribe, we proceed to the *Camelopardalis*, the camels, and the horses. All these, in their native state, live in wide extended plains, where they can perceive danger at a considerable distance, and avoid it by rapid flight: nor is this all; their hard and solid hoofs are employed as natural and powerful clubs, wherewith, by kicking, to repel their enemies: and that this is no trivial effort of defence, is sufficiently apparent from the facts often occurring of limbs and bones being broken by the kick of a horse. Conscious, apparently, of the power of union, these animals, in a wild state, herd together. “Whenever they are menaced by a ferocious beast, or any other of their enemies, they instantly combine in close order; and if any succumb, it is generally the weakest.” Their principal enemies are the larger *Felineæ*, or the lion, tiger, panther, and leopard, — which, observes major Smith, “they generally escape with facility, or resist with success. Their fleetness soon leaves their pursuers at a distance, and they can strike with the hinder feet with immense force, and bite with great violence and effect.* The wariness and circumspection of these animals are extraordinary; and both form a part of that principle of self-preservation which we are now illustrating. The wild horses of America march in columns, — these troops being headed by a vigorous male chief, who is continually at their head in travel or in battle, and is invariably followed under all circumstances. When the herd is disturbed by any object, they approach it within a certain distance, having the strongest individuals at their head, examine it attentively, and describe one or more circles round it. If it does not appear dangerous, they approach with

* Griff. Cuv. vol. iii. p. 438.

precaution ; but if the chiefs recognise any danger, and give an example of flight, they are instantly followed by the entire troop." * The *Camelopardalis*, notwithstanding its apparently unfavourable shape, runs with great speed, and kicks as effectually as a horse. Mr. Burchell, and all the African travellers who have seen this animal, attest the difficulty with which it is approached. The defence of the camel is different: too unwieldy to seek its safety by flight, it bites its adversary, strikes with its fore feet, and kicks with its hind. Major Smith cites an instance of the dreadful bite of this animal which happened in India, where a camel tore off the arm of a lad, whose person was with difficulty rescued from the further grasp of the ferocious beast, — which, when the victim was withdrawn, stood in terrific exultation over the torn limb, not suffering any one to approach it for some time. Of the modes of defence possessed by the lamas, or sheep-camels of South America (*Anchenia*), very little is known: they are probably mountain quadrupeds, possessing the climbing habits of goats. It is well known, however, that such as are seen in confinement show their dislike to certain individuals, by ejecting saliva from their mouth ; but what may be the effect of this indignant mode of warfare, we have not clearly ascertained.

(155.) The following account of a fight between an Indian tiger and a domesticated buffalo is so applicable to our present object of illustrating the defences of animals, as displayed in different species, that we cannot withhold it from the reader. These fights take place in a large arena, securely fenced all round, and to a considerable height, by a palisade of strong bamboos, above which are galleries adapted for the spectators. "As soon as the tiger has been turned loose into this place, the gates are closed, and a short time is allowed him to look round and examine his new situation. It is remarkable that, at this time, the

* Griff. Cuv. vol. iii. p. 442.

cowardly animal very rarely quits the palisades, but creeps along close to them, wistfully looking up to their tops, as if to measure their height; and occasionally grinding his teeth at the spectators,—many of whom, of the lower orders, secure seats at the top of the inclosure, or peep through the narrow interstices of the sides. As soon as the tiger appears somewhat reconciled to the place, the buffalo is introduced; and now," says our authority, "nothing can surpass the animation displayed at this moment." The buffalo, upon entering, smells the tiger, and becomes instantly agitated. His eyes sparkle with fury as they wander in search of his enemy, who is generally attacked the instant he is discerned. The buffalo, shaking his head and pawing the ground for a few seconds, places himself in the posture of attack. With his face brought parallel to the ground, his horns pointing forward, and his tail indicating both his vigour and his determination, he rushes forward at full speed. But the cautious tiger is on the alert, and rarely fails to shift his ground as the buffalo approaches; if he succeed in this, his infuriated adversary, unable to check the impetuosity of its career, will sometimes run against the inclosure with a tremendous force, and injure the foremost of the spectators. The immense strength of the tiger lies in his fore paws,—a stroke of which would prove fatal to his enemy, if it was given with full effect. The buffalo, as if aware of this, constantly endeavours to keep in front of his opponent, rushes towards him with his whole force, and recedes with surprising celerity as soon as the tiger evinces a disposition to strike. Sometimes the tiger will follow and make a desperate spring,—which, however, the buffalo either avoids by rapidly shifting his ground, or at the same moment darts forward to receive its enemy on its horns. There are instances when the tiger has sprung over the buffalo's back, causing the combatants to change places; but the former does not, in general, follow up his attacks with spirit—while the buffalo, on

the other hand, pushes his opponent to the extreme, giving him no respite, but charging with the greatest impetuosity. The one seems to be contented with a secession of arms, the other carries on a war of extermination. Formidable as are the thrusts of the buffalo, the peculiar texture of the tiger's skin prevents the animal from being so much injured as might at first be supposed: it will, in fact, withstand such thrusts as the spectator would deem irresistible. The gloss of the thick though short fur, and the natural pliancy of the hide may account for this; so that, in general, the animal is more bruised than gored by its adversary's horns. The attacks, however, of the buffalo are unremitted. Although naturally erect, with the points of his horns turned backwards, he inverts his whole position when about thirty or forty yards from his antagonist; he then brings his nostrils between his fore legs; his horns are thus pointed forward, and not more than an inch or two from the ground. In this manner he proceeds at full speed; a quick removal, however, on one side, is sufficient to insure safety. The motions of the buffalo are so rapid, and his fury so great, that a second or a third charge follow in quick succession, until the tiger, worn out by these attacks, or, perhaps, unable longer to avoid the deadly thrust, is finally overcome." The natives assert that a buffalo, not absolutely defeated, will never quit a tiger until its death may proclaim a victory; and that, even when its subdued opponent may be breathless, the buffalo, as if to glut its revenge, shows a savage joy in still tossing about the body of the tiger. It is a singular fact, that the animals selected on these occasions are always taken from the domesticated breed of buffaloes, which may naturally be supposed to possess far less courage and strength than the wild race. Both, however, are considered of as implacable a disposition as the rhinoceros.*

(156.) On looking to the *Pachydermata*, or thick-

* Williamson's Field Sports.

skinned quadrupeds, we find other instruments and other means employed for the defence and preservation of the individuals. Here we have the most bulky quadrupeds in existence, — the elephant, the rhinoceros, and the hippopotamus. *Weight* is therefore, here, the great characteristic; and we accordingly find that these animals, apparently conscious that no others can withstand the enormous pressure of their bodies, trample upon their adversaries, and crush them into a shapeless mass: but, to effect this, they must first be thrown upon the ground. This the rhinoceros accomplishes by running with irresistible force, and knocking his adversary down with his horn; while the elephant, entwining his flexible proboscis round his foe, dashes him to the earth, and with one blow thus terminates his existence: besides this, the enormous tusks of the elephant are an additional defence, which render their possessor, otherwise the most intelligent and docile of quadrupeds, one of the most formidable, when enraged, of any in the creation. Another method in which this mighty animal exerts his strength is, by *lunging*, with nearly the force of a battering ram, against any tree, wall, or other obstacle which impedes his progress. We regret that our limits will not permit us to insert the long but very interesting narrative of the death of Mr. Cross's elephant, killed at Exeter 'Change. The trunk of this quadruped, in fact, is its chief defence; for it can be employed to lift a man from the ground with perfect ease. To all these means of preservation, may be added that remarkably thick skin which furnishes a name to this order. In the rhinoceros, this characteristic is so highly developed, that it is musket proof, and becomes as effectual for defence as if the animal were cased in a coat of mail. The hippopotamus, on the other hand, although possessed of a very thick skin, is destitute both of proboscis, horns, and tusks. His habits are aquatic; the depths of rivers are his citadels, where he retreats in the moment of danger, and bids defiance to all enemies of the land: from these

he only sallies during the night, to graze on the adjoining herbage. With such habits, he requires no other powers of defence, — they would be altogether unnecessary, and he is consequently without them. Of all the pachydermatous quadrupeds, the pig and the tapir seem to be the most defenceless; yet the former, which, in its wild state, is no other than the boar, is confessed to be a formidable and savage opponent, — and the history of the latter is too little known to admit of clear elucidation. The peccaries, or wild hogs* of Surinam, are totally destitute of that courage which renders the European boar such a formidable enemy to the hunter, in a state of nature; but, although it is destitute of tusks, or of other weapons of defence, Nature has provided for it another resource in case of danger. This animal is particularly remarkable for having, according to Stedman, an orifice on the back, about one inch in depth, which contains a stinking foetid liquor, which some compare to the smell of musk, but which is so very disagreeable, that, the instant the animal is killed, the natives take care to cut away this part with a knife, to prevent its infecting the flesh, — which it would soon do, making it so disgusting as not to be eatable.*

(157.) The horn of the Indian rhinoceros (*fig. 44.*),



and, indeed, of all the other species, although short and blunt, is one of the most effective weapons with which Nature has armed the ungulated order of quadrupeds. All who have seen it in its native jungles,

describe it as a most ferocious animal, capable of defeating the elephant (to which it seems to have a rooted

* Stedman, vol. i. 370.

antipathy), by ripping it up without mercy, with this weapon. One of these animals is known to have killed a horse by a single stroke of the horn, which not only penetrated though the saddle flap and padding, but fractured two of the ribs, leaving a wound through which a small hand might pass into the horse's lungs.*

(158.) The next great division of quadrupeds (*Glires*) comprehends the smallest and the weakest: these are the rats, the mice, the squirrels, the hares, and similarly formed animals. In these, the means of defence, for the most part, are of a very feeble nature. It is true that all have the power of inflicting, by their sharp and enormous cutting teeth, very severe wounds, in proportion to their bulk; but this quality is of little avail against those larger animals of which they are the prey. Their safety, indeed, for the most part, consists in their quickness, precaution, and nocturnal habits. The rat and the mouse are familiar instances: they bite, it is true, with great force, considering their diminutive size; but their safety consists in caution, agility, and nocturnal motions. The hare is, probably, for its size, the most defenceless quadruped yet discovered. It has not even the hooked claws of the sloth, or the burrowing habits of the mole; yet, how admirably has Nature provided for its safety! Its whole organisation seems to indicate the extreme of watchfulness in perceiving danger, and of speed and cunning in avoiding it. Hence, but for a refined and regularly organised system in effecting its destruction, by means of men, horses, and dogs, the hare — the most timid and defenceless of quadrupeds — would be one of the most secure from the injuries of uncivilised man, and from all the quadruped races. The whole of the *Glires*, in short, represent the order of *Grallatores*, or wading birds; and both respectively comprise the smallest individuals and the swiftest runners in their separate classes. The speed of the horse, in comparison to its bulk, is nothing to that of the hare; and

* Williamson's Field Sports, vol. i. p. 174.

every one knows that the different families of sand-pipers, plovers, curlews, and couriers (*Tachydromus Orientalis* Sw.*, fig. 45.)

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are, of all birds, the swiftest runners in the whole circle of ornithology. The same principle of safety is seen in the extensive family of squirrels, with the addition of another quality, — that of climbing with the greatest agility among trees, and

of taking prodigious leaps from bough to bough ; they run, in fact, like hares, but over a different surface, and in a different direction : they are the hares of the trees, instead of the ground ; and this principle is carried so far among certain genera, that the quality of leaping almost borders upon that of flying : hence, the name of flying squirrels, given to such as have the skin, between the legs, dilated into a thin membrane, sufficiently wide to expand in the act of jumping, and of supporting these animals in the air in the manner of an umbrella or parachute. The porcupines have a different and a very peculiar mode of self-defence. Speed does not belong to them, — but they are armed with acute spines, which they can raise or depress at pleasure ; and one species can even shoot these spines, as it is affirmed, into their foes. Most of the species climb trees with much facility, for they are provided with a prehensile tail. All these, however, have the power of rolling themselves into a ball, erecting their spines, and thereby presenting to their foes an uninterrupted surface of spears. The power of throwing the quills, as above mentioned, and attributed to the European porcupine, has recently been denied ; but its mode of defence is scarcely less formidable. It will

* See the specific characters of the species composing this genus, in the volume on Animals in Menageries, p. 339, 340. ; and Birds of Western Africa, vol. ii.

throw itself with impetuosity upon its opponent, and always sideways ; thus bringing into action the longest and sharpest of its quills. It seems most anxious, when attacked, to protect the head ; and yet no animal, perhaps, can bite harder. The thickest and strongest boards soon yield to the gnawing operation of their teeth. The beaver is equally remarkable for the same propensity ; it is well known to be aquatic, seeking safety in flight, or in the intricacies of its watery citadel ; and both the beavers and the porcupines are nocturnal animals. If, as we believe, the marsupial or pouched quadrupeds are really of this order, we see great powers of jumping joined to the active defence of kicking with their strong hind feet, the toes of which, from being armed with sharp claws, are capable of inflicting severe wounds. The cavies so nearly resemble the hares, that they probably possess the same instincts regarding personal safety.

(159.) On looking to the whales, or cetaceous quadrupeds (*Cetacea*), the means of self-defence are not very apparent, yet they are sufficient to protect these animals from the few foes which they are likely to meet with in their native element. In the true whales (*Balaenæ*), which are destitute of teeth, the only defence is in the tail : this part, however, is highly flexible, and very strong, and can be moved about on one side or the other with great rapidity. It is well known that those employed in the capture of this huge monster are exposed to imminent danger ; for many instances are on record where the whale, by a single stroke of its tail, has dashed the boat to atoms, or has thrown it up in the air, with all its crew, with as much ease as we should toss away a pea-shell. Among the cachalots, or spermaceti whales, we find large and strong teeth ; and these monsters are described as the most agile, the most audacious, and the most formidable of their congeners. They are not only able to defend themselves, but they seem to be among the most savage and voracious inhabitants of the deep, — “ where they reign as despotic

conquerors, with an empire absolute and destructive. They are not contented with repelling any attack, but dash with fury against everything which appears to resist them. They combat with intrepidity, cover the sea with blood, and pursue their prey with a bitterness and pertinacity that has scarcely any parallel. In these attacks they are distinguished by the extreme rapidity of their movements: they are said to appear and disappear like lightning; they advance and retreat with the velocity of an arrow, and the eye can with difficulty follow their varied evolutions. In the combat, fear, fury, and pain draw from them such profound groans, or piercing hissing cries, that their congeners are attracted in crowds from all sides, continue the fight with fresh ardour and audacity, and stain the waters with blood often to the distance of many leagues." * We know not upon what authority the industrious editor, from whom we have now transcribed this passage, has relied for his information; but, admitting that the account may be somewhat highly coloured, it will readily be perceived that these monsters are the *Feræ* of the natatorial quadrupeds, and as formidable in the ocean, as the lion and tiger are upon dry land. The narwal, although a much smaller animal, is the most completely armed of the whole order. He is, in fact, the elephant of the ocean, — being furnished with tusks, or teeth, sometimes twenty feet long, twisted spirally, excessively hard, and pointed, and capable of inflicting instant death or the most dangerous wounds. These and the cachalots are entirely carnivorous, — feeding upon fish, and even upon young whales. Even when the narwals, which generally go in troops, meet a full-grown whale, they are sure to give him battle, and a bloody contest ensues, of which they are not unfrequently themselves the victims. The dolphins, long celebrated by poetic fabulists as gentle and social to man, are, in reality, a cruel and blood-thirsty race, — preying upon the weaker inhabitants of the deep with great voracity, and following ships for no

* Griff. Cuv. vol. iv. p. 473.

other purpose but to feed upon the offal that may be cast overboard.

(160.) The means of defence enjoyed by Birds are much less varied, and apparently less efficacious, than those which have been given to quadrupeds. Their preservation, in short, depends, for the most part, on their flights—that is, in retreating from danger, rather than encountering it. It might be thought that the power so generally possessed by these creatures, of immediately launching into an element of their own, would prevent them from being attacked by terrestrial foes; but such are really their chief enemies. The whole tribe of martens and weazels feed almost entirely upon the feathered race; the tiger-cats and lynxes do the same; and all the families of the small *Carnivora* are perpetually on the watch for birds. Nor have they less to apprehend from animals of their own class. The whole of the falcons, the kites, the buzzards, and the harriers live upon their weaker brethren; and the typical butcher-birds are their small but powerful foes. They have enemies, also, among the reptiles. The rattlesnake, it is well known, feeds upon small birds: many others of America and India, probably, do the same; and serpents, in general, are proverbially great destroyers of their eggs. Very few of the feathered creation are provided with offensive weapons by which these enemies can be repelled. Some in the rasorial order, however, are armed with acute spurs, particularly the Argus pheasants of India; and many use their sharp-pointed beak as a spear, by which they can not only drive away intruders, but, by well-directed blows, deprive them of life. Others are capable of inflicting severe blows with their wings; and those of a larger size, as the eagles and swans, have been known, in this manner, to break the arm of a man. Upon the whole, therefore, we find that birds are not so entirely destitute of offensive and defensive weapons as, at first, might have been imagined: and we must recollect, that in their power of flying they enjoy a mode of fleeing

from their enemies which is almost peculiar to themselves.

(161.) In the rapacious order (*Raptores*), we, of course, find the greatest courage, and the power of inflicting the greatest injury upon their enemies. The sharp retractile claws of these birds, formed upon the same model as those of the beasts of prey, are the chief weapons of the rapacious birds, and with which they seize and secure their prey. The bill, also, is always hooked, generally very acute, and in a considerable number armed with angular projections — as in the true falcons



(fig. 46.)—analogous to teeth: these assist in tearing the flesh of their foes or of their food; while to these defences is superadded a muscular force far superior to all other birds of their own size. Humboldt affirms that two condors are able to attack and destroy a puma, or a heifer, and to peck out their eyes. It was long asserted that these birds flew off with young

children in their talons; but the author just named positively assures us that this is a vulgar error. The claws of the condor, and of the vultures generally, are by no means so formidable in their construction as those of the other *Raptores*; but they have an additional defence in the thickness of their skin, the compactness of their feathers, and the coat of down beneath them. Their tenacity of life is astonishing. M. De Humboldt was present at certain experiments on the life of a condor at Rio Bamba. They first attempted to strangle it with a noose; they hung it to a tree, and dragged the legs with great force for many minutes: but scarcely was the noose removed, than the condor began to walk about, as if nothing had been the matter. Three pistol-balls were then discharged at him, within less than four

paces' distance: they all entered the body; he was wounded in the neck, chest, and belly, but still remained on his feet: a fifth ball struck against the femur, and, rebounding, fell back on the ground; nor was it in less than half an hour after all these wounds that the bird died. Ulloa also affirms, that in the cold region of Peru the condor is so closely furnished with feathers, that eight or ten balls may strike against his body without one piercing it. But it may well be questioned whether many of the eagles — the *Aquila destructor*, for instance — are not as completely armed as is the condor. The claws of all the eagles and falcons are sickle-shaped, and both in form and effect may be compared to steel hooks; with these the prey is struck, and the bill is only used to separate the food. The owls have a singular mode of defence. A common barn owl, which we endeavoured ineffectually to tame, when under a suspicion of being handled, would make a loud hissing, like what we should imagine would proceed from a serpent; it would then throw itself on its back, and begin fighting with its claws: these are such formidable weapons, that, even in so small a bird, they would penetrate the flesh to the depth of an inch.

(162.) There are few very striking peculiarities attending the defensive habits of other birds; nor are there any which — so far as man and their own class are concerned — can be termed very offensive. The wings and the bill are almost their only weapons; and these are alone formidable when the bird is of a large size. In the gallinaceous tribe, however, we find strong and very acute spurs affixed to the legs, as in the Argus pheasant, the common cock, and many others; and with these, as it is well known, they fight desperately. The same appendages are found on the wings of many plovers (*Charadriadæ*) and waterhens (*Parra*); but we know not the particular enemies they are intended to repel. It seems uncertain, also, whether the horny excrescences on the heads, or rather the bills, of the

hornbills (*Buceridæ*), are used in any manner for self-defence ; but this is not unlikely, — since it is asserted that the cassowary — which is furnished with a protuberance in every way analogous in external form — is capable, in this manner, of inflicting severe bruises. Some few aquatic groups, but more especially the petrels, secrete an oily fluid, which they squirt out upon those who annoy them ; while such as are of a large size, and powerful flight, strike very severely with their wings.

(163.) Among reptiles, the *active* powers of defence are almost entirely confined to the teeth, the *passive* to their covering and their swiftness of motion. On the voracity of the crocodiles we have elsewhere expatiated. They are nearly the only animals of this class which use the tail as a weapon of defence ; and this, by being armed along its ridge with hard and pointed spines, is used to strike with, and, in the larger species, must be a very dangerous part. Their skin is covered with numerous small bucklers or shields ; and their mouth, furnished with long and narrow teeth, appears like a mighty gulf, sufficient to swallow an animal almost as large as themselves. In its more congenial element, — the water, — it has no foes capable of attacking it ; and if, as it is said, the carnivorous quadrupeds will sometimes assault the alligator, he avoids the encounter by making for the water — and, diving beneath, thus sets his pursuers at defiance. We must, however, recollect that these monsters inflict wounds either in self-defence, or when pressed by the calls of hunger ; but such is not the case with the majority of the serpent tribe. Their defence may be compared to the anger of a captious man, who, from being by nature quarrelsome, takes fire, and vents his spleen upon every one who comes in his way. Those very large lizards, which both in America and India are called *guanas*, although their bite is not dangerous, can defend themselves most effectually. The *guana* curls its tail towards its mouth when in danger, and lashes its enemy with it in a dreadful manner,

— the spines upon this part being capable of inflicting severe wounds, and occasioning the flesh to mortify.*

(164.) The defence of the tribe of snakes, generally speaking, is passive. There seems to be an instinctive horror, not only in man, but in all animals, against coming into contact with these loathsome reptiles: hence this feeling operates in their favour; for the fear of injury from their fangs generally counteracts our inclination to destroy their life. But even the most timid and humane persons cannot exempt themselves from the spiteful malice of the serpent, "the most subtle of all the beasts of the field." These reptiles enter our very dwellings, and inflict their venom upon every living thing which impedes their humour, or unintentionally offends them. Whether we are to regard the singular appendage at the tail of the rattlesnake as an indirect means of defence, is uncertain; it may, probably, by its sound, excite a dread of the animal, by intimating its approach, and thus act as a warning to others, and an indirect means of defence to the serpent. Besides the poisonous fangs, we meet with no other offensive or defensive weapon in this class, besides a small sting, not unlike that of the scorpion, which terminates the tail of one or two genera belonging to the Indies. The agility of lizards is proverbial, and both them, and the frog, are destitute of any defence: both, however, are cautious and wary; for lizards are particularly timid, and frogs generally lie concealed, during the day, beneath the dark foliage of rank vegetation. There are few animals in creation so incapacitated from active defence, and yet so protected from injury, as the tortoise. Yet how beautifully has the Creator defended this almost helpless reptile from the attacks of its enemies;—unable to sting, destitute of teeth, and proverbially the slowest of the slow, the tortoise is, nevertheless, able, in a moment, to defy the attacks of almost all other animals. He is incased with armour of proof. He is his own citadel. He has only to

* Williamson, vol. ii. p. 73.

withdraw his head and limbs within the bony shell which envelops his body, and he can defy the teeth of the tiger, the cunning of the fox, and the talons of the eagle. If, during these rencontres, the tortoise can slyly protrude his head and inflict a bite upon his enemy, the wound is most severe: the jaws, it is true, are destitute of teeth; but they are of solid bone, and so sharp, that they can only be compared to a pair of semicircular scissors. The consequence is often fatal. A middle-sized tortoise, at one bite, has been known to amputate the finger of a man, as effectually, though not so skilfully, as if it had been done by a surgeon; and if the bite is made in a fleshy part, it always brings out the piece with it.

(165.) The various modes of defence possessed by the class of FISHES are but imperfectly known; for these animals, hid from the eye of man in an element in which he cannot, for any length of time, exist, pursue their habits and instincts in secret. In this, as in all other natural groups, we find two descriptions of feeders;—one deriving their subsistence by rapine and bloodshed, destroying life and feeding upon their victims; the other, peaceful and inoffensive, feeding for the most part upon marine vegetables, and furnishing, by their flesh, a wholesome and nutritious food to man. The first of these propensities is possessed by the sharks, the rays, and a few others; and it is, consequently, among these that we find the offensive powers strongly displayed,—while they also become the means of self-defence. In the shark family, the teeth are the only weapons,—but they are of the most formidable description: these ferocious monsters have been known, at one gripe, to separate the body of a man in two, swallowing the one half, and leaving the other for a second mouthful! the irresistible power possessed by such a fish over the inhabitants of the deep may, therefore, be readily understood. The teeth of the sting rays are not so formidable; but they have a peculiar defence of their own, which always renders them

objects of great terror. This is a long, bony, and rather flattened process, (fig. 47.). placed on the tail, of great hardness, and very sharp, the sides of



which are armed with numerous barbs. So perfectly does this weapon resemble the head of an Indian spear, that it might be easily mistaken for such by an unpractised eye. Whether the fish, at the time of inflicting a wound with this instrument, discharges some poisonous liquid, or whether the effect produced by the laceration of the flesh, in withdrawing this natural spear, indisposes the wound to heal kindly, certain it is that the most fatal consequences have attended the sting of these rays; and the fishermen of the Mediterranean, where one of the species is found, persist in declaring that its sting is poisonous.

(166.) It may be generally concluded, that, whenever fish are armed with bony spines, either upon the body, the tail, or the fins, these instruments are employed in self-defence. One of the great characters, indeed, of the sub-typical group of the whole class is, to have the fins supported upon bony rays, most of which are acutely pointed, while those of the typical circle are soft, and incapable of doing any injury. The scorpion fish (*Scorpena*) derive their vulgar name, not from possessing a sting, but from the terrific appearance of the spines in the head. In others, as the genus *Acanthurus*, there is, on each side the tail, a single large spine, not unlike that of a rose bush, with the point directed towards the head; by this position, the fish, if swimming past its adversary, can tear up an open wound, for a considerable length, along the body of its enemy. The common sting-bull (*Trachinus Draco*) has the spinous rays of the first dorsal fin very acute; and with these it can inflict wounds which are accompanied by immediate, and often dangerous, inflammation, extending all up the arm and shoulder.

But the highest development of this species of defence is seen among the branchiostegous fishes, or order which we have denominated as the cheloniform fishes, because they represent the tortoises and hedgehogs. The genus *Diodon* has the body completely covered with long acute spines, which stand out in every direction; these are sometimes so sharp, that they can be compared to nothing so well as to those on the hedgehog or the porcupine. Nor do we conceive that these fish can be handled, by any possibility, when they are alive. In the genus *Tetrodon*, the belly, alone, is prickly, and this part is capable of being inflated to a very large size. In *Ostracion*, and several other genera, we have a perfect representation of the armorial covering of the cheloniform reptiles: the whole body is enveloped in a bony coat, or covered with hexagonal scales, the sides of which fit into each other compactly, and thus protect the fish even from the teeth of ordinary foes.

(167.) There are several genera where the snout is elongated either into a long pointed bone destitute of spines, or into a flat process armed on each side with formidable tooth-like spines resembling teeth. Both these offensive weapons are possessed by fish of a gigantic size, which, from their resemblance in other respects to the sharks, lead us to believe they are altogether rapacious. The first is the sword-fish (*fig. 48.*),



which frequently grows to near twenty feet long. It is a most powerful fish, which frequently attacks whales: so blind is its headstrong fury, that it will pierce the sides of ships with its sword-like snout,—probably mistaking the vessel for some huge monster of the deep. A part of the bottom of a large East Indiaman, with the

sword of this fish driven completely through, is now, as Dr. Shaw asserts, or was, in the British Museum: the fish was killed by the violence of the effort; and the vessel, in all probability, was saved from foundering, by the fish not having power to withdraw its snout. We are unacquainted with the manner in which the saw-fish (*Pristis Antiquorum*) uses the formidable apparatus which terminates its snout; but when we consider that this part, in itself, is often no less than five feet long, and that it is armed with from eighteen to twenty-four strong spines on each side, it may be concluded to be a deadly weapon. The electric quality possessed by the torpedo is, no doubt, one of the means employed by nature for effecting self-preservation: it is unknown, however, against what particular enemies this unusual defence is directed.

(168.) Michaux is the only writer who has informed

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us of the precise manner in which the formidable spines (fig. 49.) so general in the fins of the *Silures*, or cat-fish (*Siluridæ* Sw.), are used. The Ohio abounds with these fish, which may be caught with a hand line, sometimes weigh-

ing 100 pounds. The first ray of the dorsal is formed of a very strong and sharp spine, which the animal uses to kill others of a smaller size; for this purpose it gets beneath the fish it intends to attack, and then, suddenly rising, wounds it repeatedly in the belly. "We had opportunities," he adds, "of observing this circumstance twice in the course of our navigation" down the Ohio.*

(169.) The power of quitting its native element, to take refuge in another, belongs to the whole genus of *Exocoetus*, or flying-fish; and doubtless to many species of *Trigla*, or gurnard, where the pectoral fins are equally developed. The former swim in shoals; and

* Mich. Trav. p. 131.

it is no uncommon sight, between the tropics, to see one or two hundred of these pretty fish rise from the surface of the water, and, just skimming over the waves, descend gradually again into the sea. By this means they frequently escape the pursuit of the rapacious fish swimming beneath. It is customary for compilers to assert that this effort of the flying fish is attended with little or no safety to themselves; for that, so soon as they quit the sea, they are assailed by gulls and other sea birds, which seize them in the air. That such an event sometimes takes place, no one would reasonably question; but the coincidence is very rare. We have repeatedly seen whole shoals, or rather flocks, of these fish rise from the water and enter it again without a sea bird being in sight; and even where they accidentally have been near at hand, as one bird could only seize one fish, the great proportion of such as escaped must be obvious.

(170.) We may consider the slimy mucilage with which the skin of all the eel-like fishes is covered, as in some degree useful for their preservation. Every body knows the difficulty, not to say the impossibility, of holding an eel when just caught; it slips through the hand, and, in nine instances out of ten, falls into the water. Eels, in fact, are among the most defenceless of fish; but the conger, which sometimes grows to a very great size, is furnished with strong teeth, and bites very hard. Of the defensive powers possessed by the *Amphibia*, we are entirely unacquainted; they are all weak and simply constructed animals, living for the most part in the mud and banks of ponds and swampy grounds, and are totally unarmed.

(171.) We shall now consider the means of defence possessed by annulose animals, or INSECTS. It may be stated as a general truth, subject but to few exceptions, that the degree of danger to which an animal is subjected, is in proportion to its size, and to the muscular power with which it is endowed. We have seen that to the most bulky of the true quadrupeds, Nature has

bestowed proportionate means of defence to their size. The elephant can master and repel all others of its class, except, perhaps, some of the large *Carnivora*. The rhinoceros, in like manner, is one of the lords of the animal creation; while the bulky hippopotamus, although armed but with short tusks, is exposed, by its aquatic habits, to fewer injuries than are any of its congeners. But when we descend to the mouse, we see an animal whom hundreds of its own class could exterminate, had not Nature given to it a degree of caution and timidity which cannot be traced among the larger animals. On the same principle of giving security to the weak, by excessive caution, or by cunning devices, do we see that Nature has proceeded in her care of the insect world. These innumerable hosts of living creatures, exposed to a thousand dangers from the larger animals which prey upon them, no less than from foes belonging to their own tribe, are, nevertheless, protected, in a wonderful manner, by habits, by structures, and by devices the most extraordinary. These, as we have before explained, may be chiefly referred to the two heads of *active* and *passive*, or *direct* and *indirect* defences. The former, as most obvious, will first claim our attention.

(172.) "The active means of defence," observes Mr. Kirby, "which tend to secure insects from injury or attack, are much more numerous and diversified than the passive; they are also more interesting, since they depend more or less upon the efforts and industry of the creatures themselves."* When urged by a sense of danger, they assume various forms; emit noises, scents, or fluids; or boldly attack their adversaries with natural weapons, with which, for such purposes, they are armed. All modes of defence are comprised under these three divisions; but we shall follow the industrious authors who have already so ably treated this subject, by considering the active defences made by insects under the following heads: — 1st, by attitudes;

* Int. to Ent. vol. ii. p. 232.

2d, by noises; 3d, by scents; 4th, by emission of fluids; 5th, by weapons; 6th, by stratagem or concealment.

(173.) The *attitudes* which insects assume, either to screen themselves from observation, or to terrify their enemies, are very remarkable. Among the means resorted to for the first of these purposes, is that of *imitation*. Mr. Kirby mentions a *Staphylinus*, or rove beetle, which he at first mistook for a very minute shining round pebble; this appearance was produced by the insect folding its head under the breast, and turning up its body over the wing-cases. The *Silpha thoracica* Lin. (fig. 50.), when alarmed, has recourse to a similar manœuvre; in which state, the colours being black and yellow, the insect looks like a rough stone. Many of the weevil beetles (*Curculionidæ*), particu-



larly those with short thick bodies, on the least appearance of danger, gather themselves into a heap, bend their snout under the thorax, and fall to the ground from the plants upon which they happen to be feeding. It is then in vain to search for them; for, the colours being perfectly matched to those of the ground, the keenest eye will be completely baffled. There is a genus of this family, found in the sandy tracts of Africa and of Sicily, which, although large, is so exactly coloured like the sand, that few entomologists would distinguish the insects from the surrounding soil. One of the most singular attitudes of this sort is that assumed by nearly all the onisciform types of annulose animals, and by many of those in the vertebrated circle;—it is that of rolling themselves up in a perfectly spherical ball, like the common woodlouse: in this attitude the legs and all the softer parts of the body, on the under side, are entirely covered and defended by the hard crust which forms the upper surface of the animal. Other insects endeavour to protect themselves from

danger by feigning death. The common dung chafer (*Geotrupes stercorarius*), when touched, or in fear, sets out its legs as stiff as if they were made of iron wire, — which is their position when dead, — and remain perfectly motionless. The tree chafers elevate their posterior legs into the air, probably with the same view; while the *Scarabæus Sacer* and its allies, if our memory serves us right, pack their legs close to their body, in the same manner as do the *Byrrhii* mentioned by Mr. Kirby.* The same author relates, from the scarce volumes of De Geer, the extraordinary pertinacity with which the little beetle, named *Anobium pertinax* by Fabricius, persists in counterfeiting death. "All that has been related of the heroic constancy of American savages, when taken and tortured by their enemies, scarcely comes up to that which these little creatures exhibit. You may maim them, pull them limb from limb, roast them alive over a slow fire; but you will not gain your end, — not a joint will they move, nor show, by the least symptom, that they suffer pain."* Many *Tenthredinæ*, or saw-flies, pack their antennæ and legs close together; and every one has witnessed the same remarkable habit in the majority of spiders.

(174.) There are two sorts of attitudes assumed by caterpillars, which deserve attention, — the one deceptive, the other threatening. The first is chiefly practised by those belonging to the looper moths (*Geometridæ*). These caterpillars, when at rest, support themselves for hours by means of their hinder feet only, raising the body high in the air, and preserving it either in a stiff straight line, or in a curve (*fig. 51.*). The colour of the skin exactly resembles that of the stem or bark of the tree upon which the insect feeds; and thus the deception is so complete, that a person, after having had one of these deceiving masqueraders pointed out to him, will have much difficulty in believing it to be anything more than a dry or green twig. Nothing, in short, can be more deceptive; so that the

* Int. to Ent. vol. ii. p. 224.

† Id. *ibid.*

insect feels perfectly secure from the attacks of those



numerous small warblers, and other insectivorous birds, which are constantly searching for insects among foliage. Rösel relates a story of his gardener, who, mistaking one of these caterpillars for a dead twig, started back in great alarm, when, upon attempting to break it off, he found it was a living animal. Nearly the whole of the typical hawk moths (*Sphingides*) assume attitudes of a threatening or terrific character; thus becoming fit emblems of the *Feræ* among quadrupeds, and the *Arachnoïdes* among insects. When at rest, these caterpillars,—which are usually of the same green colour as the foliage upon which they feed,—by drawing their heads into an elevated curve, assume a rampant attitude (*fig. 52.*), and thus remain motionless for hours: if, however, they are disturbed, they move the head and fore part of the body, by sudden jerks, on one side and the other, precisely as if it intended to give a side blow to its assailants. An attitude precisely similar is assumed by the great caterpillar of the *Bombyx regalis*, called by the Americans the horned devil; when disturbed, it draws up its head, and shakes it from side to side, as if threatening to attack its enemy: this motion, together with the strange horns which point out from the head in every direction, gives this insect such a

terrific appearance, that the natives dread it as much as they do a rattlesnake.



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(175.) Another extraordinary mode of intimidation is mentioned by De Geer, as being used by a species of *Malachius* Fab. When irritated, this insect shows its rage by puffing out and inflating four vesicles from the side of the body; these vesicles are soft, of an irregular shape, and of a bright red colour. When the cause of alarm is removed, they are retracted, so that only a small portion of them appears. Nearly all the species of rove beetle (*Staphylinus*), if disturbed, expand their jaws, and elevate the body upwards, as if they intended to sting their foe. Now, the first of these defences is real, because the insect can really bite very hard; but the latter is merely to intimidate, for the abdomen has neither forceps nor sting, and is, consequently, incapable of inflicting the least injury. Humble-bees, when disturbed, intimidate by well assuming grotesque and threatening attitudes: they lift up the legs in a strange manner; turn themselves upon their backs, and protrude their sting, accompanied by a drop of poison; sometimes they will even spit out that liquor. Other bees will dash and strike about the heads of those who intrude near their nests. Every one must have remarked that the peculiarly irregular zigzag flight of the butterflies renders it extremely difficult to catch them; and it is, no doubt, to this circumstance that they are indebted for their safety

during summer, when swallows are chasing insects in all directions.

(176.) The *noises* emitted by insects are, doubtless, in many instances, intended to effect their preservation from enemies. The "drowsy hum" of beetles, humble-bees, and other insects, during flight, may tend to preserve them from some of their aerial assailants. The noises, however, which many of these insects produce, when free from danger, are sensibly different from those emitted when they are captured, and apprehensive of life; the latter sounds are always shriller and more plaintive, as if the little creature had lost its joyous hum of liberty, and was interceding, in piteous terms, for its freedom: this modulation of voice is more especially observed among certain bees and flies; and is sufficient to disarm — as we have ourselves experienced — even the ardent zeal of the collector. This cry of intercession is in no insect so remarkable as in the death's-head sphinx (*S. atropos*). Its cry is peculiarly plaintive, and resembles that of a young child. A learned divine, as Mr. Kirby states, who was also an entomologist, had one of these insects brought to him when he was unwell; but he was so moved by its plaintive noise, that, instead of devoting it to destruction, he gave the animal its life and liberty.

(177.) Insects are provided with additional defences, by emitting *scents* and *fluids* of the most repulsive quality. Examples of these occur in nearly all the orders. The *Gyrinus natator* emits a strong rancid smell; and that of the *Blaps mortisaga* is very disgusting. Many *Carabidæ* exhale a disagreeable and penetrating odour; that of the cockroach is very sickening, and nearly as bad as the smell of the bed-bug. Nearly the whole tribe of the *Cimicides* possess a very strong and disagreeable scent: but the most remarkable insect in this respect is the *Hemerobius perla*, a golden-eyed and lace-winged insect, of a delicate green colour, very common in gardens: this beauty, however, is counter-balanced by a strong and most disgusting scent of

human ordure, that proceeds from its touch. Some of the ants are equally offensive. Many insects emit their smell from particular organs: thus, nearly the whole of the caterpillars of the true butterflies (*Papilio* Fab.) have two retractile horn-shaped processes, which, from Bonnet's observations on the European species, emit a strong smell, and are probably employed by the insect to drive away the flies and ichneumons that annoy it. De Geer mentions the larva of the *Tenthredo*, or saw-fly, which throws out a most nauseous odour, from somewhat similar organs, situated between the legs. The larva of *Chrysomela Populi* emits a white milky fluid, the smell of which, as De Geer says, is almost insupportable. But the most extraordinary insects possessing this species of defence, are the beetles called bombardiers (*Brachinus*). The most common species (*B. crepitans*), which is found occasionally in many parts of Britain, when pursued by its great enemy, *Calosoma Inquisitor*, seems at first to have no mode of escape, — when, suddenly, a loud explosion is heard, and a blue smoke, attended by a very disagreeable scent, is seen to proceed from its *anus*; and this immediately stops the progress of its assailant. When it has recovered from the effects of this discharge, and the pursuit is renewed, a second, in like manner, arrests its course. This little bombardier can fire its artillery twenty times in succession, if necessary; and so gain time to effect its escape. Another species (*Brachinus displosor*), by bending the joints of its abdomen, can direct its smoke to any particular point. M. Leon Dufour observes that this smoke has a strong and pungent odour, very similar to that of nitric acid. It is caustic, and produces on the skin the sensation of burning.

(178.) The *emission of fluids* is another means of defence possessed by insects. The *Chrysomela tenebriosa* Fab. (fig. 53.), when handled, usually ejects from its mouth drops of a red fluid, which stains paper of an orange colour. Lesser, having once touched the anal



horn of the caterpillar of some sphinx, it suddenly turned its head, and vomited upon his hand a quantity of green, viscous, and foetid fluid, which infected his hand for two days: many other caterpillars do the same; and some spiders, when they are provoked to bite, emit small drops of a clear fluid. The larva of a *Tenthredo*, or saw-fly (*Pteronus Pini*), upon being touched, immediately raises the fore part of the body, and emits from its mouth a drop of clear resin: these larvæ live in societies; and, "what is very remarkable, no sooner does a single individual of the group give itself this motion, than all the rest — as if they were moved by a spring — instinctively do the same. Thus do these little animals fire a volley, as it were, at their annoyers, — the scent of which is, probably, sufficient to discomfit any ichneumons, flies, or predacious beetles that may be desirous of attacking them."* Several beetles, particularly the larger *Carabi*, eject a liquor from their *anus*: and the acid smell of many ants is one of their most powerful means of self-defence. Other insects, like those of the genus *Meloe*, or oil beetle, exude a fluid from the joints, and the segments of their body; while that discharged by the common ladybird stains the hand of a deep yellow. Some have the power of throwing or squirting this liquor upon their enemies: the larva of the great emperor moth (*Bombyx pavonia*) does this, when the spines of the body are touched; but in that of the puss moth (*Bombyx vinula*), and several others, there is a peculiar apparatus for this purpose. These caterpillars have a cleft in the neck, between the head and the first pair of legs; from this issues, at the will of the animal, a singular syringe, laterally bifid, the branches of which are terminated like the rose of a watering-pot. By means of this organ, when touched, it will syringe a

* Int. to Ent. vol. ii. p. 242.

fluid to a considerable distance, which, if it enter the eyes, gives acute, but not lasting, pain. *

(179.) We may now pass on to the *arms* or *weapons* assigned to insects. The two branches or tails, above mentioned, of the puss moth come under this denomination; for the caterpillar, upon being irritated, lashes its sides, as with a whip, and thus effectually drives away those ichneumons, or parasitic *Hymenoptera*, which seek to deposit their eggs in its skin. Most of the typical thrysauriform caterpillars have the head furnished with horns or spiny processes, analogous to the quadrupeds (*Ungulata*) and the birds (*Buceridæ*) which they represent. Lewin describes a caterpillar of Australia, which inflicts very painful and venomous



wounds, by means of bunches of little stings, which are darted forth from the tubercles placed on the back. The whole of the *Theclidæ* (fig. 54.), or hair-streak butterflies, furnished with tails on their posterior wings, keep these processes in constant motion when the insect itself is at rest,—a fact we observed in Brazil, in 1815. These tails, as Mr. Kirby well observes, resemble antennæ,—so that, at first sight, the in-

sect appears to have a head at each extremity;—a deception which is much increased by an eye-like spot at the base of these processes. It is thus, in all probability, that these insects perplex or alarm their assailants. Of the uses of those singular horn-like spines on the head and thorax of many coleopterous insects, particularly those of the *Dynastidæ* MacLeay, we are in total ignorance. They are probably intended, among other things, to point out their analogy to the ruminating quadrupeds; and even the

* Int. to Ent. vol. ii. p. 232.

sight of these formidable processes may be sufficient to protect those which possess them from many enemies. All the large masticating insects, without doubt, employ their jaws as weapons of defence, no less than for preparing their food ; and some of the larger locusts of South America bite so hard as to draw blood from the part they get hold of ; the spines, also, of the hinder legs of these insects, and those upon the anterior feet of the *Mantidæ*, will penetrate the flesh, and frequently oblige the entomologist, who has captured these insects, to let go his hold.

(180.) But the most formidable weapon belonging to insects is the sting. Such as are provided with this defence, are the most courageous little warriors of the animal world. They attack, with the greatest boldness, any animal which impedes their progress, or whom they suspect of injuring them : the giant bulk of the elephant, or the sovereignty of man, will not deter these puny warriors from entering the lists against them. Death has been known to follow the united attack of a hive of enraged bees, and even the single infliction of a sting from some of the large African scorpions. "I know nothing more astonishing," observes Mr. Kirby, "than the wonderful muscular strength of insects ; which, in proportion to their size, exceeds that of any other class of animals. This is likewise to be reckoned among their means of defence. Take one of the common chafers or dung beetles in your hand, and observe how he makes his way in spite of your utmost pressure ; and read the account which authors have left us of the very great weights that a flea will easily move, — which is just as great as if a single man should be able to draw a waggon with forty or fifty hundred weight of hay.

(181.) *Concealment* is another method by which Nature has provided for the safety of these little creatures. One mode is that of covering themselves with various substances. This is often done by small aquatic beetles, with mud ; so that when feeding, at the bottom of

the water, they are secure from the larger predacious sorts which surround them. A little beetle (*Georyssus cretifera* K.), which frequents chalk, whitens itself all over with that substance; for as this animal, when clean, is very black, were it not for this manœuvre, it would be too conspicuous, upon its white territory, to have any chance of escape from birds or other assailants. No insect is more celebrated for rendering itself hideous, by a coat of dirt, than the *Reduvius personatus* Fab.: when in its larva and pupa state, every part of its body, even its legs and antennæ, are so often covered with the dust of apartments, such as particles of sand, hairs of wool or silk, and other similar matters, that the animal, at first sight, would be taken for one of the ugliest spiders. This disguise answers a double purpose; — first, as a protection to the insect itself; and, secondly, as a stratagem by which it secures its greatest enemy, the bed-bugs, for food. Several Brazilian species of the same group (*Reduviæ*) are covered with a thick coat of down, which is also glutinous, so that they can put on any disguise most adapted to their wants. As Hercules, after he had slain the Nemæan lion, made a doublet of its skin, so the larva of *Hemerobius chrysops* covers itself with the skins of the luckless plant lice (*Aphides*) that it has slain and devoured. Some of the *Cassidæ* have the singular custom of sheltering themselves under a canopy affixed to their tail, and formed of their own excrement; this they elevate in the air, bringing it over their body precisely the same as we should hold an umbrella. Mr. Kirby notices the same habit in a little beetle (*Lema merdiger* Fab.), and explains the process by which it is effected.* While, among the *Cocci*, or cochineal insects (representing the *Cassidæ*, in their own circle), the same object is effected by very long cotton-like tufts, which clothe the hinder parts of the body, and are recurved over the insect. Every one must have observed the tortoise-like *Cocci* found upon vines and other

* Int. to Ent. vol. ii. p. 260.

greenhouse plants, as being covered, some with a white powder, and another species with fine brown dust, so exactly resembling the bark, that even an entomological eye may be deceived by the resemblance. Among crabs, which, as being annulose animals, come under the general name of insects, this method of concealment is peculiarly strong. Several of the long-clawed species dress themselves up in little fragments of sea-weed; and thus disguised, both from their enemies and their prey, they move among the *Fuci*, and other marine plants, in perfect safety to themselves, and without the least suspicion to those lesser animals upon which they feed. The whole family of the hermit crabs conceal themselves in empty shells, where they take up their permanent abode, and crawl about with their defence upon their backs.

(182.) Caterpillars, from the delicacy of their skin, are more especially subject to injury; hence we find that Nature protects them, either by long and compact, or dense and silky, hairs, by clothing them in the precise colour of the leaves upon which they feed, or by giving them the instinct of concealing themselves. This latter method is performed in two ways, either by the whole brood of caterpillars spinning a common web, like a large tent, under which all the community, for a part of their lives, reside; or, by teaching every individual to roll itself up in a leaf, so as to be completely hidden, and inaccessible to its enemies. Now, the whole of the *Hesperidæ*, or skipping butterflies, are protected in this manner; and those little moths, which Linnæus placed in his section *Tortrix*, do the same in their larva state. The caterpillars of the *Phryganidæ*, or cad-worms, so common in streams and ponds of water, inclose themselves in moveable tubes, and crawl about, like their representatives, the hermit crabs, at the bottom of the watery element. Many conceal themselves in the flowers upon which they feed; and the male of a little bee (*Apis campanularum* K.) dozes voluptuously in the bells of the different species of *Campanula*. Certain bees and wasps (as *Apis variegata* Lin., and *Nomada*

Goodeniana K.) occasionally sleep in security, by suspending themselves by their jaws. This unusual attitude is, probably, to secure themselves from particular enemies. We have before mentioned the cad-worms, or May-flies (*Phryganea*), in their caterpillar state; but the economy of these insects, when about to undergo a change into the chrysalis state, is still more curious. This latter is a state of inactivity: it is, therefore, necessary that the open end of their cylindrical case should be sufficiently closed to prevent the intrusion of enemies, and still admit the water necessary for their existence. But these sagacious little creatures know how to do this; for they interweave a grate or portcullis at each end of their fortress, which, at the same time, keeps out intruders and admits the water. These grates they weave with silk, spun from the *anus* into long threads. Both Reaumer and De Geer have given us many interesting accounts of this family; which, by their spinning, represent, in their own order, the spiders among the *Aptera*, and the *Lepidoptera* among the *Ptilota*, or winged insects. The nocturnal habits of a very large proportion of the *Lepidoptera*, including many thousand species of moths (*Phalœnides* Sw.), are well known; they remain concealed during the day, and the night is, to them, the season of recreation, feeding, and enjoyment. Many of the larvæ or caterpillars of this tribe do the same; by which means they escape destruction, not only from birds, but from many large carnivorous insects. Some (like that of the *Noctua subterranea* Fab.) never ascend the stems of plants; but, like an experienced woodman, lop down the stems at their base, which, by falling, bring the foliage within the reach of the caterpillar.

(183.) But the principle of *concealment* is remarkably developed in a family of moths peculiar to New Holland, named by Lewin, who has investigated their economy, *Cryptophasia*. Their history may be exemplified in that of the *C. irrorata* Lewin (*fig. 56.*). The egg is deposited on the bark, into which the young cater-

pillars (*fig. 55.*) immediately enter, boring downwards a cylindrical cell to the centre of the stem, where it finally



takes up its abode. It secures the entrance by weaving a convex covering or door (*fig. 56.a*). This door is fastened



securely on the upper end, while the lower is left in such a manner that the larva can pass and repass at pleasure. After sunset, the cautious inmate sallies forth to provide food. He cuts off the leaves, and conveys them, one by one, to the mouth of his cave, into which he then descends, and draws his provender after him: this laborious occupation is continued during the whole night; but, on the approach of day, he retires with precipitation to his retreat, and begins quietly to regale upon the provisions he has collected.* We were puzzled to conjecture in what manner these industrious caterpillars

could open the door of their hut when their mouth was

* See Lewin's *Ins. of Nat. Hist.* pl. 10.

employed in securing and carrying their food ; but this our author explains when describing another species.* When the caterpillar arrived at the entrance of his retreat, he raised up the door *with his hinder parts*, and, sliding down into the cell backwards, dragged the leaf after it, — the extreme end of the stalk of which it held artfully in its jaws ; nor did it quit its hold until the leaf was safely and almost wholly within its cell, where it fastened it down, together with the covering of the entrance (*fig. 56. a*), by a web.

(184.) The *stratagems* by which insects defend themselves are almost innumerable. They are, however, for the most part, connected with those methods of self-defence which we have already noticed. It has been observed that some of the Brazilian *Hesperiæ*, or skipper butterflies, upon flying into cover, strike violently some leaf to deceive the eye of the pursuer, and to make it appear that the insect is there concealed, — whereas it retreated by another passage. The same artifice is used by the common golden Y. moth, and by many other *Bombycides* ; for the whole group represent the *Hesperiæ*. Bees are exceedingly skilful in their stratagems. In order to guard against certain little moths (*Tinea mellonella* Fab.), the greatest destroyers of their combs, they place sentinels at the entrance of their hives, who pace about, with their antennæ extended, and alternately directed to the right and left. In the mean time, the moths flutter round the entrance ; and it is curious to see with what art they know how to profit by the disadvantage that the bees, which cannot discern objects but in a strong light, labour under by moonlight. But, should they touch a moth with these organs of nice sensation, it falls an immediate victim to their just anger. The moth, however, seems to glide between the sentinels, — avoiding, with the utmost caution, as if she was sensible that her safety depended upon it, all contact with their antennæ. These night sentinels upon guard are often heard to

* Ins. of Nat. Hist. p. 12. pl. 11.

emit a very low hum ; but no sooner does any strange insect or enemy touch their antennæ, than the guard is put into an evident commotion, the hum becomes louder, and the enemy is assailed by the bees from the interior of the hive. To defend themselves from the death's-head hawk moth, they have recourse to a different proceeding. In seasons when they are annoyed by this animal, they barricade the entrance of their hive by a thick wall, made of wax and propolis. This wall stops up the gateway, but is itself pierced with one or two openings, each sufficient for the passage of a working bee. These fortifications, however, are occasionally varied. Sometimes there is only one wall, as above described ; at others, many little bastions, one behind the other, are erected. Gateways masked by the interior walls, and not corresponding with those in them, are made in the second line of building. These case-mented gates are not constructed by the bees without the most urgent necessity. When their danger is present and pressing, and they are, as it were, compelled to seek some preservative, they have recourse to this mode of defence, — which places the instinct of these animals in a wonderful light, and shows how admirably they can adapt their proceedings to circumstances. Dr. Leach (on the authority of Mr. D. Bydder, a well-informed collector, whom we personally knew) informed Mr. Kirby that the humble or ground bee (*Apis terrestris*), when covered by those small mites (*Gamasus gymnopterorum* Fab.) which frequently infest it, will take its station in an ant-hill, where it will begin to make a disturbance by scratching and kicking : the ants, enraged at such a bold enemy, sally forth and immediately attack him ; the bee, however, is secure, by his hairy coat, from their jaws, — but the mites become the victims : they are seized by the ants ; and are either destroyed on the spot, or carried off in their jaws in triumph, — while the bee, thus delivered of his enemies, opens his wings with renewed vigour, and takes his flight.

(185.) We might extend this inviting subject to a

considerable length, but our limits have already been transgressed. The insect kingdom, more than any other, abounds with the most curious and wonderful facts, demonstrating the goodness of that Almighty Providence which is continually watching over the well-being of its creatures, and giving to every one, not only the enjoyment of life, but the instinct to preserve it against injury. "Why, then, should man" (as the pious and learned naturalists whom we have so often quoted observes), "the head of the visible creation, ever doubt, if he use his powers and faculties rightly, that his Creator will provide him with what is necessary for his present state? Why should he imagine that a Being, whose very essence is LOVE, — unless he compels him, by his own wilful and obdurate wickedness, — will ever cut him off from his care and providence? Another idea, that, upon this occasion, must force itself upon our mind, is, that nothing is made in vain. When we find that so many seemingly trivial variations in the colour, clothing, form, structure, motions, habits, and economy of animals, are, in one way or other, of essential importance to them, we may safely conclude that their other peculiarities — of which, as yet, we know not the use — are equally so: and we may almost say, reversing the words of our Saviour, that not a hair is given to them without our heavenly Father." *

(186.) On the *passive defences* possessed by insects, we shall but slightly touch, since they are less striking than those of which we have already treated, and many of them have been incidentally mentioned in connection with the other properties of these creatures. In many tribes, self-preservation is promoted by some peculiarity of form; in others, by colour, by which they either deceive, dazzle, alarm, or annoy their enemies; while, in others, the same object is effected by their clothing or external substance, their involuntary secretions, their vitality, or their numbers. Many insects deceive by the close resemblance of their form to other substances.

* Kirby and Spence, *Int. to Ent.* vol. ii. p. 269.

The *Curculio nebulosus*, by its grey colour, spotted with black, is so like the soil upon which it is generally found, that it will deceive even the eye of an entomologist. The little species of the same family, found on the blossoms of the *Scrophulariæ*, by its close resemblance to the black and white excrement of a bird, nearly escaped our observation this very morning. Others resemble chalk, pebbles, or little black stones, either rough or polished: by these means, they escape the observation, and consequently the injury, of their enemies. Multitudes, as already remarked, are clothed in the colours of the plants upon which they feed, or the substances which they generally frequent. The upper wings of nearly all the hesperian moths (*Nocterides*) are mottled and variegated with dull colours; and for this reason, these insects, during the day, repose on the sides of the trunks of trees, pales, walls, &c., without sheltering themselves under cover; and, being perfectly motionless, their colours harmonise so exactly with these objects, that they are overlooked by their enemies, and can scarcely be perceived by the keen eye of an entomologist. The whole of the *Mantis* family, or walking-leaf insects, as they are commonly termed (*Phasmidæ*), may be said to deceive by their resemblance to the leaves and fragments of vegetables: some, of an enormous length, look so exactly like slender dead twig covered with bark, that, in prosecuting our researches in Tropical America, we only discovered they were insects by mere accident: upon being handled, they feign death; and their legs are often knobbed like the withered buds of trees. Some resemble living twigs, and are green; others, such as are dead, and are therefore coloured brown; the wings of many put on the resemblance of dry and crumpled leaves, while those of others are vivid green,—in exact accordance with the plants they respectively inhabit. As all these insects are rapacious, these disguises are not only given for their protection, but also to enable them to approach their prey unsuspected. The same observations are applicable to

many of the wood-bugs, or hemipterous insects, and even to some *Lepidoptera*. We have two or three Brazilian moths, whose wings appear like withered leaves that have been eroded or gnawed round their margins by insects: when these moths are disturbed, instead of flying away, they fall upon the ground like the leaf which they resemble,—so that it is extremely difficult, if not impossible, on such occasions, to know what they really are. The English lappet moth (*Bom-*



byx quercifolia F., fig. 57.) is one of the best native examples we can adduce of this passive deceit; for its wings, both in shape and colour, resemble an arid

brown leaf. There are, even in this country, a genus of spiders, which, without spinning any web, live entirely in flowers, and, being coloured precisely the same as the petals, they can only be detected on a very close examination. Mr. Kirby mentions an African *Pneumora*, a sort of grasshopper, whose rose-coloured wings, shrouding its vesiculose abdomen, gave it much the appearance of a fine flower; while several of the beetles, belonging to the families *Trogidæ* and *Curculionidæ*, by the spine-like protuberances and deep sulcations of their wing-cases, resemble the dried hispid seeds of plants. Mr. Kirby suggests, and with much reason, that the intimate resemblance of certain flies (which in the larva state live in the nests of bees) to *Hymenoptera*, is, that they may deceive the rightful lords of the dwelling, and enter with security for the purpose of depositing their eggs.

(187.) The brilliancy of colour possessed by many tribes, and which of itself is sufficiently constant to point out a natural group, has, no doubt, some relation to the safety of the creatures themselves. These colours, often highly metallic, may dazzle the sight of their

enemies, and thus contribute to their safety. The whole family of *Chrysidæ* are of this description; while the extreme hardness of their covering — equivalent, in them, to a suit of polished armour — is one of the best defences they can enjoy against the attacks of bees and wasps, in whose nests they deposit their eggs. The brilliant metallic colours which adorn these beautiful little insects, by their radiance, are well calculated to dazzle the sight of their enemies, especially in those sunny situations where they love to sport. The fearful aspect and threatening appearance of many insects is, undoubtedly, another means of passive defence, to which we have already adverted. The formidable aspect given to many coleopterous insects — as the horned beetles (*Dynastidæ*) and the stag-beetles (*Lucanidæ*) — by their large and grotesque horns, the spiny processes on the heads and bodies of many caterpillars, and the dark yet dazzling lustre on the wings of the sand wasps (*Sphegides*), are all calculated to excite fear in the insect world; and produce, even in our own minds, a repugnance to come into contact with such creatures. But, of all the grotesque and diversified forms which



Nature has given to these creatures, none are so extraordinary as those of the *Membracidæ* (fig. 58.), a family of the neuropterous order. Some are furnished with a long blunt horn, placed nearly straight forwards on the head, and as long as their whole body; others have horns shaped like acute spines, directed vertically: one bears an elevated shield, which extends over

and protects the whole upper part of the body; while the most complicated of these extraordinary defences is a buckler, or crescent, of spiny balls, placed over the

head of *Centrotus globularis* Fab., which terminate behind in a long spear. Were not these insects very small, they would excite the wonder of the most listless observer; and we should have them sent over in abundance to our cabinets. But their minuteness protects them; and they are but seldom seen in the collections sent to Europe. Among the most grievous annoyances occasioned by the passive defence possessed by insects, are the poisonous or stinging properties of such caterpillars as represent the *Scolopendridæ*, or scorpions. One of these, of a beautiful black colour, with yellow radiated spines, we met with in Brazil. Anxious to secure this prize for the breeding cage, we incautiously took hold of it with the naked hand; but so instantaneous and so violent was the pain which followed, that we were obliged to return home: warm fomentations, placing the hand in tepid water, every device we could think of to allay the intolerable itching produced by the venomous hairs of this creature, were in turn resorted to, with little or no effect, for several hours; nor had it entirely ceased on the following morning. This formidable creature very much resembles the caterpillar figured in White's *Voyage*, pl. 51. f. 4. M. Merian has figured another, of a much larger size, found in Surinam, which seems to have inflicted equal pain upon her: it was completely covered with long shaggy hairs, the touch of which caused severe inflammation, succeeded by excruciating pain.



(188.) There is a family of wood-bugs (*Reduvius* Fab., fig. 59.), peculiar, we believe, to Brazil, whose body and legs are entirely covered by a thick clammy down, similar to that found on the stems of different species of *Silene*, or catch-fly plants. Now, these insects, by the structure of their mouths, obviously live by sucking the juices of others; but

whether this gummy covering assists them to capture their prey, or acts as a defence against their enemies, we were unable to ascertain. Many beetles are defended by prickly spines, either upon the wing-cases or the legs; and others, from the extreme hardness of their external covering, will set the pin of the entomologist at defiance. Even the skin of the common horse-fly (*Hippobosca equina* Lin.) is so tough, that the utmost pressure of the finger and thumb will scarcely deprive the insect of life. Numerous insects are provided with involuntary secretions, for the defence of their young, or of themselves. Among the former, none is more familiar than the little drops of white froth so frequently seen on the plants and shrubs of our garden during summer, and which is usually called by the vulgar *cuckoo-spit*. Within each of these will be found a little soft pale green insect, with an enormous head and no wings: this is the larva or caterpillar of the *Cicada spumaria*, or frog-hopper, generally inhabiting the same plants. Our apple trees are well known to suffer from what is called the American blight,—the little bits of white cotton-like substance, which is the outward sign of this disease, being the covering of the insects and their eggs, intended, probably, to protect both from the rain. Mr. Kirby suggests that this secretion is either for concealment, or to render them distasteful to creatures that would otherwise prey upon them.

(189.) *Passive defence* is also effected by the great vitality of some tribes, whether in surviving injuries which would kill other creatures, or recovering from the effects of severe wounds. It really seems impossible for us to kill many insects, without injuring them too much for our cabinets,—a circumstance which is a source of regret and pain to every feeling mind. Grasshoppers will sometimes outlive immersion in boiling water; and, unfortunately, survive the removal of their intestines. A mite has been known to live eleven weeks, without food, gummed to the point of a pin: and Swammerdam affirms, that the chamæleon fly

(*Stratyomys Chamæleon* Fab.) will retain its vital powers for forty-eight hours after being immersed in spirits of wine. This insect seems to possess an uncommon portion of vitality,—for Godart informs us that it will live nine months without food! Luckless flies, which, while sipping the sweets of wine at the neck of bottles, have fallen in, have been known to revive in the sun, after the bottle has been uncorked. Mr. Curtis immersed four plant-lice (*Aphides*) in water for sixteen hours: when taken out, three survived the experiment; but a second immersion, of twenty-four hours, proved fatal. In the boiling sulphureous springs of Abano, are found numbers of small black beetles, which died upon being taken out and plunged into cold water. This extraordinary fact, Mr. Kirby tells us, was communicated to him by the celebrated Jones, of Nayland, one of the brightest ornaments of the Christian church. It is really surprising that an intensity of cold, which is not only inconvenient, but painful, to the human constitution, can be endured, and even enjoyed, by these minute and delicate creatures. De Geer saw some larvæ of gnats that had survived after the water in which they were was frozen into a mass of ice; and, even in a winter's day, we see a few little insects stealing from their hiding places, and enjoying themselves in the momentary gleam of a December sun. The vitality of insects is shown, also, in the little comparative pain they appear to feel from injuries, which to us would occasion excruciating torment or instant death. A violent or unnatural turn of our leg or arm will produce a sprain or dislocation, which may last for ever; while the loss of one of these members, by violent means, is generally followed by death. But these accidents, to the insect world, produce no such effects. A luckless *Tipula*, or crane fly, in the rude hands of a thoughtless boy, will fly away with the loss of half its legs; and a specimen of *Scolia quadrimaculata*, a large wasp-like insect of Southern Europe, has been known to free itself from the pin

which transfixes it, and devour the other insects contained in the entomologist's box.* This vitality, and insensibility to pain, is manifestly a wise and merciful provision of the Almighty towards those of his creatures, which, of all others, are most liable to accidents, from the number and variety of their enemies.

(190.) The preceding remarks are chiefly confined to what are usually, but inaccurately, termed true insects; but, as the crabs, spiders, intestinal worms, and red-blooded *Annelides*, or sea worms, are truly annulose animals, they come within the limits of this section. These, however, will not long detain us. The crabs are the most completely armed of all apterous insects, their formidable fore claws acting both as offensive and defensive weapons; while the resolute courage with which these creatures will threaten to repel an injury, very often secures them from a real one. Like the crane flies (*Tipulæ*) we have just mentioned, most of the crabs, in order to free themselves from restraint, will cast off a limb, and scramble away as if nothing had happened. The same occurs with spiders; and the vitality of the intestinal worms is well known. Of the means of defence possessed by sea worms (*Annelides*), we are altogether ignorant; while those enjoyed by the barnacles (*Cirripedes*) seem to be entirely passive: they retire, on the first appearance of danger, within their shelly coverings, close the valves or doors of their habitations, and effectually exclude all intruders.

(191.) The defences possessed by the *Mollusca*, or soft-bodied animals, composing the polypes (*Acerita*), the shellfish (*Mollusca*), and the sea stars, or radiated class (*Radiata*), possess little of that popular interest—(so far as our limited acquaintance with their history enables us to judge)—which belongs to the more perfect animals. Generally speaking, they secure their safety by passive resistance. The testaceous animal instantly withdraws itself into its shell, and is secure. The slug, being naked, contracts itself into a heap, and throws

* Kirby, vol. ii. p. 229.

from the pores of its body a thick slimy mucilage, which renders it difficult to make any impression upon its body, and is, no doubt, extremely offensive to many of its brute enemies. The spines of the *Echinidæ*, or sea eggs, being movable, can be employed like those of the hedgehogs, and, probably, secure them from many injuries. Among the *Medusæ*, and other similar families, we find many animals, however, which are endowed with more active qualities. A species of medusa, common in the Mediterranean, has all the irritating properties of the nettle,—stinging the hands, and causing instant inflammation upon the skin. The same property is possessed by several others, found by us between the tropics, and on the coast of Spain. The British species of *Aplisia* are said to cause considerable itching upon being handled; but there are very many in the Mediterranean, which we know, from experience, to be perfectly harmless. None, however, have yet been found, which can inflict permanent injury upon man. But let us remember that the “caverned cells” of the mighty deep conceal innumerable myriads of creeping things, which human eyes have not, and never will, behold; all deriving life, and enjoying existence, from Him who is the fountain of love, and who has delighted to call them into being, that they might enjoy the effects of his bounty. Could the eye of science penetrate these inaccessible regions, we should, doubtless, discover the same variety of habits and of instincts, the same care and contrivance for the preservation of the species, and the same endless diversity of stratagem by which the stronger prey upon the weaker, as is seen upon the dry land. “The earth, O Lord, is full of thy riches. So is the great and wide sea, also, wherein are creeping things innumerable, both small and great beasts. These wait all upon Thee, that Thou mayest give them their meat in due season.”

CHAP. VI.

DIRECT INJURIES INFLICTED BY ANIMALS.

(192.) THAT MAN, divinely appointed to rule over the works of creation, should yet be exposed to innumerable injuries, and even to certain death, from those beings which he was appointed to govern, would appear, at first sight, anomalous, and inconsistent with the fitness of things. But we must recollect the period when this dominion was given to him, and the altered circumstances of the governor and the governed. It was our first parent, in the garden of Eden, in a state of blissful innocence, and when violence had not entered the creation, whom the Almighty constituted a representation of Himself, so far as the dominion over the beings which surrounded him was concerned: but no sooner had Adam violated his obedience to his Creator, — no sooner had he, himself, broken the law of subordination, — than the animal creation caught, as it were, the same rebellious spirit; they renounced their allegiance to their appointed lord, and either fled from his presence in dismay, or dared him to enforce his superiority. Disobedience entered the irrational, no less than the rational world; and, from that hour to this, the animal creation, with a few solitary exceptions, turn from man as from an enemy, rather than court his assistance as a powerful friend. The true Christian will extend this analogy to the spiritual world.

(193.) But though the dominion of man over the brute creation is tacitly shown, in the fear which his presence generally inspires, there are, nevertheless, many tribes which, for wise but unknown purposes, are permitted to injure him, as if to impress upon his re-

collection that he is no longer what he was. These injuries are of various natures and of different degrees; they either affect his personal wellbeing, or his necessary possessions. In the former case, they are *direct*; in the latter, *indirect*. The first will claim our attention in this chapter; and, pursuing a uniformity of plan in the more popular, as well as in the scientific portions of our work, we shall now enumerate the direct injuries we are exposed to from the different branches of the animal kingdom;— first, from vertebrated; and, secondly, from invertebrated animals.

(194) QUADRUPEDS, more than any other animals, have, in general, the greatest muscular strength, and the most determined courage and ferocity; it is, consequently, from them that we have most to fear. When it is considered that man, viewed as a material being, is, by nature, one of the most defenceless in creation, it seems wonderful that he is not subject to injuries innumerable. Brute animals are all provided with means of defence against their enemies, either by some peculiar structure, or some defensive property. The teeth of carnivorous beasts, the horns of ruminants, the swiftness of some, and the intolerable stench of others, the thick and impenetrable hide of the rhinoceros, and the tusks of the elephant, are all natural weapons, or preservative qualities, with which they are endowed for self-preservation. But man has none of these; in a state of nature, he is as helpless as a child,— scarcely able to repel an infuriated cat, much less a dog, by the mere exertion of animal strength. Yet he, alone, is gifted with the attribute of reason; and, by this, he is impelled to use other substitutes for his defence, which no animal can resist, and by which he can destroy not only them, but, unhappily, his own species. It is, however, to be remembered, that very few brute animals will attack us, if not previously provoked, or if not pressed by the calls of hunger. There appears something in the form of man,— particularly when animated by courage,— which seems to impress the brute

creation with fear, and an innate sense of their own inferiority. This is manifested in the well-known fact, that dogs, bulls, and even bears, will turn and slink away before a resolute person, whom they would inevitably attack, did he exhibit any symptoms of fear, or endeavour to escape by flight. This feeling is, doubtless, the remnant of that primitive subordination which was impressed upon their conceptions at the time of their creation. Certain, however, it is, that there are very few animals, out of the innumerable hosts in existence, which will attack man, otherwise than in self-defence, — to resent injuries, or to prevent them. To this, however, there are some few exceptions, chiefly, if not exclusively, to be found in those formidable and fearless species, whose natural habits are “bloody, bold, and resolute.” With these, therefore, we shall commence our survey: and that their manners, in this respect, may be fully illustrated, we think it preferable to give the original words of our authorities, in the shape of facts, or anecdotes, as narrated by travellers, rather than diminish their force by any language of our own.

(195.) The animal whose thirst for human blood exceeds that of all others, is the Asiatic tiger, — the scourge of Asia and the Indian islands. The devastation they cause among the poor inhabitants of the villages and plantations, is almost incredible. “In Hindostan,” observes Forbes, “it is dangerous to take a solitary walk, on account of these animals; for they approach close to the habitations in country villages. On one occasion, an immense tiger rushed close past my bed, under a tent, when I was at a bathing place, in pursuit of a goat; and we all considered that, if unsuccessful in the chase, he would have returned to make one of the party his prey.”* Again, the same author tells us, “In the island of Salsette, a poor woman, who was gathering fuel on the skirts of a wood, laid her infant on the grass, when a tiger sprang from his cover, and carried it to its den, in sight of the

* Orient. Mem. vol. i. p. 197.

wretched mother." * Those of Sumatra appear to be particularly numerous and fierce; for Mr. Marsden writes, "The number of people usually slain by these rapacious tyrants is almost incredible; whole villages are sometimes depopulated by them; yet, from a superstitious prejudice, it is with difficulty that the natives can be prevailed upon, by large rewards, to use methods for destroying them, until they have sustained some particular injury in their own family or kindred." † That they follow the track of armies on the march, may be gathered from this passage: — "The number of stragglers taken from a line of march, in India, when troops are proceeding through a close country, would surprise persons unaccustomed to such events. Three sentries have been carried off in one night, besides several camp followers, who fell victims to their impatience, in their attempts to get ahead of the line, by taking short cuts through the jungles." ‡ Pennant remarks, that the natives are so infatuated with the notion of these animals being possessed by the souls of their ancestors, that they will seldom kill them. They seem to prefer human flesh to any other; and bound upon their prey, from ambush, with a force, and from a distance, that is scarcely credible. § Against this fearful enemy, no precaution will suffice at all times; "for although generally pusillanimous, and especially dreading fire and noises, yet an instance is well known of a tiger occupying a spot in Goomeah pass for near a fortnight, during which time he daily carried away a man, generally one of the postmen, who usually go on foot, protected by two persons with drums. At one time he was disappointed of his meal, as he, by mistake, carried off the leather bag instead of its bearer; but, the following night, he seized one of the torchmen, and soon disappeared with him." || The same author gives a melancholy proof of the little re-

* Orient. Mem. vol. i. p. 428.

† Orient. Mem. vol. ii. p. 284.

|| Orient. Mem. vol. ii. p. 283.

† Hist. of Sumatra.

§ Hist. of Quad.

gard a tiger pays to fire, when hard put to for a meal, in the fact of a young gentleman, of a well-known family, having been taken away by one when benighted on Sanger's Island, at the entrance of the Hooghly river. The party was sitting at a fire, which had been kindled for the purpose of security; yet the tiger sprang through the flames, and carried off the unfortunate victim, in spite of the efforts of his companions, who were well provided with fire-arms.*

(196.) Another instance may be adduced, to show that even travellers, while in large companies, are not exempt from this terrible animal. "When two English ladies, with a large retinue, were travelling from Dhuboy towards the Nerbudda river, a large tiger sprang among the mounted soldiers, overthrew one of the riders, and killed his horse by the blow."† There also seems to be, in the province of Guzerat, another animal of the same genus, but equally formidable. "The last which I destroyed," continues the same traveller, "in the Dhuboy district, was a leopard, most beautifully spotted, which weighed about 250 pounds: his strength and ferocity equalled his size, and had long rendered him a terror to the villages near his haunts.‡ So great, indeed, is the dread of beasts of prey throughout the whole of India, but more especially in the villages on the Sabermatty river, at the head of the gulf of Cambray, that the inhabitants carefully collect all their cattle within the mud walls, which encircle every village, at the close of day, — after which all egress is avoided; even the dogs, instinctively conscious of peril, keep within the protection of the walls. It is certain danger to travel in the jungles, or Indian forests, after sunset, when the savage beasts leave their haunts and prowl about for prey; but as they retire to their dens at the approach of dawn, accidents are then not so frequent. In Africa, the native beasts of prey are different, and not so fearful.* Still, in a country inhabited by lions, panthers,

* Orient. Mem. vol. ii. p. 284. † Id. *ibid.* : *Ibid.* vol. iii. p. 90.

and similar carnivorous races, the life of a traveller is in perpetual danger.

(197.) The Asiatic lion (*Leo Asiaticus* Sw.) is a rare animal in the eastern world; but that of Africa is well known to possess much more generosity than cruelty. M. Cuvier well observes, that, unlike some of its family, which appear to derive gratification from the destruction of animal life, the lion, when once satiated, ceases to be an enemy. Hence, very different accounts are given by travellers of the generosity or cruelty of its nature, — resulting, most probably, from the difference in time and circumstances of each case. There are certainly many instances of a traveller meeting a lion in the forest during day, —

“ Who glared upon him and went surly by,”

without annoying him. But, when urged by want, this tremendous animal is as fearless as he is powerful. Nothing will impede his deadly design. His strength is so prodigious, that a single stroke of his paw is asserted to be sufficient to break the back of a horse, and that one sweep of his tail will throw a strong man to the ground. Kolben says, that when he comes up to his prey, he always knocks it down dead, and seldom bites it until the mortal blow has been given. It has been generally asserted, that the lion prefers the flesh of an African to that of a European, and that, when he attacks a party, he generally singles out a Hottentot rather than a white; but this instinct is not unnatural, seeing that one is more his *native* food than the other. We need not dwell longer upon the deadly injuries resulting to man from the typical carnivorous quadrupeds; the whole family are to be feared; and they are distributed in all the warm, and even the temperate regions of the Old and the New World. The latter hemisphere, however, — if we except the jaguar, — is free from those terrible species which attack mankind under all circumstances, and in all situations, like the tiger of India. Fortunately, the number of such animals is

comparatively small in more temperate countries. But even there the inhabitants are exposed to others equally deadly, under an extraordinary pressure of hunger, with those of Africa and India. We allude to the families of bears and wolves, from whose depredations the inhabitants of this island formerly suffered, and both of which are devourers of mankind.

(198.) With regard to bears, however, the preceding observations must be understood with some limitation,—since several of the species, particularly some inhabiting India, live mostly on vegetables; and the black bear of America does not eat animal food by choice.* The Barren Ground bear of the northern regions is much dreaded, even by the intrepid hunters of that country,—which, they assert, will attack travellers without provocation. The grisly bear is still more formidable; and is distinguished from others by its great strength and ferocity, and its carnivorous disposition.† Dr. Richardson authenticates a distressing story of one of these ferocious animals springing upon a boat's crew assembled on shore, at twilight, over their fire, seizing one of the party, and carrying him off leisurely: the unfortunate man, however, had presence of mind sufficient to call to his companions to shoot the bear, regardless of the risk of killing himself: one of them immediately took a deliberate aim, and, providentially, with effect, for the savage beast immediately fell; and although the poor sufferer was almost squeezed to death, he finally recovered.‡ This animal must have been sorely pressed for food; for another traveller in the same country informs us, that although, upon his botanical excursions, he frequently got sight of the grisly bears, and even, upon turning the angle of a rock, would come suddenly upon them, yet, if he showed no disposition to attack them, they suffered him to pass unhurt. “On such occasions they reared on their hind legs, and made a loud noise, like a person

* North. Zool. vol. ii. p. 15.

† Id. *Ibid.* p. 24.

‡ *Ibid.* vol. i. p. 27.

breathing quick, but much harsher: he kept his ground, however, without attempting to molest them; and they, on their part, after attentively regarding him for some time, generally wheeled about, and galloped off; though, from their known disposition, there is little doubt but he would have been torn in pieces, had he lost his presence of mind, and attempted to fly."* This opinion fully confirms what we have already expressed on this subject. The polar or sea bear is another of those species which may be ranked among our most deadly enemies. It lives almost entirely upon flesh, — and many distressing accounts are upon record of its attacking parties of seamen, and others, when on the shore. The crews of the whale vessels are very much exposed to this animal. Its scent is peculiarly keen, and it is consequently attracted to the vessels by the smell of the whale blubber, which it is usual to burn on board, in the process of extracting the oil. Nor are these ferocious enemies of our race extirpated from the more civilised parts of Europe; for, although the bears have greatly diminished, the wolves of the Alps and Apennines are still in sufficient numbers to create terror among the country population, who frequently, in winter, lose some of their neighbours by these animals. When under the suffering of excessive hunger, at this inclement season of the year, the wolf is ravenous to the highest degree, and nothing will deter him from making the most desperate efforts to allay his craving appetite.

(199.) During the dreadful famine which prevailed over all the North of India, in 1783, so great was the mortality, that the wretched inhabitants died in heaps in the fields and highways, and became an unresisting prey to the wolves of the country. "These animals, finding their customary sources of subsistence cut off by the universal famine, betook themselves to the carcases that lay thickly strewed around; and were to be seen in all directions, committing havoc among the expiring

* North, Zool. vol. I. p. 27.

multitude. They absolutely occupied the outhouses and gardens; and often, in open day, loitered about like so many dogs, without seeming to entertain the least apprehension."* These wolves, the same author informs us, from being thus attracted, remained in that part of the country (Cawnpore) long after, in such considerable numbers, that they were the terror of the remaining population. Long accustomed to human food, they would not leave their haunts; and were now grown so fierce, that they not only frequently carried off children, but actually attacked the sentries at their posts, — who had, in consequence, been doubled. The first night the governor arrived at Cawnpore, he ordered his bed to be placed in a garden; and was surprised to hear, in the morning, that a goat had been carried off from very near the place where he slept. Three of these monsters had attacked a sentinel, who, after shooting one, and despatching another with his bayonet, was overpowered by a third, and killed upon his post. While the governor was at this place, the following fact fell under his own knowledge. A man, his wife, and his child were sleeping in their hut, — the man at a little distance from the rest. The mother was awakened by the struggles and shrieks of the child locked in her arms, which a wolf had seized by the legs, and was dragging from her bosom: she grasped the infant, and exerted all her strength to preserve it from the foe, but in vain; the ravenous animal tore it from her embrace, and carried it away.* To this horrible fact our author pledges his veracity, having been in the country at the time it happened.

(200.) The grievous injuries inflicted by the wolves of India have been much expatiated upon by another author, who also wrote upon the spot. "When a wolf enters a camp or village," observes Williamson, "he proceeds with the utmost silence and circumspection. His favourite object is a child at the breast, which he always seizes by the throat, — thereby not only preventing

* Forbes, *Orient. Mem.* vol. iii. p. 60.

it from giving an alarm, but securing such a hold as will enable him to bear away his victim readily. He will thus carry it through crowds who may rush forward on the first alarm. Often, when closely pursued, — especially if hit by a stick or stone, — he will drop the child; but, if it be not taken away immediately, the ferocious brute will make a turn to the spot, and snap it up again. Few children survive the bite; but grown persons are not unfrequently met with, who carry the marks of the wolf's teeth. Military troops in India usually move with a host of camp followers, many of them having families; and these are accompanied by numbers of young children at the breast. In some parts of India, especially in the kingdom of Oude, all these are kept in a constant state of alarm by the wolves which over-run that country. When a wolf is seen by the sentinels, — who dare not fire among such crowds of people, — a general shout and pursuit take place. And yet these cruel beasts are so bold, that three or four young children are carried off — or, at least, seized and dropped — in one night. Many are taken from the very arms of their mothers, although covered with quilts, and surrounded, perhaps, by a dozen persons. The wolf proceeds in so subtle a manner, that, often, a child is taken from his mother's breast, and is not missed until the morning, — when the parent first becomes acquainted with her loss. The melancholy effects produced by the cries of these distressed mothers, and to whom no aid can be given, surpass imagination; they continue to distress the feelings of every one during the whole night, and destroy the rest of all endued with the least pity for the hapless sufferers."

(201.) Wolves were, once, such a scourge to the people of the United States, that the government of Pennsylvania allowed a reward of 20s. for each head; and that of New Jersey, even 30s. A similar mode — but in the way of taxation — is well known to have been pursued in the early periods of British history, to free

our island from these detestable creatures. The dog, the friend of man in domestication, is his enemy in a wild state. Some of these varieties or species approach so near to the wolf, both in appearance and manners, that their distinction is by no means clearly defined. Pennant probably alludes to one of these races, when he says that the wolf dogs of North America, although they will not, on ordinary occasions, attack men, yet that, when pressed by hunger, they assemble in immense packs, hunting, attacking, and destroying whatever they meet, and carrying devastation and terror to the neighbouring villages. It is universally remarked, that, when once a carnivorous animal is acquainted with the taste of human blood, it shows a decided preference for that food. Civilisation, and the effects of the chase, have probably done much to preserve Europe from carnivorous animals, — for the temperature of the air is not the cause. Bishop Heber remarks, that the tiger, lion, and hyæna, all thrive in the high latitudes of the Himalaya mountains, where the climate is as mild as that of Europe. The jackals and the hyænas of Africa are as much to be dreaded, during night, as any of those we have described: the former hunt in packs, like the wolves and wild dogs, and prefer living victims; but the hyæna is well known for its decided preference to dead bodies, — a disgusting, but not an injurious, propensity to the living.

(202.) We may here terminate our enumeration of such carnivorous animals as seek for man, to accomplish his death; but there are a few others which effect the same mortal injury, without the same motive. The whole race of bisons, buffaloes, and wild oxen — more particularly at some seasons of the year — are not only fierce, but cruel enemies to man; attacking him without provocation, and never leaving the body until its mangled remains are crushed to a hideous mass. Such is the Cape buffalo (*Bos Caffer*), called by Pennant the musk ox. It is a ferocious and terrible beast, of amazing

power and undaunted courage : these animals make for themselves paths in the woods, where to meet them is almost certain death. Even the common buffalo of India and of Europe is not always to be trusted, even in a state of domestication ; and it is, no doubt, owing to the dangerous propensities of the Scotch *Urus*, or wild ox, that the breed has not been preserved or increased to a greater extent than we now find it. The extraordinary effect which the sight of red has upon oxen, generally, and upon certain birds, is perfectly unaccountable ; and this has proved a fruitful source of misfortune to those who, either from ignorance or carelessness, have excited their fury. The following anecdote, given by major Smith, is highly characteristic of this fact : — “ A general officer, now living, relates, that, while a young man, he was employed in surveying in Hungary, and happened to use a small portable table, the back of which was covered with red morocco. As he walked from one station to another, he sometimes carried it with the paper against his breast, and the crimson colour in front. On a sudden, he perceived, at a considerable distance, a herd of grazing buffaloes throw out signs of defiance, and come down in full gallop towards him, with their tails up, and evincing the most tumultuous frenzy. Not suspecting the cause, he paused and dropped his hand, — when the whole troop stopped and looked about, as if at a loss for the object of their fury ; he went on, and, unconsciously raising the table again, brought the red colour in sight : they set off, a second time, towards him ; but, guessing the cause, he turned the obnoxious colour towards his body, and was suffered to proceed unmolested.” The rhinoceros of the Cape is as formidable an enemy as that of India. Lichtenstein says he is one of the most dangerous to travellers, particularly at night ; he rushes forward impetuously, with blind rage, at every noise of which he is informed by his acute hearing, or at every object betrayed to him by his acute smell. Examples have been known of these animals running, by night, against

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a waggon, overturning it, and trampling down, in its rage and fury, men, oxen, and everything belonging to the party.* It is scarcely possible to overtake one of these animals when he flies, or even to pursue him with any chance of success. He treads down shrubs and bushes which oppose him, with the utmost facility, which would entirely stop the progress of a man on horseback. He is, therefore, seldom pursued in the open plains. His mode of attack is by bending his head to the ground, and, with half-shut eyes, rushing forward with his horn close to the ground.†

(203.) Were we to extend our enumeration of direct injuries which can be inflicted upon us by quadrupeds, in self-defence, we should have to particularise nearly the whole order. Self-preservation is said to be the first law of nature, even with the rational man; it cannot, therefore, be denied to the brute: and if we wantonly, or from necessity, seek to injure them, the injury they inflict upon us is not only natural, but perfectly justifiable. It may be remarked, however, that the males of all quadrupeds, during the season of courtship, are so excessively jealous of their females, that they enter into furious battles among themselves, and indiscriminately attack both man and beast, — although, at other times, their general disposition is gentle and harmless. This is exemplified even among the domesticated races — by the bull and the stag. Goats will do the same; and old rams not unfrequently attack those who are passing: these, certainly, are *unprovoked* injuries; but, for the rest, we may almost say that they are *merited*.

(204.) When we thus see how large a proportion of mankind are exposed to the chances of a cruel death from the animals which surround them, we cannot but rejoice, and bless that Providence which has placed us far away from such evils, and has cast our lot in a land uninhabited by ferocious beasts. Yet, before we dismiss this subject, it will be proper we should advert to

* Lichtenstein's Travels, p. 351.

† Ibid. p. 356.

two quadrupeds, which, although not at all formidable, have yet been known to attack human beings, unprovoked, — and to cause their death. We allude to swine and rats. Many instances are upon record, where young children, or infants in the cradle, have been attacked by the domestic pig, and either mutilated or partly devoured. From an animal proverbial for its brutality, and which does not scruple to indulge in the unnatural propensity of devouring its own young, no habits of docility can be expected; but it is inconceivable what could tempt a pig to try a sort of food so totally different from its usual nourishment, either in domestication or a state of nature. Certain, however, it is, that such instances have frequently occurred. In regard to rats, we were reading, only the other day, from one of the daily papers, an authenticated statement of a little boy who was disfigured for life by these loathsome animals. He was sleeping in a mean lodging, with his parents, who were awakened in the middle of the night by his screams. With much difficulty a light was procured, when the poor little child was discovered, bathed in blood, with nearly one half of his nose devoured by rats. This is by no means a solitary instance; for it is well known that these animals will frequently attack the extremities of sickly persons, and even disfigure a corpse that has been laid near their haunts.

(205.) As a supplement to this catalogue, we should not omit the unprovoked injuries occasioned by bats, although there is no real danger to be expected from them. Those of the tropics, as is well known, are of an enormous size, and have given rise to the fabulous wonders of the vampire. An eccentric, but, in many respects, a veracious traveller, has thus mentioned those of South America: — “Some years ago I was in Demerara, with a Scotch gentleman, by name Tarbet. We hung our hammocks in the thatched loft of a planter’s house. Next morning I heard this gentleman muttering in his hammock, and now and then

letting fall an imprecation or two. 'What is the matter, sir?' said I softly. 'Is anything amiss?' 'What's the matter!' answered he surlily, — 'why, the vampires have been sucking me to death.' As soon as there was light enough, I went to his hammock. 'See,' said he, 'how these infernal imps have been drawing my life's blood!' On examining his foot, I found the vampire had tapped his great toe: there was a wound somewhat less than that made by a leech, and the blood was still oozing from it; I conjectured he might have lost from ten to twelve ounces. While examining it, I think I put him into a worse humour, by remarking, that a European surgeon would not have been so generous as to have blooded him without making a charge." * Another traveller in these countries gives us, however, a somewhat different account. "On waking, about four o'clock, one morning, in my hammock, I was extremely alarmed at finding myself weltering in congealed blood, yet without feeling any pain whatever. Having started up, I rung for the surgeon. The mystery, however, was soon solved, for I then found I had been bitten by the vampire, or spectre of Guiana." This is a monstrous bat, which sucks the blood of men and cattle while they are fast asleep, — even sometimes till they die; and the manner in which this is done is truly wonderful: knowing, by instinct, that the person they intend to attack is in a sound sleep, they generally alight near the feet, where — while the creature continues fanning with his enormous wings, which keeps one cool — he bites a piece out of the tip of one's great toe, — so very small, indeed, that the head of a pin could scarcely be received into the wound, which is, consequently, not painful; yet, through this orifice he continues to suck the blood until he is obliged to disgorge: he then begins again; and thus continues sucking and disgorging, till he is scarcely able to fly, and the sufferer has often been known to sleep from

* Waterton's Wanderings, p. 177.

time into eternity."* There is, obviously, much exaggeration in the latter part of this story, although the common people in Brazil assured us that deaths sometimes followed these bleedings. We never experienced these attacks upon our persons; but our horses and mules, upon being turned out to graze for the night, were frequently brought into the camp in the morning covered with blood.

(206.) We now turn to BIRDS. Among this charming portion of Nature's works, notwithstanding the vast superiority they possess over quadrupeds in point of numbers, we find very few, if any, which are decided foes to man. They almost seem created, in short, for our solace; to give life, buoyancy, and animation to the face of nature; to enliven our spirits by their delightful song, their varied colours, their light and aerial movements, and their innocent occupations. True it is, that even among these we find a race, cruel and bloodthirsty, fit types of those formidable carnivorous quadrupeds of which we have lately treated,—and representing, like them, the fierce and malignant beings of our own race. But the eagles, vultures, and falcons confine their depredations to the animal world,—only feeding upon man when life is extinct, and when the removal of his inanimate body is not only desirable, but beneficial. It has ever been the propensity of the vulgar to attach great power and destructiveness to animals of large size or uncommon strength: hence we may trace the marvellous stories of the gigantic vultures mentioned in Arabian tales; and the superstitious belief, which formerly prevailed, that the immense condor of South America not only flew away with young children, but would attack travellers, and pick out their eyes. Baron Humboldt, however, who gave us the first authentic accounts of the manners of these birds, declares that, after the most diligent inquiry, he never discovered a single instance of a condor having taken off a child; not, indeed, that the strength of this powerful

bird would be unequal to lift such a weight from the ground, but that it has, providentially, no such habits. It is a bird, nevertheless, much to be dreaded by the husbandman; for baron Humboldt says it will frequently attack the calves, and tear out their tongue and eyes. Similar stories are told, and believed, by the common people, of the *Lammer-geyer*, or great bearded vulture of the Alps, — yet they have never been fully authenticated. Bishop Heber was told that the great eagles inhabiting the summit of the rocks round the Himalaya mountains, sometimes carried away the poor naked children of the peasants; but this is mentioned only as a popular belief, not as a fact vouched for.* On the whole, therefore, we may safely pronounce that there is no bird existing, which will inflict wanton and unprovoked injury upon man, although there are several which, in self-defence, can do him serious bodily harm. The cassowary, indeed, has been said to attack people unprovoked†, and to inflict severe wounds by the strong bony excrescence with which its front is crested, like unto a helmet; but this is probably done during the season of courtship only; for this bird is gallinaceous, feeding only upon vegetable substances, — and it is, therefore, highly improbable that it would attack man with any deadly intention.

(207.) From the class of REPTILES, however, we have much to fear; for though, with few exceptions, they are small in comparison to the size of the ferocious quadrupeds, they can inflict death in a form nearly as dreadful. We shall arrange these under two heads; — first, the crocodiles, which attack man as their natural prey; and, secondly, the serpents, which accomplish his death by poison. We may, however, remark, that the tortoises, which also belong to this class, are, if unprovoked, a harmless race, yet, in self-defence, they can not only inflict severe wounds, but effect the amputation of a finger. Their jaws, indeed, are without teeth,

* Heber's Journal, vol. i. p. 499.

† Orient. Mem. vol. iii. p. 186.

but then they are so sharp, that they may be compared to a pair of circular scissors; and such is the great muscular force of these animals, that by a single bite they can snap off a finger with as much ease as a piece of dried stick can be broken.

(208.) The crocodiles, in comparison to all other existing reptiles, are a race of giants, with habits and manners the most ferocious, and with an aspect well calculated to excite terror and dismay. They are, fortunately, all inhabitants of other climates, far removed from Europe. They swarm in the rivers of India, are equally prolific in Africa, and are by no means uncommon in the salt and fresh waters of Tropical America. A few anecdotes, authenticated by modern observers, will show the dangerous instincts of these hideous creatures. "In India, the streams are alive with these river pests, whose fondness for human flesh renders that chiefest luxury in a tropical climate, — bathing, — a matter of extreme danger. Yet it is strange to see with what perfect indifference the natives take the water. A beautiful specimen of an alligator's head was here given to the governor; he was rather a distinguished monster, having carried off, on different occasions, six or eight brace of men from an indigo factory in the neighbourhood. A native, who had long laid wait for him, at length succeeded in slaying him with poisoned arrows. One of these notoriously ghaunt-frequenting alligators is well nigh as rich a prize to the poor native who is fortunate enough to capture him, as a Spanish galleon is to a British frigate; for on ripping open his stomach, and overhauling its freight, it is not unfrequently found to contain 'a choice assemblage' — as advertisers have it — of gold, silver, or brass bangles (bracelets) and anklets, which have not been* so expeditiously digested as their fair owners, victims to the monster's voracity."* The Dutch settled in the East Indies, with their characteristic cunning and tyranny, used to keep a great number of crocodiles

* Pen and Pencil Sketches in India, vol. ii. p. 192, 193.

in the ditches of Bavaria, to prevent the desertion of their soldiers, most of whom were enlisted by force; they likewise served to oppose the nocturnal attacks of the people of the country, who supported their yoke with impatience. It is supposed that one reason why the ancient Egyptians venerated this animal was, that the fear of the crocodiles arrested the course of the Lybian and Arabian robbers, who, but for these reptiles, would have been continually passing and re-passing the river and its canals. The courage and strength of these creatures are in proportion to their size. Bartrum, the American naturalist, tells us, that his armed companions had to sustain a vigorous combat against one of them which came to attack their camp. Stedman, however, says that those of Surinam will not attack a man, so long as he remains in motion in the water. Waterton, on the contrary, affirms that the Indians "take uncommon precautions lest they should be devoured by these cruel and voracious reptiles, which are very numerous on the river Essequibo." * The same writer gives us the following anecdote, told to him by one of the Portuguese governors, on the spot where the event happened. "One fine evening, last year, as the people of Angustura were sauntering up and down here on the Alameda, I was within twenty yards of this place, when I saw a large cayman seize a man and carry him down, before any one had it in his power to assist him; the screams of the poor fellow were terrible, as the cayman was running off with him. He plunged into the river with his prey. We immediately lost sight of him, and never saw or heard of him more." † In reference to the apparently contradictory accounts given of crocodiles in general, we should remember that there are not only many species, but genera, each distributed in peculiar parts of the world, and all having certain shades of difference in their economy. Some are, consequently, much more savage than others; and hence, no doubt, have frequently

* Wanderings.

† Ibid.

arisen the discrepancies which appear in the accounts of those, who, under the belief that they are speaking of the same species, are, really, narrating the habits of another totally different. The crocodiles, fortunately, are the only race of lizards from which mortal danger is to be expected.

(209.) We now proceed to the SERPENTS. Here a formidable list presents itself; for, whether we look to such as, like the crocodiles, are actual devourers of mankind, or distil into his veins their deadly venom through malice or in self-defence, we find a much larger number of mortal enemies in this tribe than in any other. If we regard size, and the certainty of becoming food to these horrid reptiles when once they have seized us, we should place the gigantic boas and pithons of the two hemispheres at the head of this list. In the early stages of European population in tropical countries, there can be no doubt that these enormous serpents were much more numerous, and attained, from age, to a much larger size, than they are usually found at present. The extension of man over the face of the earth is always accompanied by a proportionate diminution in the number of its wild and ferocious animals: hence, in the vicinity of towns and villages in the maritime parts of Tropical America, the traveller has little to fear from the gigantic boa, because, although they occasionally linger in such districts, they are generally met with and killed long before they have reached their full growth. In proof of this, we, ourselves, while botanising among the marshes close to the town of Pernambuco, encountered a boa near seven feet long, coiled up among the grass and rank herbage of the banks; it was killed by a discharge of the gun; and on dragging it home and showing it to the Indians, they assured us it was only a young one, which, in a few years, would have reached a length of twenty or even thirty feet. Boas of that size are well known to the Indians of the interior; and such destruction do these gigantic reptiles cause to the herds of cattle, that the

neighbouring planters often assemble for the sole purpose of discovering and destroying the common enemy. But it is not in such encounters that the greatest danger lies; for the boa, except in self-defence, or under the cravings of hunger, flies before man. It is by surprise and stratagem that the boa secures his prey; he darts upon his victim, like the tiger, by a sudden and instantaneous spring; grapples him in the enormous folds of his body; and, after thus crushing the bones, proceeds to swallow the whole at leisure. Well-attested accounts of the loss of human life from these monsters have frequently been given us; nor does it require much reasoning to show that a serpent, which would thus devour a young horse or bullock, could, with equal facility, swallow a man. That serpents of a size fully equal to the boas of America are also found in Africa, is abundantly proved from the writings of the ancients. Aristotle alludes to serpents of enormous size from that continent. Pliny was well acquainted with those of India; and Suetonius mentions that, in the reign of Augustus Cæsar, a serpent was exhibited, alive, of the length of fifty cubits. Others, of the genus *Pithon*, lurk in the tropical forests of India. Bishop Heber alludes to their attaining the length of thirty feet; and a melancholy instance is upon record, of a talented painter, who disappeared from his party while travelling through an Indian forest, — seized, as his companion supposed, by one of these terrific reptiles.

(210.) The poisonous snakes, though greatly inferior to the boas in respect to size, are more numerous and deadly: the latter will only attack man from severity of hunger, while a snake will often bite from sheer spite. From among a host of species scattered in all parts of the world, we shall select the rattlesnake, the *Cobra di Capello*, and the *Cerastes*, or horned viper of Africa, as pre-eminently destructive to human life. Rattlesnakes formerly abounded much more in America than they do now. As it lives upon small

animals alone, it does not attack man, if unprovoked ; but then this provocation may be given in a hundred ways, even unintentionally, and death may be the consequence. Bartrum asserts that he had seen individuals as thick as a man's thigh, and more than six feet long ; and that they were found in Georgia of a much larger size. So subtle is their venom, that the slightest prick made by their poisonous fangs will kill almost the largest animals. Laurenti says that, in the human subject, the entire body is swelled, the tongue becomes prodigiously inflamed, the mouth has a burning heat, an excessive thirst is felt, the edges of the wounds become gangrened, and at the end of five or six minutes the victim dies in frightful agony. But there seems to be much inaccuracy in this. From a more authentic source than the last, we are told that the first symptom which appears, *about an hour* after the bite, is excessive vomiting, succeeded almost immediately by a strong fever. " At the time," continues our author, " when I saw the man who had been bitten, his leg and thigh were prodigiously swelled, his respiration very laborious, his physiognomy turgid, and resembling some hydrophobic patients whom I once had an opportunity of seeing. I have known several persons who have been thus bitten. Those who survived were constantly valetudinarians, and extremely affected by the variations of the atmosphere." *

(211.) The *Cobra di Capello* (fig. 60.) is one of the most deadly serpents of India. When unintentionally disturbed, it raises its head, dilates the hood on each side of the neck, and advances against the aggressor by the undulating motion of the tail. It rarely happens that any one recovers, who has had the misfortune of being bitten ; and Forbes observes that death generally takes place in less than an hour. These reptiles are not only frequently met with in the cultivated grounds and plantations, but will creep into the houses, and insinuate themselves among the furniture. Bishop Heber heard,

* Michaux's Travels, vol. i. p. 512.

at Patna, of a lady, who once lay a whole night with a *Cobra di Capello* under her pillow. She repeatedly



thought, during the night, that she felt something move; and, in the morning, when she snatched her pillow away, she saw the thick black throat, the square head, and the green diamond-like eye of the reptile advanced within two inches of her neck. The snake was without malice; but, alas for her, if she had, during the night, pressed him a little too roughly! * Dr. Russell made many experiments with this

serpent, from which it appears that its bite will kill a dog in twenty-seven minutes, and a young fowl in one minute and a half. This is the snake so frequently exhibited by the Indian jugglers,—who contrive, by some unknown method, to tame them so far as to perform certain movements, in cadence, and to dance to the sound of music. It has been naturally supposed, before this could be done, that the poisonous fangs had been extracted; and this question has given rise to much discussion: it seems, however, from the following anecdote, that this is not usually practised:—“A man, who had been entertaining Mr. Forbes one evening with his dancing snakes, the next day was exhibiting the same performances to some peasants, when suddenly one of the vicious animals darted at the throat of a young woman, and inflicted a wound, of which she died in half an hour.”† The *Cerastes*, or horned viper, is one of the most deadly serpents of the African deserts. They are so numerous in some parts, that Bruce mentions, half a dozen would sometimes be found round the embers of the fire where the travellers had dressed their

* Heber's Journal, vol. ii. p. 319.

† Orient. Mem. vol. i. p. 41.

victuals. Without going into the question about the power of some of the Africans to handle these serpents with impunity, it may safely be concluded that a bite which would produce certain death in one case, may reasonably be supposed to do so in another. The usual symptoms which follow the bite of the *Cerastes*, are, a tumefaction of the part, a general icterus, swelling of the face, delirium, convulsions, and death.

(212.) It would be impossible to enumerate, correctly, many others, equally venomous, that have been mentioned by travellers, since the greater part are known to us only by their provincial names. A species mentioned by Forbes, as insinuating itself into the houses of India, is the smallest and most dangerous in that country. It is of a brown colour, speckled with black and white; though, at a distance, it is not easily distinguished from the ground upon which it moves. Its bite occasions a speedy and painful death. Mr. Forbes assures us he once found four, and at another time five, of these reptiles creeping among the furniture in his own chamber.* The *Trigonocephali*, or square-headed serpents of the West Indies, seem to be universal objects of horror, not only to man, but to the brute creation. The horse trembles and prances violently in its presence; rats scud away at its approach, sending forth cries of terror: and birds especially, upon which it feeds, often indicate to man the place of its retreat. The bite of this serpent is terrible; sometimes it produces death, with all those distressing symptoms above mentioned, in a few hours; and sometimes the miserable patient lingers for several days. But even if, by a timely application of the most efficacious remedies, life is preserved, it is embittered for many years by vertigoes, paralysis, phagedenic ulcers of a malignant nature, and a variety of other distressing infirmities. Bancroft, one of the oldest and best writers on the habits of the snakes of Tropical America, gives us a fearful list of

* Orient. Mem. p. 42.

several eminently poisonous. It is to be regretted, however, that he scarcely mentions them by their vulgar names. That called the *Woods-master* has a wide and flat head, and has a frightful appearance, from having long loose scales on the head, which can be erected at pleasure. This snake never flies before an enemy, and its bite is universally deemed fatal. The effects of the bite of another, the *Labarra* snake, are instantaneous. "A negro, who was bitten by one, had just time to kill it, when his limbs were unable to support him, and he fell to the ground, — expiring in less than five minutes from the time of receiving the wound: the blood exuding from the ends of the capillary sanguine arteries occasioned the appearance of purple spots on every part of the external surface of the body; and hæmorrhages ensued from the nose, eyes, ears, and lungs."* Brazil is infested by several others peculiar to that empire. Spix, who travelled there, observes, "Among the most poisonous of serpents is the one called *Urutá*, which, like several species of *Bothrops*, lives chiefly in the gloomy recesses of the forests: its bite is said to occasion almost instant death. The bite of the Brazilian rattlesnake is nearly as terrible as that from the North American species, for it is almost always fatal in twenty-four hours; while that of the *Bothrops leucurus* takes effect in a much shorter time: it is peculiarly horrible, being attended with dreadful convulsions, and with all the symptoms of hydrophobia."†

(213.) The puff adder (*Vipera inflata*) is held in universal dread by the Africans, as being, probably, the most venomous of its tribe in Southern Africa. Unlike the generality of snakes, which make a spring or dart forwards, when irritated, the puff adder, as it is said, throws itself backwards, — so that those ignorant of the fact would place themselves in the very direction of death. The natives, however, by keeping always in

* Bancroft's Nat. Hist. of Guiana, p. 218.

† Spix's Travels, vol. i. p. 131.

front, are enabled to destroy it without much risk. The snakes of Africa, as of Europe, observes Dr. Burchell, lie concealed in their holes, in a torpid state, during the colder part of the year.*

(214.) The last we shall enumerate is the common viper, fortunately the only venomous species known to us as a native. Its effects, at all times, are dreadful, and in most cases fatal; but we may safely omit the distressing detail of all the symptoms which attend it.

(215.) The serpents of which we have hitherto spoken, inflict their venom by their bite; but there is one inhabiting Southern Africa, which has the singular property of spitting forth a fluid which often blinds the unfortunate person at whom it is aimed. "The *Spugslang*, or spurring snake," observes professor Lichtenstein, "is from three to four feet long, and has the singular property of spurring out its venom, and of giving it such a direction as to hit the eyes of the person attacking him; this is followed by violent pain, and so strong an inflammation, that it will occasion the entire loss of sight. Washing the eyes with warm water is considered the best remedy. The bite also of this serpent is said to be extremely dangerous."† The same naturalist gives us a slight notice of a species of poisonous spider of the same country, which measures, when its legs are stretched out, upwards of four inches in length.‡ We should be apt to think, from all these accounts, which enumerate, in fact, but a small portion of the serpent reptiles which are poisonous, that the greatest number of the whole tribe are of this description; but this inference would be altogether erroneous. Dr. Russell, who particularly studied the serpents of India, assures us that, out of forty-three species which he himself examined, not more than seven were found to possess poisonous fangs. On comparing the effect of the poison of five Oriental serpents upon brute animals, with those occasioned by the bite of the rattle-

* Burchell's Travels, p. 469.

† Lich. Travels, vol. i. p. 96.

‡ Id. ibid. p. 349.

snake and the European viper, it was remarked that they all produce morbid symptoms nearly similar, however much they may differ, in their deleterious power, as to degree, or the rapidity of its operation. The bite of a rattlesnake in India killed a dog in two minutes, while the bite of the most pernicious snake in India was never observed to kill a dog in less than twenty-seven minutes.*

(216.) Among the AMPHIBIA, we know of none whose nature or habits are even indirectly injurious. Popular superstition, indeed, long invested the toad with poisonous qualities; and the fable has even been revived in modern times; but it is now generally admitted that the viscous humour upon the skin is not poisonous, but merely intended to protect their body from the dryness of the air and the heat of the sun. The tribe of salamanders is equally harmless. To this belong not only the salamanders, but the sirens, and that species which was supposed by the ancients to resist the action of fire. It is hardly necessary to allude to such fables, but for the purpose of pointing out their absurdity.

(217.) Among FISHES we find some of the most destructive animals in existence. The healthy and exhilarating exercise of bathing, so peculiarly grateful in warm countries, is there attended with imminent danger; and frequently with certain death. The gigantic crocodiles, already mentioned, are not the only creatures which dispute the possession of an element, which man was not designed to inhabit. Enormous sharks are continually roaming about these tepid seas, devouring everything living which comes in their way. Hideous and gigantic rays lie in wait at the bottom, to intersect the diver after submarine treasures; while, if he escape from these, the torpedo is ready to benumb his limbs, and cut off his retreat. Sharks, under a variety of forms and of species, are spread over the whole ocean. Several, indeed, occur in our own seas;

* Forbes's Orient. Mem. vol. i. p. 45.

for the dog-fish of the sailors truly belong to this race, although, from their small size, they prey only upon the lesser marine animals: but those of tropical latitudes are far different. The very aspect of a shark's

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tooth (*fig. 61.*) is sufficient to give a terrific idea of its use; it seems of a form compounded between that of a lancet and a very fine saw: of these there are from three to six rows in each jaw; and the animal has the power of raising

or depressing them at pleasure. The white shark (*Squalus Carcharias* Lin.) is one of the most formidable; but the species, as before observed, are very numerous. One anecdote will be sufficient to illustrate the savage nature of these monsters: it is related by Hughes, the well-known and esteemed author of the *Natural History of Barbadoes*. "In the reign of queen Anne, a merchant ship arrived at that island from England: some of the crew, ignorant of the danger of the recreation, were bathing in the sea, when a large shark appeared, and swam directly towards them: being warned of their danger, however, they all hurried on board, where they arrived safe, except one poor fellow, who was bit in two by the shark, almost within reach of the oars. A comrade and intimate friend of the unfortunate victim, when he observed the severed trunk of his companion, vowed his revenge. The voracious monster was seen traversing the bloody surface of the waves, in search of the remainder of his prey, when the brave youth plunged into the water. He held in his hand a long sharp-pointed knife; and the rapacious animal pushed furiously towards him. He had turned on his side, and opened his enormous jaws, when the youth, diving dexterously, seized the shark with his left hand, somewhere below the upper fins, and stabbed him repeatedly

in the belly. The animal, enraged with pain, and streaming with blood, attempted in vain to disengage himself. The crews of the surrounding vessels saw that the combat was decided; but they were ignorant which was slain, till the shark, exhausted by loss of blood, was seen nearer the shore, and along with him his gallant conqueror, — who, flushed with victory, redoubled his efforts, and, with the aid of an ebbing tide, dragged him to the beach. Finally, he ripped open the stomach of the fish, and buried the severed half of his friend's body with the trunk, in the same grave." It is no uncommon thing for the negroes — who are most admirable divers — to achieve the death of this animal by the same means; but, then, this can only be done with consummate dexterity, and by those who are armed for this express purpose. Ordinary swimmers are constantly falling a prey to the sharks of warm climates; and there is an interesting print, delineating the event by which the late sir Brooke Watson — a gentleman once well known in London, but who then resided in the West Indies — lost one of his legs, in this manner. It is unnecessary, in this place, to enlarge upon the remarkable powers of the torpedo: it is so far dangerous to a swimmer, that a shock would be sufficient to deprive him, in all probability, for a few minutes, of power to use his limbs. The rays (or flat-fish, similar to those termed thornbacks and maids by our fishermen) grow to an immense size in the Indian seas, and are quite as voracious for human flesh as the sharks. Many species are armed with a long bony spear, situated towards the tail, and barbed like an arrow; with these they can inflict dreadful wounds, which, many assert, exhibit all the appearance of being poisoned. These monsters live, for the most part, in the greatest depths; and they are the most formidable enemies which the pearl divers of Ceylon and the neighbouring coasts have to encounter.

(218.) Minor injuries can be inflicted by numerous species of this class, and in a great variety of ways.

Many have their gills armed with spines; and wounds by these processes are very severe, and sometimes occasion a considerable effusion of blood. Others — and they form a large division — have the rays of their dorsal fins entirely composed of these spines, which they can erect and depress at pleasure; while those of the genus *Acanthurus*, or lance-tail, have a sharp bony process, not unlike the very large thorn of a rose tree, placed on each side of the tail; by this they can inflict a lacerated cut on the hand of any one who is so imprudent as to seize them in that part. But the hedgehog fish of the Indian seas (*Diodonidae*) possess this defence in its highest degree: their whole body is beset by strong acute spines, pointing at a right angle from the fish in every direction; so that it is quite impossible to handle them, when alive. Some are said to be poisonous in their flesh; others to inflict the same injury by means of certain fins and spines, placed near the head: but all these, comparatively, are minor evils, and seldom, if ever, terminate fatally.

(219.) If the injuries to which mankind is subjected, from the larger animals of creation, appear more to be dreaded, from their nature and their frequency, than such as he is exposed to from the lesser races, the latter are not, therefore, to be despised, or regarded as insufficient to destroy life. Whether we regard the injuries inflicted upon us by the insect world, — puny beings which we can crush in an instant, — as intended to teach us humility, or to show us what insignificant instruments can be employed, in the hands of the Almighty, to punish individuals, or nations, for their sins, certain it is, that these tribes have the power of afflicting us with the greatest evils that can befall the human race. They have produced death in its most loathsome form; and have been, to entire nations, the occasion of plague, pestilence, and famine. Messrs. Kirby and Spence, from whose varied researches we shall, in this portion of our work, draw largely, has truly observed, that “the numerous tribes of insects, as the prophet

Joel declares, are the armies of the Almighty, marshalled by him, and by his irresistible command impelled to the work of destruction: where He directs them, they lay waste the earth; and famine and pestilence follow in their train."*

(220.) INSECTS, as to their direct attacks upon us, may be arranged, as these authors observe, under three principal divisions. Under the first we may class those which seek to make us their food; the second are such as revenge our intentional or unintentional provocation; and the third comprises those which, without offering us violence, nevertheless incommode us exceedingly in other ways. The first sort of these injuries are the most important, and will claim our chief attention.

(221.) Man, like all created beings, is doomed to furnish nourishment, from his own body, to various detested parasites, which either affix themselves upon the surface of his skin, or reside within his flesh. The disgusting



genus *Pediculus*, or louse (fig. 62.), belongs to the first description. Providence seems to have created this pest to punish inattention to personal cleanliness. This insect increases so prodigiously, that Leeuwenhoek states, "a single female may, in eight weeks, witness the birth of five thousand descendants." We may remark that this disgusting insect is most common

in the South of Italy, where heat of climate and personal dirt are greater than in any other part of Europe. We are inclined, also, to believe it peculiar to Europeans, or, rather, whites; for, although the poorer class of Portuguese Brazilians swarm with lice, we never saw them *hunted* on the woolly heads of the African negroes. Whether the disease named *Phthiriasis* by the ancients, originated from lice, mites, or

* Int. to Ent. vol. i. p. 82.

maggots in general, is a question involved in much doubt; but all agree in stating that it was produced by insects. Considering the conflicting accounts that have been given, it seems highly probable that more than one disease has been confounded under this general name, each produced by a different insect. Dr. Willan, in a case of *prurigo senilis*, observed a number of small insects on the patient's skin and linen, which were quick in their motions, and very minute. He took them, at first, for small lice; but Mr. Kirby rather suspects they belonged to a new genus, allied to the *Acarus*.

(222.) The *Acaridæ*, or harvest bugs, indeed, contain a host of enemies to our race; they cause excruciating pain, by digging into the cuticle of the skin, and, in some instances, establishing themselves beneath it. Dr. Adams conjectures they may be the cause of certain cases of *ophthalmia*,—a disease remarkably prevalent in Egypt, and from which our troops suffered most severely. We are decidedly of the same opinion; notwithstanding the popular notion, then prevalent, that this disease, which generally terminated in total blindness, originated from the glare of the hot sands of the desert. Our medical officers soon found that the Egyptian *ophthalmia* was infectious, and that it spread rapidly among those regiments of which part of the men only had been to Egypt, and the rest had remained in Sicily: a clear proof that the disease could not have originated from the above cause. Sir J. Banks attests that, several seamen of the Endeavour brig being tortured with a severe itching round the eyelids, an Otaheitan woman cured one of them by extracting an abundance of very minute lice. We can, from personal experience, bear testimony to the excruciating pain caused by more than one species of *Acarus*, called by the Brazilians *Cara-pato*. They are found, in the dry season, among the parched-up herbage, and seem to be gregarious; for we have sometimes found our garments, on going through a break of the forest, suddenly covered with them, as if they congregated together, ready to catch hold of

the first living object which passed that way. They immediately begin to burrow with their snouts into the skin, where they get so firm a hold, that it is frequently necessary to use a sharp instrument to pick them out: if this be done by taking hold of their body, much danger is risked, for the head generally remains in the skin; and this, if not extracted, causes intolerable pain, and, finally, severe ulcers. The annexed cut of *Acarus variegatus* (fig. 63.) magnified, will give



a perfect idea of these detestable pests. It is probable that the insect named by Linnæus *Pediculus ricinoides*, on the authority of Rolander, is one of these, simply from this circumstance, — that, so far as our observations have extended, there is no insect known in South America, which “gets into the feet of people who walk,” except the chegoe, common also in the West Indies. The whole of the *Acari*, or harvest bugs, are eminently parasitic; and, in all probability, the only tribe of apterous insects, except the true *Pediculus*, or louse, which preys upon man. The fact mentioned by Linnæus, that a minute species, swallowed in water, produced a violent dysentery, is incontestable, and gives no small sanction to the belief that many of the modifications of this disease have the same origin. To these pests, also, many learned and intelligent writers have traced the itch. There are, no doubt, several *species* — if we may use the expression — of this disease, — each, in all probability, originating from a different cause; but that more than one of these are to be attributed to insects has been sufficiently proved. Our ignorance, in fact, on the connection between insect agency and bodily disease, is so great, that the discussion would lead to nothing satisfactory. We have long been of the same opinion as was Linnæus, that the plague originates from the same cause. We were in Malta during the whole time that island was afflicted with this terrible

scourge ; every precaution which proved efficacious to prevent the infection was of a nature to destroy insect life : the most contaminated substance, if soaked in water, could be taken out and handled with impunity. Oil is the most subtle poison to the insect world ; and oil is the most efficacious remedy against receiving the plague. Paper, again, is a powerful conductor ; but if that paper is, in the first instance, either fumigated, or passed through water,—either of which processes will destroy insects,—it may be handled with perfect security. These facts we have personally ascertained.

(223.) Scarcely less horrible than death from the plague, are two instances quoted by Mr. Kirby, from good authority. One is the miserable case of a French nobleman, from whose eyes, nostrils, and mouth, red-coloured animalcules, excessively small, broke forth day and night, attended by the most horrible and excruciating pains ; and, at length, occasioned his death. The other case is recorded by Moffat, of Lady Penraddock, concerning whom he expressly tells us that *Acari* swarmed in every part of her body, — her head, eyes, nose, lips, gums, the soles of her feet, &c., — tormenting her day and night ; till, in spite of every remedy, all the flesh of her body being consumed, she was, at length, relieved by death from this terrible state of suffering. Moffat attributes this horrible disease to the free use of goat's milk ! — no doubt ignorant that a large portion of the peasantry of Southern Europe know no other milk than that of goats. In Sicily, more especially, such is the fact ; for, during eight years' residence in that island, we scarcely remember to have tasted the milk of cows more than once or twice. We need not dwell longer on these details — painful as they must be to every compassionate mind. They teach us, however, a great moral lesson. Nothing is more inimical to the best interests of man, or more offensive to his Maker, than pride ; and, to punish this, the Almighty has manifestly made these vile and loathsome insects, to be the instruments of his displeasure. Some of the

most horrid of the deaths we have enumerated, have been inflicted on the titled and the wealthy; and, if we required further proof, the miserable state and death of two of the proudest and most cruel tyrants of ancient times are awful examples;—the inhuman Pheretima swarmed with *Eulæ*; and Herod Agrippa was “eaten of worms.” Whether the insects here termed *Eulæ* and *Scoleches*, were larvæ, maggots; or *Acari*, affects not the question. These wretched men were tormented and killed by the meanest and most disgusting creatures on the face of the earth.



(224.) One of the most pestiferous of the West India *Acari*, or ticks, is the *Leptoscarius nocturnus** of Guilding (fig. 64.), of which the annexed cut gives a magnified representation. “In its nocturnal habits and wanderings it resembles the common European bed bug (*Cimex lectularius*), and is one of the greatest pests among the *Acari*. They lie hid during the day-time in chinks, where they are

betrayed by the livid spots caused by their excrement.



At nightfall they creep from their retreats, and attack our domestic animals with the greatest obstinacy. Before I discovered the cause, my goats wasted away, and became restless and

noisy; and a powerful horse suffered so much from the

* “Distinguished from *Argas* by the very minute trophi totally concealed in the breast.”—*Guilding*.

host of these furies that assailed him, as to rub down a strong division in the stable, in his attempts to get rid of his tormentors. By pouring boiling water into their retreats, the colony was at last destroyed. The *Caris penetrans* Guild. (*fig. 65.*), in a young state, called, in St. Vincent's, the fowl-borer, was associated with them by hundreds: it is a more nimble animal, and is equally the scourge of our domestic poultry.* Its snout, when magnified (*a*), is seen to be barbed.

(225.) Fleas are certainly troublesome, but by no means disgusting, animals. In themselves, they are particularly cleanly; and, although they are more attached to the lower orders than to the higher, yet excessive dirt seems to drive them away. Townson mentions that the Hungarian shepherds grease their linen with hog's lard, as an effectual antidote against the attacks both of fleas and lice. Although these "little merry things" suck our blood, their attacks produce no other effect than a momentary tickling, which some people think rather an agreeable sensation than otherwise. But there is another species, peculiar to the hot parts of America, which can not only inflict severe pain, but cause the mortification of a limb. This is the well-known chegoe or jigger of the West Indies, the *Pulex penetrans* of systematic writers. Of this pest we can also speak from personal experience. It gets into the feet of the most cleanly; and attacks, indiscriminately, the blacks and whites. The slight itching it at first occasions, is hardly thought of; but in two or three days appears a little white round ball beneath the surface of the skin, with a small dark speck in the middle: the ball is the *nidus*, or nest; the speck is the chegoe itself. Some skill is necessary to extract both; the skin is gently removed from the little round white ball or nest, precisely as we should peel an orange; this ball is covered by a thick outer skin, and, by pressing the flesh all round, it may be squeezed out

* Guilding's MSS., in the possession of his widow.

without breaking ; the cavity which it has left is then filled with snuff or tobacco, and will heal up in a few days. If the bag or nest break, it is ten to one but some of the eggs — which are very minute — remain in the wound ; and to guard against the possibility of a fresh colony being thus formed, the use of the snuff is adopted. New comers are particularly subject to these creatures, and they should immediately be extracted. We have seen negroes, who, from sheer idleness or negligence, in the first instance, have been lamed for life, and become loathsome to the sight. In such a state, these miserable objects are incurable ; and death only puts a period to their sufferings. Europe is fortunately exempt from this scourge ; but we have another, which, if not timely subdued, would rob us of necessary rest. This is the bed-bug, who feeds upon us by *sucking*, and not, as is generally supposed, by biting. The English houses are but little infested with these disgusting creatures ; although the beds of lodging-houses in London are seldom free from them. In the warmer parts of Europe they abound ; nor shall we ever forget the following circumstance, which happened to us in one of the miserable inns of Italy. Notwithstanding the fatigue of a long day's journey, we were awoke, in the middle of the night, by swarms of bugs, which were on every part of the bed. A light being in the room, we commenced a general massacre, by drowning : and, after placing the mattress on the floor, in the middle of the room, endeavoured once more to gain repose ; but this was in vain. We were again awoke, and totally disconcerted by seeing fresh parties crawling from out the perforated plaster of the walls, and resolutely advancing from all sides of the room towards the mattress where we lay. To sleep, in such a den of *Cimices*, was utterly impossible ; so we *turned in*, for the rest of the night, into an adjoining hay-loft. Strange, indeed, must have been the feeling of those Orientalists who founded the hospital at Surat, mentioned by Forbes, where a ward was ap-

propriated to bugs, &c., fed at the public expense. "The overseers of the hospital," says our author, "frequently hire beggars from the streets, for a stipulated sum, to pass a night among the fleas, lice, and bugs, on the express condition of suffering them to enjoy their feast without molestation." *

(226.) But there are other apterous or wingless insects, which inflict severe injuries upon man, without any intention of feeding upon his blood. The most prominent of these are the two tribes of scorpions and centipedes. The very aspect of these reptile insects is sufficient to make us start back with fear and horror: both are more especially inhabitants of warm climates. The form of a scorpion is, indeed, terrific, and is a complete personification of malignity. The ancients have given us marvellous accounts of these beings. Aristotle relates the superstitious belief that armies were employed for several days in destroying them; and Pliny affirms that they depopulated whole countries. These, of course, are fables; but the enormous size to which these terrific insects attain, and their poisonous nature, may well admit of poetic embellishment. Mr. Kirby mentions that they sometimes attain a foot in length,—probably on the authority of some traveller, for we have never seen them longer than seven inches. The poison is placed in the tail. In ordinary cases, it produces numbness in various parts of the body, tumours on the tongue, and severe fever. The only means of saving the lives of our soldiers, who were stung by those of Egypt, was the amputation of the wounded limb. Others, still more deadly, found both in South America, Ceylon, and Africa, are asserted, by travellers in all these countries, to be capable of killing those whom they sting. Of all animals the scorpion, in its own nature, is the most cruel and ferocious. They carry on a war of extermination among themselves; and are even said

* Orient. Mem.

to kill and devour their own young, without pity, as soon as they are born.

(227.) The poison of the scorpion is lodged, as before observed, in its tail; but that of the centipede is in its jaws. These are likewise among the pests of tropical climates; for, although several are found in Europe, and even in Britain, from their small size, they are harmless to us. Those of India and South America, on the other hand, are enormous. Lister mentions one which measured eighteen inches in length. Ulloa, usually considered one of the most voracious of travellers, asserts (if his translator has not mistaken his words) that some of the centipedes of Carthagera sometimes exceed a yard in length, and five inches in breadth! The bite of this gigantic serpent insect, he tells us, is mortal,—as well it may be: from its cylindrical body, Mr. Kirby supposes it to be an *Iulus*; but it must be remembered that this latter genus is entirely destitute of poisonous jaws. There is an African insect, related to the scorpion (*Solpuga Araneoïdes* Fab.; *Galeodes* Oliv.), without a sting, whose bite is represented to be fatal both to man and beast; and another from the same continent, as its name implies (*fatale*), may be supposed equally fatal.* In respect to the celebrated tarantula spider of Italy, we strongly suspect it has no real existence; for every spider, with the common people in that country, is a tarantula. Whether there is any species really possessing poisonous qualities, may be reasonably doubted; for, during a long residence in the Mediterranean, we never heard of a single injury of this sort: nor could we get the country people to show us any particular spider acknowledged to be the true tarantula. Here we may terminate the list of apterous insects deriving nourishment from man, or inflicting upon his person decided injuries. But among annulose animals, of which insects form but a part, there are others which feed upon his juices, and, taking up their habitation within his body, afflict

* Int. to Ent. vol. i. p. 126.

him with grievous pain, and often with death. The scorpions of Guiana, although not nearly so large as those of Africa, inflict venomous and extremely painful wounds, although the termination is not fatal. A negro girl, stung by one of these animals, in a few minutes complained of being excessively cold, though the weather was very hot; she felt, also, a violent shivering fit, like the paroxysm of an ague, together with a quick, weak, tremulous pulse; these symptoms were also accompanied by yawning, stretching, and frequent gasping for breath.*

(228.) The injuries caused by intestinal insects, or, more properly, worms, are most grievous. These foes, indeed, more particularly excite our apprehension and disgust, from the impossibility of seeing and exterminating them, and of guarding against them. We have dwelt so largely on those outward maladies produced by insects, that we shall spare our readers the full details of those distressing inflictions produced by the numerous worms which inhabit our body. Suffice it to say, that of the Linnæan genus *Tænia*, or tape-worm, there are no less than six species which are known to be peculiar to the human subject. All these feed upon our juices, and usually take up their habitation at the upper part of the alimentary canal. Sometimes they are found in great numbers in the same individual, producing the most distressing symptoms, and very frequently a lingering death. They have the power of reproducing parts which have been broken off,—so that they are exterminated with the greatest difficulty. The *Tænia Solium* is, perhaps, the most formidable,—for it has been found to reach the length of thirty feet, and, as some authors assert, even sixty feet: it feeds on the chyle and juices, thereby turning all the nourishment taken by the patient to its own support; hence it produces frightful emaciation, and ultimate death. It is removed with the greatest difficulty, even by the most active medicines; for, by means

* Bancroft, vol. i. p. 46.

of a double series of hooks round the mouth, it adheres to the intestines with the most astonishing firmness. The common species (*T. vulgaris*) feeds also on the chyle, and is from one to five yards long: it is likewise so tenacious as to resist the most violent remedies. These, where the mouth is not armed with hooks, are more easily expelled than the others; yet some of them grow to an enormous and almost incredible length. The *T. tenella*, or broad tape-worm, principally confined to the inhabitants of Russia and Switzerland, is said to have been found from six to forty yards long. There are other races, where the annulose structure seems obsolete, but which most authors concur in placing in the same class as the former; these are the *Ascarides*, *Tricocephalus*, *Filaria*, *Fasciola*, and *Furia*: the last is a most deadly plague, happily confined to the marshes of Sweden.

(229.) The vermicular *Ascarides* are simple slender worms, about half an inch long; but they are generally found in considerable numbers in the same person, and occasion much pain and distressing symptoms,—creeping sometimes up into the stomach from the rectum, where they usually reside: they are generally found in thin people, and in children. The *A. Lumbricoïdes* is from twelve to fifteen inches long, with a triangular mouth: they are much larger and more disgusting than the last, as they sometimes ascend into the stomach and creep out of the mouth and nostrils. The *Tricocephalus Hominis* somewhat resembles *Ascarides*: it inhabits the intestines of children, and is frequently found in considerable numbers within the cæcum,—giving to those who are thus infested, a very sickly appearance. All these intestinal parasites are found in Europeans; and, with but one exception, have occurred in this country: how far they inhabit the natives of other regions,—or whether, as is most probable, the inhabitants of the tropics are subject to other peculiar species,—has not been well ascertained. There is a dreadful worm, however, found in both Indies, which is fortunately

not known in more temperate regions: this is the *Filaria medinensis* of Linnæus. It comes to the herbage in the morning dew, from whence it pierces the skin and enters the feet of such as walk without shoes, and causes the most painful irritations, succeeded by violent inflammation and fever. The natives extract it with the greatest caution, by twisting a piece of silk round one extremity of the body, and withdrawing it very gently. When we consider that this insidious worm, as we are told, is frequently twelve feet long, although not thicker than a horse hair, we can readily imagine the difficulty of the operation. If, unfortunately, the animal should break, the part remaining under the skin grows with redoubled vigour, and frequently occasions a fatal inflammation. The *Fasciola Hominis*, belonging to the same genus as the worm which infests the liver of sheep (*Fasciola hepatica*), is peculiar to the human subject. But we scarcely know one of these dreadful pests which can be considered more terrible than the *Furia infernalis*, first made known by Linnæus, who met with it during his Lapland journey, and was very near becoming, himself, a victim to its deadly attacks. His account of this extraordinary plague is nearly as follows:—In Finland, Bothnia, and the northern provinces of Sweden, the inhabitants are often seized with an acute pain, confined to a mere point, on some exposed part of the body, which afterwards increases to a most excruciating degree, and sometimes, even within a few hours after its commencement, proves fatal. This disorder is more prevalent about marshy or low places, and occurs during autumn: it is occasioned by the *Furia infernalis*. This little worm appears to creep up the stalks of aquatic grass and shrubs in the marshes, where it is often carried off by the wind: if, at these times, it comes in contact with the naked skin of the inhabitants, it immediately adheres, and buries itself within. The first sensation is said to be like that occasioned by the prick of a needle; this is succeeded by a violent

itching of the part ; soon afterwards by acute pain, a red spot, gangrene ; and, at last, inflammatory fever, accompanied by swoonings. In this state, the insect not being extracted, in the course of two days, at furthest, death ensues. The extraction of the worm is very difficult. The Finlanders, however, use a poultice of curds or cheese,—which not only allays the pain, but, as they affirm, entices the worm out of the part. The most effectual method, however, is obviously to extract it by means of the lancet. The immortal Swede during one of his entomological excursions, was attacked by this worm in so dreadful a manner, that for a short time, as he himself tells us, there was great doubt whether he would recover.

(230.) Our celebrated navigator, Dampier, was nearly in as dangerous a predicament as Linnæus, from the effects of what he calls the Indian thread-worm,—probably a species of *Filaria*. His own words will best express the peril of these creatures. “If they are broken in drawing out, that part which remains in the flesh” (or rather, he should have said, the flesh itself) “will putrefy, be very painful, and endanger the patient’s life—or, at least, the use of his limb. I have known some persons that have been scarified strangely in the operation of taking out the worm.” One of these entered into his own ancle. “I was,” he says, “in great torment before it came out. My leg and ancle swelled, and looked very angry, and I kept on a plaster to bring it to head. At last, drawing off my plaster, out came three inches of the worm, and my pain abated. Till that time I was ignorant of my malady, and the gentleman at whose house I was took it for a nerve ; but I knew well what it was, and presently rolled it up on a small stick. After this I opened the place every morning and evening, and strained the worm out gently, about two inches at a time,—not without some pain,—till I had at length got out about two feet.” He afterwards had it entirely discharged by one of the negroes, who applied to it a

rough powder, not unlike tobacco leaves dried and crumbled very small.

(231.) Another instance of the injuries resulting from these dangerous worms deserves quotation, as it affords us, in other respects, some highly valuable information. "M. Dobsonville was attacked by one in his leg. He observed its head, to the naked eye, was of a chestnut colour, and appeared to terminate in a little black point. On slightly pressing it with a pin, and examining it with a common magnifying glass, he fancied he perceived something like a little trunk, or tongue, capable of being pushed out and contracted. Although the body was not thicker than a strong thread, yet, when the animal was extracted, it was found to be of the length of two or three ells. It appeared to be formed of a series of small rings, united to each other by an exceedingly fine membrane, and a single intestine extending through the body. This worm was extracted in the usual way; and the reason he gives for the injury done by breaking these animals is, that they are full of a whitish acrimonious fluid, which immediately excites inflammation, and not unfrequently produces an abscess or gangrene. A worm in his leg was twice broken, and twice occasioned an abscess. At last, at his own request, the part affected was rubbed with a preparation of mercury; and, in eight or ten days, not only the body of the insect came away in suppuration, but the wound, which had been more than three inches long, and considerably inflamed, was in this time almost entirely healed."*

(232.) Besides the internal enemies we have now mentioned, there are others, which either habitually or occasionally introduce their eggs into our bodies, and feed upon our juices, in their larva or grub state. There are several remarkable and well-authenticated instances of this upon record; otherwise we should be tempted to discredit the stories of old writers,—because it seems unnatural that any insect, whose habit is not

* *Eng. Anim. Blog.*

parasitical on the human body, should leave its habitual food, and voluntarily seek nourishment for its progeny from a totally different quarter. Certain, however, it is, that larvæ or maggots have been ejected from the stomach, or have bred in the corrupting flesh of living subjects. Several instances of this sort are mentioned by Messrs. Kirby and Spence. There seems abundant evidence to prove, beyond controversy, that the meal-worm (*Tenebrio Molitor* Lin.), although its usual food is flour, has often been voided by male and female patients, and in one instance is stated to have occasioned death; yet how these grubs could get into the stomach, it is difficult to say. Lister, a naturalist and physician of the highest authority, mentions the case of a girl who voided three hexapod larvæ, probably belonging to the genus *Dermestes* or *Byrrhus*; and by the same author we are told of a boy who vomited up several caterpillars, which, he observes, had sixteen legs. Linnaeus tells us that the larva of a little moth, common in houses (*Crambus pinguinalis* Fab.) has also been found in a similar situation, and is one of the worst of our insect infesters.

(233.) Azara, the natural historian of Paragua, relates the following extraordinary circumstance. He assures us that there is in South America a large brown moth, which deposits its young in a kind of saliva upon the flesh of persons who sleep naked; these introduce themselves under the skin without being perceived, occasioning swelling, attended with inflammation and violent pain. When the natives discover it, they squeeze out the larvæ, which usually amount to five or six. Mr. Kirby very judiciously remarks upon this statement,—"I cannot help suspecting this to be synonymous with the *Æstrus Hominis*.*" This latter insect, indeed, belongs to those which really feed upon man. It is the gadfly, in fact, of the human species, which infests the inhabitants of South America. Humboldt and Bonpland inform us that this fly is found in the

* Int. to Ent. vol. i. p. 136.

marshy districts, where it deposits its eggs in the skin of man, causing most painful tumours. Gmelin says that it remains beneath the skin of the abdomen six months, penetrating deeper if disturbed, and becoming so dangerous as sometimes to occasion death. Even the gadfly of the ox, leaving its proper food, has been known to deposit its eggs in the jaw of a woman; and the bots, produced from the eggs, finally caused her death. Leeuwenhoek mentions the case of a woman, whose surgeon took from her leg several small maggots; these our naturalist fed with flesh until they became pupæ, when they produced a fly as large as the flesh fly. Even in England, a patient of Dr. Reeve, of Norwich, after suffering, for some time, great pain, was at last, relieved by voiding a considerable number of maggots, which agree precisely with those described by De Geer as the larvæ of a fly very common in apartments.* Azara affirms, the flesh flies in Paraguay often covered his clothes with their eggs, so that he was obliged to scrape them off with a knife. He adds, that he has known instances of persons who, after having bled at the nose in their sleep, were attacked by the most violent headaches, — when, at length, several great maggots, the offspring of these flies, issuing from their nostrils, gave them relief. In Jamaica, the sick and dying are assailed by another species, which lays its eggs in the nose, mouth, or gums. A lady in that island, after recovering from a fever, fell a victim to the maggots of this fly, which passed from the nose, through the *os cribriforme*, into the cavity of the skull, and afterwards into the brain. The eminent naturalists, to whose industrious research we are indebted for these details, mentions a shocking case of a poor wretch who was actually eaten to death by myriads of worms, generated in some putrid meat which he had on his person when illness obliged him to lie down in the fields, never again to rise. Even the brain of the human subject is not free from these mysterious tor-

* De Geer, vol. vi. p. 26, 27.

mentors. Hermann has figured and described an *Acarus* which was detected running on the *corpus callosum* of the brain of a patient in the military hospital at Strasbourg; and Cornelius Gemma says that, on dissecting the brain of a woman, there was found in it abundance of *vermicles* and *punaïses*.*

(234.) Were we to enumerate all the lesser injuries inflicted upon us by insects which wound by their sting or mouth, or bite by their jaws, we should far exceed the limits assigned to this subject. These injuries, however tormenting, do not affect the life or wellbeing of the human frame; neither are they made with unprovoked cause. We must, however, except the mosquitoes, the harvest flies, and the whane flies, — all of which have a predilection for sucking human blood, and are, occasionally, most troublesome enemies to our rest. The foreign species of *Reduvius* Fab. (*fig. 66.*),



more especially those of Brazil, are able to inflict most severe wounds with their sharp proboscis (*a*), with every appearance of a venomous bite. We suffered the most excruciating pain for three or four hours, when in Brazil, from one of these insects. The wound was inflicted in the finger, but the inflammation extended for a considerable way up the arm. Many caterpillars of that country are

armed with venomous spines, which create a most intolerable itching, as already mentioned. The different species of *Culex*, or gnat, are the dread of all who live in warm climates; and in the numerous family of ants are found many which bite most severely. Some of these will be subsequently noticed. Even the common house fly is annoying by its numbers. The minute *Thrips*, so common in summer, by merely running on the skin, creates a most painful sensation: while wasps,

* Int. to Ent. vol. i. pp. 139--142.

hornets, and other tribes of stinging insects augment the list of our insect enemies.

(235.) In the third great division of animals, the MOLLUSCA, we find, comparatively, very few possessed of properties or habits directly injurious to man. Among radiated animals, however, there are several *Medusa* Lin., which, upon being touched, produce all those irritating sensations which are experienced on handling a nettle. This we have more than once experienced in prosecuting our researches among the marine animals: and upon one occasion the inflammation was so great as to suspend the use of the arm for several hours. Water, impregnated with animalculæ of the class *Acrita*, is well known to produce various distressing symptoms; and the poisonous quality of certain shellfish, at particular seasons, is a belief which has gained general credence. There seems, also, a strong impression, not only among the fishermen of Italy, but those of Europe, that the larger *Cephalopoda*, or cuttlefish, of those seas, are highly dangerous, from twisting their arms round swimmers, and impeding their motions. Some of these, particularly those of Sicily, are sometimes caught of an enormous size, with their arms fully as long as an ordinary man's leg; but, notwithstanding the marvellous stories related and believed by their captors, we did not hear of any well-authenticated instance of these animals having actually occasioned the loss of life.

CHAP. VII.

INDIRECT INJURIES.

(236.) IT is not only direct injuries which we receive from animals, — for they inflict others, which, if not

experienced immediately in our persons, are sensibly, although indirectly, felt in the various descriptions of our property; and this to such an extent, that we shall be surprised to find in how many ways they can thus affect our comfort and deteriorate our possessions. Snails and slugs — peaceable and inoffensive as they appear — do no inconsiderable mischief to our gardens and orchards, — frequently almost destroying, in the course of a few nights, whole crops of esculent vegetables, just after the young plants appear above the ground. This is generally done by gnawing off the stem, particularly that of young cabbages, &c., close to the ground: we have seen, in our own garden, repeated instances of this, and have generally found the delinquent concealed just below the surrounding clods. The young shoots of the iris family, no less than the leaves when more advanced, are likewise subject to the same injury; — a fact which every gardener, unfortunately, knows too well.

(237.) BIRDS, although indirectly beneficial in keeping the insect world within due limits, and destroying great numbers of those which feed upon vegetables, must yet be ranked among the foremost of those enemies which injure or destroy cultivated produce, whether of grain, vegetables, or fruits. In this and other densely-peopled countries, the injuries occasioned by birds is comparatively trifling to what is suffered from them in tropical and newly-settled regions. And yet, in England, we are obliged to maintain a perpetual warfare against certain species. The crow is considered by most farmers as an undoubted enemy; but this may be fairly questioned: there can be no doubt that these birds destroy an amazing number of grubs and injurious insects, which, to all appearance, have no other enemies: every one who has watched their singular mode of following the course of the plough, both in winter and spring, can have no doubts upon this fact. It is said, however, that when they pursue the same search after insects in newly-sown fields, they devour,

also, the grain they meet with in their track : this may, at least in part, be true ; but we have yet no absolute proof of such being the case. Certain it is, that in particular parts of America, where the crows were completely eradicated, or driven away by incessant firing, the numbers of noxious insects increased so prodigiously, that the farmers, to their sorrow, found the remedy worse than the disease ; the whole district agreeing to suffer the persecuted crows to return, and occupy again their old quarters. Sparrows, and other hard-billed birds, do little injury to the farmer while the crops are growing ; but no sooner is the corn nearly ripe, than they come down upon it in flocks, and, if not scared away, devour large quantities : they renew their depredations when the corn is stacked ; and although the quantity which each individual purloins in a day is comparatively trifling, yet, when numbers assemble and continue their thefts for weeks,—which is often done,—the loss to the farmer becomes most serious. But, after all, it is the gardener who suffers most—at least, in this country—from the depredations of birds. And this gives us the opportunity of correcting, through more actual experience and observation, much that we have written upon this subject elsewhere.* Of all our birds, the most determined foes of the gardener are the different species of *Parus*, or tits, and the bullfinch. Against the former race, indeed, a warfare of extermination should be carried on,—specially in winter, when they are easily seen in the naked hedges, and more readily shot. The injury done by these little pests to the hardy fruit trees is beyond all calculation : by biting off the buds, particularly of the gooseberry bushes, they often reduce the prospect of a crop to one fourth what it would otherwise have been. There are two of as fine cherry trees in our garden as were ever seen : but, from which the bullfinches and tomtits so effectually pick all the embryo buds, that we have never had more than a handful of fruit from both during any one of twelve years. We were

* London's Encyclopædia of Gardening and of Agriculture.

obliged to relinquish the growth of Indian corn, from the destructive propensities of these birds ; they strip off the protecting leaves when the corn is just ripening, and will often pick out every grain as effectually as if it had been done by the hand, leaving only the worthless husk : we were, for some time, perplexed to account for this injury, until, by watching, we detected three species — the *Parus cæruleus*, *major*, and *ater* (or *palustris*) — all busily employed, and with the greatest boldness, in this work of destruction. Blackbirds, thrushes, and robins are wholesale depredators on the small fruits, when they are ripe,—particularly the latter, two or three of which will strip a currant tree in as many days. Sparrows, comparatively, do little harm in gardens. We have no room to expatiate on the destruction caused to the grain crops by the maize birds in America, the grakles in Africa, and the parrots in Australia ; but it is often so great as almost to ruin the settler, and diminish the property of the landholder.

(238.) Quadrupeds, in such countries as are thinly inhabited, commit extensive and destructive ravages. One of the most pernicious is the hippopotamus, or river horse of Africa,—a large and powerful animal, which, on leaving the water for its nocturnal rambles, frequently tramples over large plantations of rice, sugar-canes, &c., tearing up the shrubs, and causing the most terrible devastation. Another, less formidable in appearance, but equally injurious, is the *Mus Lemmus*, or lemming rat, already alluded to as inhabiting Norway and Lapland ; and which is, we are informed, at once the wonder and the pest of those countries. Pennant remarks that “ vast numbers have been known to march (like the army of locusts, so emphatically described by the prophet Joel), destroying in their progress every root of grass, and spreading universal desolation. They infest the very ground ; and cattle are said to perish with the taste of the grass which they have touched.” The jackal is in some countries an insidious enemy ; in the daytime drawing

near the haunts of men, forming near them a subterraneous hiding place, and concealing himself in its recesses until the approach of night,—when he emerges from his retreat, and attacks eggs, poultry, and other live stock, which may be within his reach and control, and generally carries them off in safety.* The *Mus Cricetus*, or hamster rat, found in Germany, Poland, and Russia, is also extremely destructive to grain, by eating vast quantities itself, and afterwards carrying away still more in its large cheek pouches.† The squirrels of North America commit equal ravages among the plantations of maize, — hundreds of them attacking a single field at once, climbing up the stalks, feasting upon the sweet corn, and, perhaps, in one night, effecting the spoliation of the whole crop.‡ The squirrel of our own country, however, cannot be classed among the injurious quadrupeds, — for few, with any kind or generous feelings, would begrudge to this elegant enlivener of our parks and preserves, a few hazel nuts, upon which alone it subsists. The *Sciurus Carolinensis*, or Carolina squirrel, which is much larger than ours, makes great devastation among the wheat in some of the states. Their number, indeed, is often so considerable, that the children are sent round the fields to scare them several times a day. At the least noise they run off by dozens, and take refuge in the trees,—from which, however, they return to their depredations when their alarm is over, and are again to be scared away. They emigrate at the approach of winter; and often arrive in Kentucky in such numbers, that the farmers are obliged to unite in hunting and destroying them.§

(239.) The *Viverra Musanga* of Dr. Horsfield is called in Java the coffee rat, from its infesting and greatly injuring the coffee plantations; yet this is a questionable evil, as it appears to compensate for such mischief, by afterwards ejecting, uninjured, the seeds of the berries, — and these propagate the plant in other tracts of the

* Wood's Zool. p. 193.

† Id. ibid. p. 292.

‡ Shaw's Zool. vol. i. p. 106.

§ Michaux's Travels, p. 215.

island. Far different, however, is the Jamaica rat, which is a most dreadful pest to that island. In a book published on that island*, is the following account of this animal: — "In no country is there a creature so destructive of property as the rat is in Jamaica; their ravages are inconceivable. One year with another, it is supposed that they destroy, at least, about a twentieth part of the sugar-canes throughout the island, amounting to little short of 200,000*l.* currency per annum. The sugar cane is their favourite food; but they also prey upon the Indian corn, on all the fruits that are accessible to them, and on many of the roots. Some idea will be formed of the immense swarms of these destructive animals that infest this island, from the fact that, on a single plantation, 30,000 were destroyed in one year. They are of much larger size than the European rat."† In Java, there is a bat (*Pteropus Javanicus*) which, in its nocturnal depredations, destroys, indiscriminately, every kind of fruit.‡

(240.) The immense herds of springbok antelopes in Southern Africa, which have been already described as migrating in countless numbers, are oftentimes a real scourge to the settlers. It is scarcely possible for a person traversing some of the extensive tracts of the interior, and seeing this elegant antelope thinly scattered over the plains, to persuade himself that these ornaments of the desert can often become as destructive as the locusts themselves. The incredible numbers which sometimes pour in from the north during protracted droughts, distress the farmer inconceivably. Any attempt at numerical computation would be vain; and, by trying to come near the truth, the writer would subject himself, in the estimation of those who have no knowledge of the country, to a suspicion of exaggeration. And yet it is well known in the interior, that, on the approach of the springbok, the grazier is obliged to seek pasture for his flocks elsewhere; and that he considers himself

* Cited in No. V. of the Zool. Journ.

† Steward's Jamaica, p. 57. et seq.

‡ Dr. Horsfield's Zool. Researches.

dispossessed of his lands so long as these animals remain, and till the heavy rains again restore verdure to the earth. Every attempt to save the cultivated fields proves abortive, if they be not inclosed by high and thick hedges. Heaps of dry manure (the only fuel of Sneeuwbergen and other treeless districts) are placed close to each other round the fields, and set on fire in the evening, so as to cause a dense smoke, with the hopes of frightening away the antelopes; but the dawn of day exposes the inefficacy of the precaution, — for the fields, which were verdant with produce the evening before, are now covered with thousands of antelopes, and the crops cut or levelled with the ground. Many others might be added to the list of quadrupeds which, in a greater or less degree, inflict injuries upon our property; but their depredations are of an inferior nature.

(241.) Insects appear more insignificant, but they are, on many occasions, equally destructive. These little enemies consume our plants, eat up our food, devour our clothes, books, collections, and furniture, besides proving the tormentors of our domestic animals. Our horses are often plagued by many of this tribe, among which are the various flies (*Tabanus* Lin.) which attack them during autumn. In North America, vast clouds of different species sometimes “absolutely darken the air, and inflict so severe a wound, as to be called burning flies. Some are as large as humble bees.”* Cattle are subjected to equal annoyance; and their



* Kirby and Spence's Ent. vol. i. p. 146.

frantic motions frequently express the torture which they are suffering, particularly from the effects of the small gadfly (*Æ. Bovis* Lin. *fig. 67. a*) which bores a round hole in the skin, and deposits its eggs in the wound. Another species of gadfly (*Æ. Ovis, b*) effects the same purpose in the nostrils of sheep, in the inner margin of which they lay their eggs; from whence the maggots (*c*) make their way into the head, feeding in the maxillary and frontal sinuses on the mucilage there produced. Our dogs are not free from their particular tormentors. Besides the flea, and their own peculiar vermin, they suffer dreadfully from an insect called the dog-tick (*Acarus* Lin.), which, after being securely fixed in their flesh, will so gorge itself with the animal's blood, that it will swell from the size of a pin's head to that of a small bean.

(242.) Different species of grain, no less than of vegetables, are liable to be affected and spoiled by the depredations of insects. Wheat, in the earliest stages of its growth, is attacked by a species which devours the heart or central part; so that "out of fifty acres sown with this grain, in 1802, ten had been destroyed by the grub in question, as early as October."* Even when laid up in the granary it is not secure; for the weevil (*Calandra granaria* Fab.) preys upon it both in its larva and its perfect state. The devastation which this insect has the power of committing, may be estimated from the fact that a "single pair of these destroyers may produce, in one year, above 6000 descendants."† Many species effect sad ravages in our fields and pastures; among these is the common cockchafer (*Melolontha vulgaris* Fab.), which continues in its larva state for the space of four years, sometimes destroying whole acres of grass; and, in the year 1785, many provinces of France were so beset with this animal, that a premium was offered by the government for the best mode of their extirpation.‡ The hop plant is completely at the

* *Int. to Ent.* vol. i. p. 169.

† *Id. ibid.* p. 180.

‡ *Id. ibid.* p. 173.

mercy of several insects, which attack different parts: abroad, the sugar cane is in the power of others, which baffle all the care and labours of the planter. One of these is a species of ant, which takes shelter under the root, and renders the whole plant unproductive: such multitudes of this insect appeared, a few years ago, in the island of Jamaica, as both to over-run the country, and put an entire stop to cultivation.* There is scarcely a vegetable in our gardens which is not the prey of one or more of these tiny, but active and insidious, enemies. There are some which devour, indiscriminately, every different species which we cultivate. Among these we may reckon the caterpillar of a moth (*Noctua Gamma*, fig. 68.), so named from its



bearing on its larger wings a silvery character, resembling that Greek letter. This insect swarmed so frightfully in France, in 1735, that the roads were covered with im-

mense flocks, which were swarming from one garden to another, while a general idea prevailed that they were poisonous; in consequence of which the people abstained altogether from the use of herbs.† The *Aphides*, also, are sad destroyers of our flowers and shrubs.

(243.) Fruits have also their respective and persevering devourers, who either deface or gradually consume them. A small saw-fly attaches its eggs to the lower side of the leaves of the gooseberry, upon which, when hatched, the animal feeds in society; till, having destroyed the one on which they were born, they separate from each other, and frequently devour so rapidly, that very soon nothing is left but the bare skeletons of the leaves, the almost naked branches, and the half-ripened but shrivelled fruit. The apple *Aphis*, called, by some, the *Coccus*, but well known under the name of the

* Int. to Ent. vol. i. p. 185.

† Id. ibid. p. 193.

American blight, which covers itself with a cottony substance exuding from the pores of its own body, compasses the destruction of many thousands of the trees on which it dwells,—taking up its abode in the bark, and continually drawing away the sap. A small beetle (*Bostrichus typographus* Fab.), however, occasions, in Germany, still greater mischief. In its preparatory state, it feeds upon the soft inner bark of the fir; but it does this in immense numbers, 80,000 being sometimes discovered in one tree; and “such is its vitality, that though the bark be battered, and the tree plunged into water, or laid upon the ice or snow, it remains alive, unhurt.” In 1783, the number of trees destroyed by this insect, in the Hartz forests alone, was calculated at a million and a half.* The locust (*fig. 69.*), however, that pest of Eastern countries, is yet



more destructive, as our former remarks, under the head of Migration, will abundantly prove. On a cursory glance at this insect, we could scarcely believe it capable of inflicting such misery upon mankind. Certain it is, however, that these animals may be considered among the most dreadful plague to which some countries, and Africa particularly, is exposed; and from which most parts of Europe have not been free. From 1778 to 1780, the whole empire of Morocco was laid waste by swarms of locusts, so that a severe famine ensued, which destroyed numbers of the inhabitants. The whole country was covered with them;—every particle of vegetation disappeared;—and when, at length, they were carried, by a hurricane, into the Western Ocean,

* Int. to Ent. vol. I. p. 213.

the shore was strewed with their dead bodies, the effluvia from which produced a general pestilence.*

(244.) Houses, furniture, clothing, food, and medicine, — in fact, everything which belongs to us, — are more or less liable to the depredations of insects. The grub of *Tenebrio Molitor* Lin. devours our meal, flour, and other farinaceous substances, in which it will exist for two years before it passes into its state of inactivity. Flies and wasps will consume almost incredible quantities of sugar; and the latter are the greatest destroyers of all stone fruit. Sweetmeats are the prey of a small oblong mite; and cheeses, we well know, are frequently over-run with another species (*Acarus Siro* Lin.). Vinegar swarms with the maggots of a little fly (*Musca cellaris* Lin.); and even dried meats — such as hams, bacon, &c. — have their peculiar insect (*Dermestes lardarius*), which carries on, with considerable celerity, the work of devastation, — a fact known to every housekeeper.

(245.) The ants of Guiana and Surinam are the greatest pests of houses. Stedman says, — “On visiting my boxes, I found that great depredations had been committed by the ants, which, throughout Guiana, are very numerous, and of so many different species, that I once had a pair of new cotton stockings perfectly destroyed by them in one night only: those which frequent the estates are generally small, but very troublesome. The only possible way of keeping them from the refined sugar is, by hanging the loaf to the ceiling by a nail, and making a ring of dry chalk around it, very thick, which crumbles down the moment the ants attempt to pass it. I imagined that placing my sugar boxes in the middle of a tub, and on stone, surrounded with deep water, would have kept back this formidable enemy; but to no purpose: whole armies of the lighter sort, to my astonishment, marched over the surface, and but very few of them were drowned. The main body constantly scaled the rock, and, in spite of all my

* Int. to Ent. vol. I. p. 221.

efforts, made their entry through the keyholes ; after which, the only way to clear the garrison is, to expose it to a hot sun, which the invaders cannot bear, and all march off in a few minutes." There is a species of ant in Guiana, called the fire ant, of small size, but capable of inflicting excessive pain. Whole armies of these attacked captain Stedman and his party during the day. "These insects," he says, "are black, and very diminutive ; but live in such amazing multitudes together, that their hillocks have sometimes obstructed our passage by their size, over which if one chances to pass, the feet and legs are instantly covered with innumerable hosts of these creatures, which seize the skin with such violence, in their pincers, that they will sooner suffer the head to be parted from the body, than let go their hold. The burning pain which they occasion, cannot, in my opinion, proceed from the sharpness of the pincers only, but must be owing to some venomous fluid which they infuse, or which the wound imbibes from them. I can aver that I have seen them make a whole company hop about as if they had been scalded with boiling water." *

(246.) Another species, noticed by the same writer, is no less remarkable for its extraordinary size,—being an inch in length, and perfectly black. These insects pillage a tree of all its leaves in a short time, which they cut in small pieces, the size of a sixpence, and carry under ground. It was indeed entertaining to see a whole army of these creatures crawling perpetually the same way, each with his green leaf in a perpendicular direction. Some of the natives seem to have an idea that this was to feed a blind serpent under ground ; but the truth is, it serves for nourishment to their young brood, who cannot help themselves, and are sometimes lodged to the depth of eight feet in the earth. Their bite, however, is not near so painful as that of the fire ant just mentioned. In Ceylon is an insect, probably a species of ant, found in dwelling houses,

* Voyage to Surinam, vol. ii. p. 94.

which devours everything in its way; so that, if a person chance to drop but a piece of bread, or any other food, it is instantly surrounded by these creatures, who seize upon and endeavour to convey it away. Nothing has been found which will in any way check their invasions; and it is even, says our authority*, not unusual to see a cup of tea, when poured out, entirely covered with them, their dead bodies floating on it like a scum.

(247.) India, as well as Africa, besides being overrun with insects, swarms likewise with *Termites*, or the white ants, which absolutely eat up everything, less hard than glass or metal, which comes in their way. These little miners, however, are so ingenious in their depredations, that, although the timber-work of a spacious apartment is often destroyed by them in a few nights, it appears, outwardly, the same,—as they always consume, first, the interior of whatever substance they penetrate, and seldom attack the outside until they have previously concealed themselves and their operations by a coat of clay.† An amusing anecdote is told of the white ants of India, by captain Williamson, which, although improbable, is worth repeating. “A gentleman in India had charge of a chest of money, which, being put on the floor of his house, in a damp situation, was speedily attacked by the *Termites*,—these insects having previously effected a lodgment in the same quarters, but under the ground. The bottom of the box was, of course, the first part they attacked; they then destroyed the bags containing the specie, which, being thus set loose, fell gradually into the hollows of the ants’ burrow. When the cash was called for, the beholders were lost in amazement at the prodigious powers of both teeth and stomach possessed by these little marauders, whom, in their simplicity, they thought had devoured the contents. Upon further search, however,—probably set on foot by those more rational,—the whole amount of the treasure was found, sunk deep in the earth, but covered

* Perceval’s Ceylon, p. 307.

† Int. to Ent. vol. i. p. 245.

over with fragments of wood and earth."* Kæmpfer tells us of the white ants of Japan, that he one morning discovered that one of their galleries, the size of his little finger, had been formed up one foot, across the top, and down another foot of his table, into the floor, in the course of a single night. Nor do these creatures pursue their ruinous labours merely upon land, for they frequently attack vessels upon the sea; and a British ship of the line, the *Albion*, was once in such a condition in consequence, that, had she not been strongly lashed together, it is thought that she would have foundered on her voyage home: when brought into port, she was in such a state as to be considered of no further use.†

(248.) The annoyances which residents in India are exposed to from various sorts of animals, seem to be as numerous and distressing as those described by Smeathman on the African coast, and which are more or less to be found in all tropical countries. In India, nearly all snakes have a propensity to enter houses, not only as a temporary shelter, but to possess themselves of the numerous rat burrows, wherein to remain concealed. The abundance of vermin to be seen in houses, even of the first class, proves the original incitement, in fact, for snakes to venture in. The rats, however, soon scent their enemy, and lose no time in shifting their quarters; and yet both these will frequently be found inhabiting the thatch of the same dwelling. The presence of snakes is generally announced by some of the family being bit in their beds; or, perhaps, by the contests between the parties, — both the snake and the rat tumbling down on the floor from the inside of the roof. "I was once dining with a friend," observes our authority, "when our attention was suddenly arrested by a *Cobra di Capello* and a rat, both falling from the thatch upon one of the dishes on the table. I know not which of the four were first out of the room!"‡

* Williamson's *Orient. Sports*, vol. ii. p. 90.

† *Ist. to Ent.* vol. i. p. 247.

‡ Williamson, vol. ii. p. 171.

(249.) The last mentioned animals, although enemies, are still united together in one work of injury to man. It is a fact, authenticated by the testimony of travellers, and highly probable in itself, that the bursting of the artificial banks of rivers in India is in most cases caused by snakes, rats, and other vermin. These embankments are raised for the purpose of keeping the rivers within due bounds during the rainy season, by which large tracts of country are preserved from annual inundation. These banks are the favourite resort of rats and other burrowing animals, which, in no very long process of years, work their way nearly, if not completely, through. Though their burrows may be near the surface, the ultimate effect is much the same.

(250.) A few species of shelly molluscous animals are sometimes dreadfully destructive. The most formidable is the *Teredo navalis*, a worm-like animal, which lines with a shelly matter the windings or irregular cavities which it forms in wood or other substances; its head is armed with a pair of very strong calcareous or shelly jaws, with which it works its way into the substance it inhabits, which is generally the wood of the bottom of ships. About the year 1730, the most flourishing republic in Europe was made to tremble at the name of this seemingly insignificant creature; the dykes of Holland, during that year, exhibited such marks of decay in many parts, where they had been attacked by these animals, that great apprehensions were entertained of the woodwork giving way.*

* Shaw's Zool. Lect. ii. p. 169.

CHAP. VIII.

ON THE HYBERNATION, TORPIDITY, AND MIGRATION
OF ANIMALS.

(251.) THE changeful breezes of spring have passed and the glowing warmth of a summer's sun gladdens and revives all nature. Everything looks bright and joyous ; and the animal, as well as the vegetable world, appears endued with fresh life, and strength, and vigour. The note of love, and the voice of happiness, resound through the woods and meadows, uniting in one sweet and general chorus ; while, to the pious heart, this universal concert seems, in the accents of harmony, to speak the praises of that great and gracious Being whose creative hand first formed, and still sustains, the wondrous whole. But the bloom of spring passes away ; the genial fire of summer soon exhausts itself ; and winter, with its stern and chilling aspect, closes the annual circle of time. What, then, becomes of that variety of animals, many of whose delicate forms are incapable of sustaining the rigour of this inhospitable season ? Are they left, unprotected, to meet their destiny, or struggle with their fate ? No : the same wise and merciful God, who first called them into life, now directs them, by an unerring instinct, in what manner to prepare for the storm and the tempest. And, perhaps, in no part of the wise economy of nature is the Almighty agency more clearly apparent, than in these several preparations for a period which none of them could foresee, and the approaches of which many of them had never before experienced.

(252.) Animals avoid extreme cold in three different ways, — by hybernation, by torpor, and by migration.

We shall now take a rapid view of the animal circle, and slightly touch upon such as afford us examples of these instincts. The first two will be treated of conjointly ; the migration of animals, separately.

(253.) Of the manner in which such *zoophytes* and *animalculæ* as survive the year, pass the winter months, in cold latitudes, we know very little. The greater part of those which are not formed to survive the year, naturally perish, having reached their destined age ; but such as are of longer life, and are endowed with locomotion, in all probability retire to the deep recesses of the ocean, or, at least, beyond the influence of atmospheric air ; while, according to Ellis *, they are generally found to be contracted, or torpid, during this period. With regard to the *Mollusca*, or shellfish, our information is equally defective. From the number of empty shells frequently seen on the margins of our freshwater ponds, it seems probable that several of our native fluviatile univalves perish in autumn, while the rest retire to the deepest crevices. Most of the land shells close the opening of their habitations, at the beginning of winter, with a thick white cover, or false operculum †, by which it is securely sheltered ; they also seek a further protection in the hollows of banks and trees. The garden slug generally forms for itself a winter retreat beneath the earth, close to the roots of plants.

(254.) REPTILES are particularly subject to the law of torpidity. The Greek tortoise (*Testudo Græca*), and probably others of the same group, burrows a hole in the ground, into which it retires for several months. White of Selborne, who attentively observed the manners and habits of one of these animals, states, that it regularly took up its subterranean station in November, and did not reappear until the following April. Having occasion to carry it from the residence of the lady to whom it belonged, to his own house in Hampshire, it

* Essay on Coral. Introd. p. 14.

† The true operculum of spiral shells is always either horny and elastic, or stony and rigid.

was dug up in March, 1780, and conveyed in a chaise to the place of its destination. An eighty miles journey had so far recovered it from its torpor, that it walked about for a short time on being turned into the garden; but towards evening, the weather being cold, it again insinuated itself into the earth, and remained in concealment for a month. The green lizard of Carolina hastens, on the approach of winter, into the hollows or crevices of decayed trees; and the *chamæleon* retires into the holes of rocks, or some other equally safe retreat, where it is supposed to become torpid. Similar retreats, we suspect, are chosen by the numerous lizards of the South of Europe,—more especially as they are always more numerous near stone walls and rocks, in the spring, than in any other localities. Serpents, inhabiting cold and temperate climates, become torpid during the winter. They are said principally to retire under ground, from whence they emerge upon the return of warm weather. We are told, by an American writer, that, on a fine spring day, numbers of rattlesnakes may be seen creeping out, in an apparently languid state, and assembling together, for the object of basking in the rays of the sun.

(255.) Passing over the class of BIRDS, in which no well-authenticated instance of hybernation or torpidity is known, it may be observed, that QUADRUPEDS have three different modes of guarding against winter,—viz., migrating, burrowing, or becoming torpid. Few species, comparatively, are migratory animals; for their locomotive powers being much more confined than those of birds, it would be impossible for them to pass over such enormous distances as would produce a change of climate.

(256.) The Alpine hare, and the field mouse, are interesting examples among the instances of burrowing quadrupeds; and the sagacious care with which these animals provide for their winter support is truly admirable. The most remarkable of the *torpid quadrupeds* are the bears of North America, who are well

known to form caves, in which they fall into a state of complete or partial somnolency. Bats, in the same manner, retire into caverns, hollow trees, or old buildings, in vast numbers, where they pass the winter in a state of torpidity. The loir, or fat dormouse, however, is a more interesting example: it rolls itself into a ball, and, in that state, as it has been said, may be tossed about without its being awakened to consciousness,—nothing appearing to effect its resuscitation but long exposure to heat.*

(257.) The jumping mouse of Canada, according to a communication made by general Davies, makes a very curious and artificial preparation for the cold season,—a specimen of which was discovered in a gentleman's garden, about two miles from Quebec, in the latter end of May, 1787. "It was," we are told, "inclosed in a ball of clay, about the size of a cricket-ball, nearly an inch in thickness, perfectly smooth within, and about twenty inches under ground: The man," it is added, "who first discovered it, not knowing what it was, struck the ball with his spade, by which means it was broken to pieces, or the ball would also have been presented to me."† The *Mus Cricetus*, or hamster, however, above all other quadrupeds, appears to fall into the most complete torpidity,—every animal function being so completely deadened, that it is said the creature may be cut open without exhibiting any signs of sensibility: the heart, however, may be observed to contract and dilate alternately,—but with a motion so slow, that the pulsations do not exceed fourteen or fifteen in the space of a minute. The strongest stimulants are of no avail; and the electric shock may be passed through the animal without exciting any appearance of irritability.‡

(258.) Amphibious animals of cold and temperate climates generally pass the winter, like the tortoises, beneath the surface, in a state of torpidity. Frogs and toads both burrow into the earth at this season. Mr.

* Wood's Zool. vol. iii. p. 119.

† Shaw's Zool. Lect. vol. i. p. 106.

‡ Linn. Trans. vol. iv. p. 156.

Hearne, the traveller, when in Arctic America, met with frogs in such a completely frozen state, that, although their legs were broken, the injury did not appear to cause the slightest sensation to the animal. He, however, adds, that, by wrapping them up in skins, and exposing them to a slow fire, they have been restored to activity.

(259.) The generality of INSECTS, during winter, pass into a state of temporary torpor. "The sites chosen for their hybernacula," as Messrs. Kirby and Spence well observe, "are very various;—some merely insinuate themselves under any large stone; others prefer a collection of dead leaves, or the moss on the sheltered side of an old wall or bank; others seek a retreat in the moss itself, or bury themselves deep in the rotten trunk; while numbers penetrate into the earth to the depth of several inches. . . . Those insects which bear considerable cold without injury, are less careful about their winter retreats; while the more tender species either enter the earth beyond the reach of frost, or prepare for themselves artificial cavities in various substances, such as moss and rotten wood, which conduct heat with difficulty, and defend them from an injuriously low temperature."* The same authors also state, that the first cold weather which occurs after insects have entered their winter quarters, produces precisely the same effect upon them as upon many species of the larger animals. "At first, a partial benumbment takes place; but the insect, if touched, is still capable of moving its organs. But, as the cold increases, all the animal functions cease;—the insect breathes no longer, and has no need of a supply of air; its nutritive secretions cease, and no more food is required; the muscles lose their irritability, and it has all the external symptoms of death. In this state it continues during the existence of great cold; but the degree of its torpidity varies with the temperature of the atmosphere. The recurrence of a mild day, such as we

* Int. to Ent. vol. ii. p. 440.

sometimes have in winter, infuses a partial animation into the stiffened animal: if disturbed, its limbs and antennæ resume their power of extension; and even the faculty of spurting out their defensive fluid is re-acquired by many beetles. But, however mild the atmosphere in winter, the great bulk of hybernating insects, as if conscious of the deceptive nature of their pleasurable feelings, and that no food could then be procured, never quit their quarters, but quietly wait for a renewal of their insensibility by a fresh accession of cold." *

(260.) Insects, whether in the egg or pupa state, are, by the efforts of instinct, placed in such situations as will best secure them from the effects of cold. Thus, the majority of the grasshoppers, as well as several other insects, insinuate their eggs deep into the earth, where they will be out of the reach of frost; while the female of *Bombyx Neustria* covers hers with an unusually strong and hard shell, and gums them in bracelets round the twigs of hawthorn, &c., firmly securing them to the bark with a very adhesive gum: thus they are protected from the blasts and storms of winter, and, being impenetrable to rain, they remain uninjured. Those insects which continue, during winter, in the pupa state, are often protected by cocoons of silk and other materials; but such as are more hardy, as the pupæ of the common cabbage butterflies, receive no injury from being naked, although they are usually suspended in some such sheltered situation, as the corners of palings, the south side of walls, &c. Those, on the other hand, which hibernate in the larva state, either conceal themselves in some hole or cavity; or, if aquatic, bore into the sand or mud, round the pools which they inhabit. It is a most extraordinary but well-attested fact, however, that some species of larva become so entirely frozen, as to appear literal masses of ice, which will yet afterwards revive. In proof of this, Lister asserts that he has found caterpillars which have actually chinked like

* Int. to Ent. vol. ii. p. 442.

† Lister, Goedart, de Insectas, p. 76.

stones when dropped into a glass, but which have yet recovered to life and vigour.† It is unfortunate that he has not left us a sufficient clue to discover the particular species in question.

(261.) The hybernation of insects, as it has been justly observed, cannot be ascribed altogether to the effect of cold, since it is proved that the period of their seclusion is not regulated by the state of the atmosphere. Insects are uniformly found to retire at a certain period, without any reference to those variations of the climate which would otherwise cause corresponding variations in their disappearance. To what, then, is to be attributed this apparently wise forethought with which animals prepare for a season, the rigours of which they are neither formed to endure, nor have had any experience of? Most assuredly, to that same instinct which accounts for so much in their habits and economy otherwise inexplicable to us. It is clearly impossible that this apparent forethought can be anything else but inbred instinct, of which they know neither the cause nor the effect; because they have had no experience to guide them, or to show them the necessity of the preparations they thus make. Reflection and forethought cannot be employed upon things or events which are totally unknown. Neither can it be put down to the force of example or imitation,—as may be urged in the case of swallows, or other animals, which migrate, or perform certain acts in society. Nearly all insects select their winter quarters singly; and this, not until they are compelled by cold, as Kirby and Spence justly observe, but at certain periods, uninfluenced, as far as we know, by any change of the atmosphere. The hybernation of insects, in short, is one of the best proofs that animals do not enjoy reason, and of the real difference between that faculty and instinct, that can possibly be adduced.

(262.) The MIGRATION of animals, and the sociability with which it is generally accompanied, is one of the most interesting subjects in the economy of nature. It might, indeed, have been treated of, under the following

chapter, as a modification of the imperfect societies of the animal world; but, being more intimately connected with hibernation, we introduce it in this place. These unions, independent of other and more paramount causes, would seem to be produced by a love of sociability, or by some feeling corresponding to that propensity of timid people congregating at the time of any common danger or hazardous enterprise. It does not appear, however, that, upon these occasions, the stronger assist the weaker, or the courageous protect the pusillanimous, — at least, this mutual support is not put forth when man is the aggressor; and we, consequently, have few or no opportunities of judging in respect of their conduct when attacked by other foes. But be this as it may, the associations in question are of a very different character from those last mentioned. They are essentially peaceful; and carry the mind back to those primitive ages of the world, when the patriarchs of families, accompanied by their descendants, journeyed to fresh fields and more fruitful valleys, as those spots successively became inadequate for the entire and increased community. They seem to congregate, not for the mere gratification of a sensual appetite, but to live together for a season in peace and harmony; journeying and feeding together, and generally moving under the direction of sagacious leaders. We have numerous and familiar instances of such associations both among vertebrated and the annulose animals; for in both classes is the instinct of migration, in certain families, strongly implanted. Looking to quadrupeds, we find the monkeys of the New World (and, no doubt, those of the Old) changing their quarters, according as the seasons bring to perfection different species of fruits upon which they feed: when these become exhausted, they bend their course to other localities, in joyous and agile troops, the females carrying their young; and thus, leaping from bough to bough, they travel a long chain of forests, many leagues in extent, until they reach the next fruit-bearing district, — which is, in turn, abandoned for others

more distant. We shall not here speculate upon the causes of migrations generally, since these simultaneous movements appear to originate from various motives, — but of which a necessary supply of food seems to be the chief: our present purpose is to show its effects.

(263.) As united migration implies a great development of the social principle, we find it most remarkable among quadrupeds in the class of *Ungulata*, comprising the ruminants, and all those tribes whose docility towards man is most conspicuous. A few instances may be briefly noticed. The Saiga antelopes (*Antelope Colus* H. Smith) are sociable and migratory, especially in the autumn, — when they assemble, sometimes to the number of ten thousand, in a herd, and traverse towards more southerly deserts, — returning, in the spring, in smaller troops. They are unwilling to reside far from water; are seldom seen single; and the herd, when in a state of repose, always keep a few stationed to look out. But perhaps the most striking instance of this instinct is afforded by the springer antelope or springbok of the Cape colonists. This species resides on the plains of Southern Africa, to an unknown distance in the interior, in flocks, assembling in vast herds, and migrating from north to south, and back, with the monsoons. These migrations, which are said to take place, in their most numerous form, only at the intervals of several years, appear to come from the north-east, and in masses of many thousands, — devouring, like locusts, every green herb. The foremost of these vast flocks are fat, and the rear exceedingly lean, while the direction continues one way; but with the change of the monsoon, when they return towards the north, the rear become the leaders, fattening in their turn, and leaving the others to pick up a scanty subsistence.* Mr. Burchell, speaking of the same species, observes, that it is one of the most numerous in Africa, — sometimes being seen in flocks of two thousand. The most animated account, however, is that of Le Vaillant, which we shall give in

* H. Smith, Cuv. vol. iv. p. 209.

his own words.* “Being informed that the herd was approaching, I immediately set out with Haripa, my attendant, who posted me in a defile of the plain, through which the antelopes must necessarily pass. We had not long remained in this position, when we saw rising from the sides of the hills, clouds of dust, which seemed every moment to extend themselves and become larger. He then desired me to lie down upon my belly, with my face towards the ground; and in this posture, which appeared to me very little proper for hunting, I waited the event in silence. The antelopes advanced full speed; and did not fail to direct their course towards us, as he had foreseen. As the situation we had taken did not permit them to see us, they were not startled, but proceeded forward without altering their direction: when about two thousand of them, however, had passed us, he rose up, began to discharge his arrows, and desired me to fire at the same time. I was fully sensible that, when the herd was once put in motion, the antelopes in the rear would follow the rest; and that during the impression of their fear, which made them fly and press forward in crowds towards us, they would not be able to perceive us. I saw, also, that the savages, by despatching them silently with their arrows, ran no risk of scaring them; but I was apprehensive that, if I fired my gun, the explosion would spread terror among them, and that they would then return the way they came. My apprehensions, however, though founded in reason, were not verified. I fired repeatedly in all directions; but the column continued to advance as before,—and fear produced upon them no other effect than that of making them move on faster. I frequently poured the contents of my gun into the middle of this confused multitude, and each of my balls often brought down several of them at a time. Had I wished, I might easily, in this manner, have procured a hundred; and I only ceased firing, merely because such a quantity of game would have been of

* Trav. vol. ii. p. 109.

no use to me. Every time I discharged my piece at these antelopes, all their rumps, immediately, and at the same moment, became white ; and those thousands of red backs flying before me formed, as it were, one sheet of snow, — which seemed displayed, only to disappear again in an instant." It is difficult, as our author well observes, to account for "the prodigious multiplication of these antelopes in a country so infested with carnivorous animals as the whole of Southern Africa. I had," he says, "in other places, met a few of their numerous flocks ; but when I beheld this, I often wondered how so many thousands of animals—which, by their number, must have dried up the streams and consumed the pasturage of a whole district — could live in a place so barren and destitute of water. But though antelopes, as well as goats, have not the same need of drink as other animals, they, doubtless, inhabit more fertile cantons,—and there were such in the neighbourhood. In short, to give my readers an idea how numerous this herd was, I shall only say that, notwithstanding the rapidity of its course, it employed three whole hours in passing the spot where I was stationed."

(264.) The antelopes and ruminating quadrupeds



of America appear also to assemble in very large num-

bers at particular seasons. Dr. Richardson remarks of the *Caribou*, or Barren Ground reindeer (*fig. 70.*), "that it travels in herds, varying in number from eight or ten to two or three hundred."* And captain Lyon adds, that they regularly visit the polar regions at the latter end of May, or the early part of June, and remain until late in September. The woodland reindeer (*Rangifer sylvestris* Sw.) cross the Nelson and Severn rivers in immense herds in the month of May, pass the summer on the marshy shores of James's Bay, and return to the northward in September.† These instances, taken almost at random from among the true ruminants, sufficiently establishes the frequency, in this order of quadrupeds, of regular migration.

(265.) Among the *Glires*, or gnawing animals, these movements, although conducted on a scale equally large, generally occur at uncertain periods; and they therefore, in all probability, originate in other causes than a search after food. The history of the economic field mouse, as given by Pallas, affords a striking instance of this: their migrations take place in uncertain years, but chiefly in the spring, at which season they assemble in surprising numbers: this mighty host proceeds in a direct course westward, occasionally swimming with the utmost intrepidity over rivers, lakes, and even arms of the sea. During these perilous adventures, some are drowned, or fall a prey to fish or other enemies; those which escape, rest awhile to bask, dry their fur, and refresh themselves, and then again set out on their migration. On these occasions the flocks are so numerous, that an observer has waited two hours to see them all pass.

(266.) The migratory habits of the lemming, observes major Smith, almost exceed credibility, were they not authenticated on very respectable authority. The natural or general residence of this animal is in the mountains of Lapland and Norway,—from which tracts, at particular but uncertain periods, it descends

* North. Zool. vol. i. p. 245.

† Id. *ibid.* p. 250.

into the plains below, in immense troops; and, by its incredible numbers, becomes a temporary scourge to the country,—devouring the grain and herbage, and committing devastations equal to those caused by an army of locusts. These migrations seldom happen oftener than once in ten years; and, in some districts, still less frequently. They are supposed to originate from an unusual multiplication of the animals, and a consequent defect of food; and, perhaps, an instinctive prescience of unfavourable seasons: for it has been observed that their chief migrations are made in the autumn of such years as are followed by a very severe winter. On these occasions they collect themselves into an army, and descend from the mountains into the neighbouring plains in a firm phalanx, moving on in a straight line, resolutely surmounting every obstacle: their efforts, undismayed by every danger, cannot be contemplated without astonishment. All who have written on the subject agree that they proceed in a direct course; so that the ground along which they have passed appears, at a distance, as if it had been ploughed,—the grass being devoured to the very roots in numerous stripes or parallel paths, of one or two spans broad, and at the distance of some ells from each other. This army of mice move chiefly by night, or early in the morning, devouring the herbage in such a manner that the surface appears as if burnt. No obstacles alter their route,—neither fires, nor deep ravines, nor torrents, nor marshes, nor lakes; they proceed obstinately in a straight line,—and hence it happens that many thousands perish in the waters, and are found dead on the shores. If a rick of hay or corn occurs in their passage, they eat through it; but if rocks intervene, which they cannot pass, they go round, and then resume their former straight direction. If disturbed or pursued while swimming over a lake, and their phalanx separated by oars or poles, they will not recede, but keep swimming directly on, and soon get into order again: they have even sometimes been

known to endeavour to board or pass over a vessel. On their passage overland, if attacked by men, they will raise themselves up, utter a kind of barking sound, and fly at the legs of their invaders; and will fasten so fiercely at the end of a stick, as to suffer themselves to be swung about before they will quit their hold, and are with great difficulty put to flight. It is said that an intestine war sometimes takes place in these armies, during their migration, and that the animals thus destroy each other.

(267.) In the class of BIRDS, migration is much more general, and has, consequently, attracted greater attention from zoological writers. It is not our intention to go into all the details of this subject,—our purpose being chiefly confined to one of its numerous ramifications. Whatever may be the combination of causes which instinctively lead birds, no less than other animals, to perform long and dangerous journeys, certain it is that the desire and necessity of procuring a supply of suitable food, either for themselves or for their expected progeny, is the chief impelling motive. The annual arrival of our summer insectivorous birds, no less than of the aquatic species in winter, places this beyond doubt. The comparatively short migrations of the frugivorous families peculiar to Tropical America are guided by the same principle: they are seen in particular districts or provinces at regular and stated periods,—arriving when certain fruits are ripe, and departing so soon as the season of their food is over. The most remarkable migrations, both as to the numbers congregated together, and to the extent of space they go through, are performed by birds belonging to the natatorial and the grallatorial types of form. Hence we find that among perching birds, the fissirostral tribe, which represents the first of these types, contains the whole family of swallows (*Hirundinidæ*). These, also, are represented by the ducks, the bee-eaters, the flycatchers, and the passenger pigeons (*Ectopistes* Sw.). Next to these are the grallatorial types, comprising the

waders generally: these, however, are more properly wanderers, since their visits are always transient, even in countries where an equal temperature and a sufficiency of food exist at all seasons. Migratory species, however, occur in every order of the feathered creation; but it is highly probable that by far the greater number of these, when better known, will be found representatives of either natatorial or grallatorial types. The migrations of the swallow family are too well known to require repetition in this place, but those of the passenger pigeons of North America (*Ectopistes migratoria* Sw., fig. 71.) are certainly without parallel in this



class of animals: we shall, therefore, relate their extraordinary history in the words of an eye-witness.

(268.) "The passenger pigeon," observes Wilson, "merits a distinguished place in our annals of the feathered tribes. The most remarkable characteristic of these birds is their associating together, both in their migrations, and also during the period of incubation, in such prodigious numbers as almost to surpass belief. These migrations appear to be undertaken rather in quest of food, than merely to avoid cold,—since we find them lingering in the northern regions, around Hudson's Bay, so late as December; and since their appearance is so casual and irregular, sometimes not visiting certain districts, for several years, in any considerable numbers, while at other times they are innumerable. I have witnessed these migrations in the Genessee country, often in Pennsylvania, and also in various parts of Virginia, with amazement; but all that I had then seen of

them were mere straggling parties, when compared with the congregated millions which I have since beheld in our western forests, in the states of Ohio, Kentucky, and Indiana. These fertile and extensive regions abound with the nutritious beech nut, which constitutes the chief food of the wild pigeon. In seasons when these nuts are abundant, corresponding multitudes of pigeons may be confidently expected. It sometimes happens that, having consumed the whole produce of the beech trees in an extensive district, they discover another, at the distance, perhaps, of sixty or eighty miles, to which they regularly repair every morning, and return as regularly in the course of the day, or in the evening, to their place of general rendezvous, or, as it is usually called, the roosting place. These roosting places are always in the woods, and sometimes occupy a large extent of forest. When they have frequented one of these places for some time, the appearance it exhibits is surprising. The ground is covered to the depth of several inches with their dung; all the tender grass and underwood destroyed; the surface strewn with large limbs of trees, broken down by the weight of the birds clustering one above another; and the trees, themselves, for thousands of acres, killed as completely as if girdled with an axe. The marks of this desolation remain for many years on the spot; and numerous places could be pointed out, where, for several years after, scarcely a single vegetable made its appearance." But we must pass over a large portion of this wonderful narrative, and confine our remaining extracts to the migrations of these countless myriads witnessed, and thus described, by the great American ornithologist. "I had left the public road, to visit the remains of one of these breeding places near Shelbyville — when, about one o'clock, the pigeons began to return in such immense numbers as I never before had witnessed. Coming to an opening by the side of a creek called the Benson, where I had a most uninterrupted view, I was astonished at their appearance.

They were flying with great steadiness and rapidity, at a height beyond gun-shot, in several strata deep, and so close together, that, could shot have reached them, one discharge could not have failed of bringing down several individuals. From right to left, far as the eye could reach, the breadth of this vast procession extended, seeming everywhere equally crowded. Curious to determine how long this appearance would continue, I took out my watch to note the time, and sat down to observe them. It was then half past one. I sat for more than hour,—but, instead of a diminution of this prodigious procession,*it seemed rather to increase both in numbers and rapidity; and, anxious to reach Frankfort before night, I rose and went on. About four o'clock in the afternoon, I crossed the Kentucky river,—at which time the living torrent above my head seemed as numerous and as extensive as ever. Long after this I observed them in large bodies that continued to pass for six or eight minutes,—and these, again, were followed by other detached bodies, all moving in the same south-east direction, till after six in the evening. The great breadth of front which this mighty multitude preserved, would seem to intimate a corresponding breadth of their breeding place, which was known to extend to several miles. I crossed this breeding place soon after, where the nests, for more than three miles, spotted every tree. A few observations upon their mode of flight must not be omitted. The appearance of large detached bodies of them in the air, and the various evolutions they display, are strikingly picturesque and interesting. A column eight or ten miles in length would appear from Kentucky, high in air, steering across to Indiana. The leaders of this great body would sometimes gradually vary their course, until it formed a large band of more than a mile in diameter,—those behind tracing the exact route of their predecessors. This would continue, sometimes, long after both extremities were beyond the reach of sight,—so that the whole, with its glittering undulations, marked a space

on the face of the heavens resembling the winding of a vast and magnificent river. When this bend became very great, the birds — as if sensible of the unnecessary circuitous course they were taking — suddenly changed their direction, — so that what was in column before, became an immense front, straightening all its indentures, until it swept the heavens in one vast and infinitely-extended line. Other lesser bodies also united with each other, as they happened to approach, with such ease and elegance of evolution, — forming new figures, and varying these as they united or separated, — that I was never tired of contemplating them. Sometimes a hawk would make a sweep on a particular part of the column, from a great height, when, almost as quick as lightning, that part shot downwards out of the common track, but soon rising again, continued advancing to the same height as before. This inflection was continued by those behind, who, on arriving at this point, dived down, almost perpendicularly, to a great depth, and rising, followed the exact path of those who went before. As these vast bodies passed over the river near me, the surface of the water, which was before as smooth as glass, appeared marked with innumerable dimples, occasioned by the dropping of their dung, resembling the commencement of a shower of large drops of rain or hail."

(269.) In regard to the numerical amount of pigeons thus assembled, our author proceeds to make the following remarks: — "To form a rough estimate of the daily consumption of one of these immense flocks, let us first attempt to calculate the numbers of that already mentioned, as seen in passing between Frankfort and Indiana. If we suppose this column to have been one mile in breadth, — and I believe it to have been much more, — and that it moved at the rate of one mile in a minute, four hours — the time it continued passing — would make its whole length 240 miles. Again, supposing that each square yard of this moving body comprehended three pigeons, the square yards in the whole

space, multiplied by three, would give 2,230,272,000 pigeons! — an almost inconceivable multitude; and yet, probably, far below the actual amount. Computing each of these to consume half a pint of mast daily, the whole quantity, at this rate, would equal 17,424,000 bushels per day! Heaven has wisely and graciously given to these birds rapidity of flight, and a disposition to range over vast uncultivated tracts of the earth, — otherwise they must have perished in the districts where they resided, or devoured up the whole productions of agriculture, as well as those of the forests.”* M. Audubon’s account speaks of equally prodigious numbers. “In the autumn of 1813,” observes this traveller, “I left my house at Henderson, on the banks of the Ohio, on my way to Louisville. In passing over the barrens, a few miles from Hardensburgh, I observed the pigeons flying from north-east to south-west, in greater numbers than I thought I had ever seen them before. I travelled on, and still met more the further I proceeded: the air was literally filled with pigeons; the light of the noon-day was obscured, as by an eclipse; the dung fell in spots not unlike melting flakes of snow; and the continued buzz of wings had a tendency to lull my senses to repose. Before sunset I reached Louisville, — distance from Hardensburgh fifty-five miles. The pigeons were still passing in undiminished numbers, and continued to do so for three days in succession. The people were all in arms. The banks of the Ohio were crowded with men and boys, incessantly shooting at the pigeons, which there flew lower as they passed the river, — and multitudes were thus destroyed. For a week, or more, the population fed on no other flesh but that of pigeons.” Our author then proceeds to give the following calculation: — “Let us take a column of one mile in breadth, — which is far below the average size, and suppose it passing over us at the rate of one mile per minute. This will give us a parallelogram of 180 miles by 1, covering 180 square miles; and

* Wilson.

allowing two pigeons to the square yard, we have 1,115,136,000 pigeons in one flock; and as every pigeon consumes fully half a pint per day, the quantity required to fill such a flock must be 8,712,000 bushels per day.* It is time, however, to return once more to the general subject.

(270.) Birds in general migrate in very different ways, both as to the direction of their course, the season it is performed in, the number assembled, and the circumstances which accompany their journeys. There is even a variation in the habits of the same species, when spread over widely separated countries; and numerous others, which are undoubtedly migratory, perform their journey either solitary or in pairs. There is, also, every possible variation both in the extent and in the duration of these migrations. To illustrate all these circumstances would far exceed our limits; but it may be stated, in general, that in every case these movements are made either for the object of procuring a sufficient supply of suitable food, for the purposes of incubation, or to avoid the extremes of heat or cold. The spring and autumn are the usual seasons; but there is some variation in the birds of tropical latitudes. The majority of the European land birds which emigrate, come from Northern Africa (or, more properly, from Asia Minor) in the spring, apparently to avoid the excessive heat of those parched and sandy countries during summer; but when the season of incubation is over, and the European winter commences, they return again to the Asiatic and African countries, which are then beginning to assume all the verdure and the mildness of our summer: this is proved by the fact of immense numbers annually visiting the shores of the Mediterranean, on their way to Central Europe; and they are again seen, upon their return, in September and October. These migrations we know, from personal observations, to be as regular as those of the arrival and departure of the swallows of England; and

* Aud. Anim. Biog.

all, with the exception of the quails, are of insectivorous families. The northern land birds, on the contrary, which migrate southward during summer, are chiefly granivorous, and are never seen in Sicily,—the situation of which island we found peculiarly favourable for making observations on this subject. Of all the Euro-



pean birds, the quail (fig. 72.) is the most remarkable, on account of the vast numbers which congregate on these occasions. For a few weeks in the month of April, when they first begin to arrive in Sicily, every-

body is a sportsman. These birds always fly against the wind, and perform their journey during the night; at least they always arrive at that season on the shores of Sicily and Greece; and although not a quail could be seen the evening before, the next morning the reports of guns in all directions attest their number, and the havoc that has begun upon them. The same winds which are favourable to the quails, are equally so to the bee-eaters (*Merops Apiaster*), the hoopoes (*Upupa Epops*), the rollers (*Coracias garrula* Lin.), and the orioles (*Oriolus galbula*); but whether these are also nocturnal in their migrations may reasonably be doubted; they are all, however, emigrants from the South. The European chatterer (*Ampelis garrulus*), the fieldfare (*Turdus pilaris* Lin.), the redwing (*T. iliacus* Lin.), and nearly all our small seed-eating birds (*Fringillidæ*), migrate from north to south, to avoid the excessive cold of the arctic regions. There is nothing, therefore, extraordinary in the linnet being stationary with us, and migratory in Greenland,—since it can bear the winter climate of one, but not of the other, country. Such are the chief and best known facts regarding the European birds; and we find those of North America subject to the same laws: the summer tribes which visit the United States

in such number and variety, return to the shores of Mexico and the West Indies, as to their winter home; for it is a fact not generally known, that hardly one species in a hundred proceeds so far south as to cross the equinoctial line. This latitude, indeed, seems to be an invisible but effectual barrier to all the insessorial birds of the New World; for out of all those that have been observed on the main land of North America, not five are to be found in Brazil. The grallatorial and the aquatic birds of the two countries are, of course, much more alike; but these, as we before observed, are wanderers, and more widely dispersed than any others. As many migratory birds, like the quail, have rounded, and, consequently, feeble wings, incapable of continued exertion, we find that their journeys are performed by short stages; while others, like the swallows, and their prototypes the bee-eaters, rest only at the termination of their journey.

(271.) Among the best known of our migrating birds is the swallow. Its disappearance formerly gave rise to so much discordancy of opinion, that, in the time of Linnæus, the prevalent belief was, that all the species of these birds retired, on the approach of winter, to the bottom of ponds; and there were even numerous attestations to this effect. Even Linnæus himself imbibed the popular credulity on this subject; and such was his authority, that it was a long time before naturalists would relinquish the preposterous idea. It is now clearly ascertained, however, that these birds regularly migrate; those few which are found dead, or half dormant, during the winter, being either too feeble, or hatched too late, to follow their parents. Nor, as Montague justly observes, can there be any reason why we should doubt their capability of performing these regular migrations, when we allow it without hesitation to other and much more delicate birds. In fact, the swallow, from its velocity alone, is peculiarly calculated for such flights; and when we consider "that it can and does suspend itself in the air for fourteen or sixteen hours together in search of food, it cannot fly over

a less space than between 200 and 300 miles in that time." * That its speed must be thus great, is proved by the circumstance of swallows having been seen on the coast of Senegal on the 9th of October, which is eight or nine days after their departure from Europe.†

(272.) The periods at which birds arrive and depart are variable even in the same species, and appear to be principally regulated by the forward or backward state of the season. The following statement, drawn out by Mr. Markwick‡, will exhibit the average dates of both, in several species of British birds, deduced from a computation of about twenty-six years.

		First seen.	Last seen.
Swallow,	<i>Hirundo rustica</i> ,	Apr. 18.	Oct. 31.
Martin,	— <i>urbica</i> ,	Mar. 4.	Oct. 16.
Sand martin,	— <i>reparia</i> ,	Mar. 26.	Sept. 12.
Swift,	— <i>apus</i> ,	May 9.	Sept. 3.
Goatsucker,	<i>Caprimulgus Europæus</i> ,	—	Sept. 27.
Turtle dove,	<i>Columba Turtur</i> ,	June 5.	Aug. 10.
Wryneck,	<i>Yunx torquilla</i> ,	Mar. 26.	Sept. 10.
Cuckoo,	<i>Cuculus canoris</i> ,	May 1.	Aug. 10.
Nightingale,	<i>Philomela lusciniæ</i> Sw.,	Apr. 25.	Sept. 20.
Blackcap,	— <i>atricapella</i> ,	May 10.	Sept. 18.
Whitethroat,	— <i>sylvia</i> ,	Apr. 22.	Sept. 16.
Wheatear,	<i>Saxicola ænanthe</i> ,	May 4.	Sept. 26.
Whinchat,	— <i>rubetra</i> ,	June 1.	Sept. 21.
Redstart,	— <i>phænicurus</i> ,	Apr. 24.	Sept. 1.
Willow wren,	<i>Motacilla trochilus</i> ,	Apr. 23.	Sept. 24.
Flycatcher,	<i>Muscicapa grisola</i> ,	May 8.	Sept. 30.
Red-backed shrike,	<i>Lanius colluri</i> ,	June 1.	Aug. 16.
Land rail,	<i>Rallus crex</i> ,	—	Oct. 20.
Quail,	<i>Tetrao coturnix</i> ,	Aug. 20.	—
Fieldfare,	<i>Turdus pilaris</i> ,	Nov. 21.	Apr. 10.
Redwing,	— <i>iliacus</i> ,	Nov. 10.	Mar. 18.
Woodcock,	<i>Sc. leopax rusticola</i> ,	Nov. 20.	Mar. 20.
Snipe,	<i>Scolopax rusticola</i> ,	Oct. 20.	Apr. 1.
Sea lark,	<i>Charadrius hiaticula</i> ,	Apr. 1.	—
Greater tern,	<i>Sterna hirundo</i> ,	Apr. 1.	Oct. 8.
Lesser tern,	— <i>minuta</i> ,	May 20.	Oct. 16.
Royston crow,	<i>Corvus cornix</i> ,	May 22.	Mar. 26.

* Mont. Orn. Dict. p. 2.

† This instance is always brought forward in proof that the swallow of Europe winters in Senegal; but it does not appear that the identity of the species has been fully ascertained.

‡ Linn. Trans.

(273.) Nearly all migrating birds assemble in flocks for some time previous to their departure ; and this is particularly observable, not only in swallows, but still more in woodcocks, terns, puffins, and shearwaters. Some, however, as the cuckoo, &c., neither congregate before nor at the time of their journey ; while others seem to undertake it with a very few companions.

(274.) Among the aquatic families of the northern hemisphere, those which are birds of passage either rear their young in the fens, and afterwards pursue a northward flight, or they quit the northern regions on the approach of winter, and proceed southwards, — returning to their former stations in the spring. The latter are by far the most numerous ; and when the well-known signs of nature prognosticate the coming change, immense flocks forsake the solitudes of the arctic regions, and wing their way to the more temperate latitudes. Geese and cranes, with several other birds, meet together before their departure, and then divide themselves into two files, which are united at a point “like a V reversed, a leader being at their head. The bird which forms the point, cuts the air, and makes



way for those which follow ; and these are supposed to lay their bills on the tails of those which go before. The leading bird only undertakes this arduous duty for a time ; he then goes in the rear, and is succeeded by another.” Storks (*fig. 73.*) assemble in great numbers at these times ; and might be imagined, by a spectator, to be busily engaged in debating upon their further

proceedings. Although exceedingly silent at all other times, on these occasions they make an unceasing chattering with their bills, and appear to be all bustle and

anxiety: when, however, the time of their departure arrives, they become again quiet, and move off, generally in the night, in a large body.

(275.) Among land birds, some perform partial migrations, — moving their quarters from one part of the same country to another, as their necessities may prompt. Among these, the fieldfare is best known: Dr. Jenner observes, “The occasional departure of these birds, and some other of our winter inhabitants, during a long-continued frost, must be very obvious. The greater number disappear soon after its commencement, if it sets in very severely: some few are always left behind, and are soon starved, if not fortunately relieved by a thaw. Those that are driven to this necessitous migration, probably, pursue a tract that quickly leads them out of the reach of frost, — or, at least, to places which furnish them with food. The migration of the soft-billed, or small insectivorous birds, is certainly astonishing; and how their frame is enabled to sustain those convulsions of the elements which they must sometimes encounter, is altogether inexplicable. Pennant remarks, that the golden-crested wren, diminutive as it is, in its migrations to the Shetland Isles, in summer, accomplishes a flight of fifty miles, — which, he observes, must be entirely without interruption, unless it should stop midway on Fair Island to rest.”

(276.) A very large proportion of the marine FISHES are more or less migratory, — traversing the ocean at particular seasons of the year, sometimes in immense bodies, and gliding through the “vasty deep” with astonishing velocity. It was long supposed that the herring was of this number; that it habitually lived in the arctic seas, and came to our coasts in immense armies. From a few partial facts favouring this supposition, Pennant framed such a lively and interesting narrative, that the migrations of the herring form a prominent subject in nearly all our popular publications. It is now, however, well ascertained, that this

* Arctic Zool. vol. i. p. 29.

fish lives in the same latitudes all the year ; and that the cause of these immense shoals is simply that the fish, during particular seasons, come near the coast, where they then appear in vast multitudes.

(277.) The tunny (*fig. 74.*), in like manner, enters the Mediterranean about the vernal equinox, for the purpose of spawning ; it swims in large companies, arranged, as it has been said, in a triangular phalanx, like the geese and other birds, — the point of which acts



like a rudder to cut through the opposing waters, while a broad base is presented to those tides and currents which must occasionally be encountered. On their return, they approach the coasts of Africa, and the young fish are placed in the van of the squadron.

(278.) The migrations of many tribes in the Insect world unfold to the observer of nature a fresh subject of contemplation. These associations are chiefly occasioned from two different motives ; — they are either for the purposes of procuring food, or for establishing a new colony when the parent society has increased beyond its due limits. The former of these migrations is much more remarkable than the latter, and is exemplified, in the most striking and terrible manner, by the family of locusts, whose assembled myriads darken the sun, and desolate kingdoms. Interesting as is the history of these formidable creatures, we must at present confine our attention to those circumstances only which regard their association and migration. This numerous family, of which the common grasshopper is a small but excellent example, is spread over all tem-

perate and tropical regions ; but it is in the Old World, alone, that those particular species are found, of which we are now to speak. How these insects are multiplied to such an excess in some particular years, and not in others, has never yet been ascertained, and, perhaps, never will be. The appearance of the locusts which caused such terrible devastation in Central Europe, in the year 1747, is thus described : — “ One of these columns, which entered Transylvania in August, was several hundred fathoms in width, and extended to so great a length as to be four hours in passing over the Red Tower ; and such was its density, that it totally intercepted the solar light,—so that when they flew low, one person could not see another at the distance of twenty paces. The breadth of this column, at Vienna, was calculated at three miles.” This, however, was but a small detachment, or a straggling party, when compared to that witnessed by major Moore in India. He relates that, when at Poonah, he was witness to an immense army of locusts which ravaged the Mahratta country. He was assured that this column extended 500 miles, and so compact was it when on the wing, that, like an eclipse, it completely hid the sun. Dr. Clarke compares a flight which he witnessed to a shower of snow, when the flakes are carried obliquely by the wind. Mr. Barrow speaks of another, seen in the southern parts of Africa in 1797 : an area of nearly 2000 square miles might be said literally to be covered by them : when driven into the sea by a north-west wind, they formed upon the shore, for fifty miles, a bank three or four feet high ; and when the wind was south-east, the stench was so powerful as to be smelt at the distance of 150 miles.* Migrations of locusts, and, indeed, of nearly all other insects, never occur, like those of quadrupeds and birds, at stated times and seasons ; on the contrary, they seem to depend on various concurrent causes, which are far beyond our reach of knowledge. To this, however, there is one exception,

* Trav. p. 257.

which we shall notice more particularly as having fallen under our personal observation.

(279.) The occasional migration of *butterflies* has been noticed by several authors ; and the appearance of great numbers of a particular species — which in ordinary years is of rare occurrence — has not unfrequently happened, even in this country. The Camberwell Beauty (*Vanessa Antiopa* Lin., fig. 75.) is well known to be one of our rarest butterflies ; but Lewin records,



that, in March, 1790, a great number were seen flying and soaring about for the space of twelve or fourteen days ; and then, as if with one consent, they migrated from us, and were no more seen.* The thistle butterfly, or Painted Lady (*Vanessa Cardui*), appears also in great numbers, at uncertain intervals, and is, no doubt, a migratory species. But, in particular parts of Tropical America, the migration of butterflies is annual and constant,—although, from having been little understood, the circumstance has been mentioned as if it was an accidental occurrence. These migrations are conducted, however, in a very different manner from those of the locusts. The individuals do not fly in compact bodies, but are, in general, scattered in small parties of twos and threes,—at least, we never witnessed them in such large parties as the natives assured us they were, in some years, to be seen. The direction taken by the

* Lewin's Brit. Ins. p. 6.

greatest number is, from the dry arid districts of the interior, towards the verdant forests of the sea coast; and the season is that of the greatest heat in Brazil, when the drought in the interior is excessive, the vegetation burnt up, and the rivulets dry. That most lovely of all butterflies, *Lelius Braziliensis* Sw. *, migrates in a peculiar manner, — proceeding in May and June — according to our observations — from north to south; but we had no opportunity of ascertaining whether it returned by the same route: its range, however, is comparatively limited, — since it is neither found so far north as Surinam, nor does it reach the southern province of Rio de Janeiro. The Surinam species (*Lelius Surinamensis* Sw. †) probably migrates northward; but we have no very certain information on this point. Lindley, the author of a little work on Brazil, informs us, elsewhere, that he witnessed in that country, in the beginning of March, 1803, an immense flight of white and yellow butterflies, — (which was, in all probability, a species of *Colius*), — which continued to pass for many days successively: they proceeded in a direction from north-west to south-east; and this course being to the ocean, at only a small distance, it is inferred “they must consequently perish.” This conclusion, however, is certainly erroneous: the richly-wooded and luxuriant parts of Brazil always border the coast: we could mention many facts tending to favour the opinion that all these butterfly migrations are made towards these verdant tracts, for the purposes of breeding, or rather of depositing their eggs; not — as Messrs. Kirby and Spence appear to believe — as a prelude to their inevitable destruction in the ocean.

(280.) Insects of several other tribes are known to make occasional migrations, and in immense numbers. Major Moore witnessed, in Bombay, an army of bugs (*Cimices*), which were going westward; and they were so numerous that they covered everything in the room where he was sitting. An army of dragon flies (*Agrion* Fab.)

* Zool. Illust. vol. ii. p. 126.

† Id. ibid. p. 125.

has been known to cast a slight shade over a field of four acres, as they passed; and a host of the common froth cicada (*C. spumaria*), which flew in the night, was at first mistaken by professor Walch for a shower of hail pelting against his study window: this continued for at least half an hour. The same writer witnessed, in August, a similar emigration of myriads of a predacious beetle (*Carabus vulgaris* Lin.). The *Aphides*, or plant lice, are another migratory family. White of Selborne mentions a flock which passed his village on the 1st of August, 1785, so numerous as to cover such persons as were in the open air at the time, and blackening all the surrounding vegetation. The ladybird beetle (*Coccinella septempunctata* Lin.) is the deadly enemy of the plant lice, — which they appear to follow, on these occasions, in immense armies. These, and many other instances of insect migration, have been given more in detail by Messrs. Kirby and Spence, to whose entertaining pages we may refer the curious reader. The land crabs of the West Indies afford a remarkable instance of migration among apterous insects. They are generally found, in great numbers, in holes and cavities among the mountains; but every spring they descend, in immense bodies, to the sea coast — pursuing so direct a line to the place of their destination, that scarcely anything will divert their course; even the most formidable obstacles are overcome by their perseverance. They march, according to a popular writer, generally in three divisions, with the utmost regularity, and under the guidance of one chosen commander; — the first being composed of the strongest males; the second consisting of females, which are sometimes formed into columns fifty or sixty yards broad, and three miles deep*; and the third being made up of a mixed, undisciplined, and less vigorous tribe, which follow a few days afterwards. When they have effected the purpose

* Upon what authority the ingenious compiler of the *Animal Biography* gives this statement, we know not. We suspect it may be a little embellished; but not having been in the West Indies, we cannot say anything of these land crabs from personal observation.

for which they undertook their journey, they slowly return, weak and exhausted; and not long after, millions of the little crabs, which have been hatched on the shore, may be seen making their way up to the mountains.*

CHAP. IX.

ON IMPERFECT SOCIETIES OF ANIMALS.

(281.) THE social principle—so vitally essential to the welfare and happiness of man, and, for that reason, more developed in him than in any created being—assumes, in the animal world, a variety of modifications. With some, it is only sufficient to prompt the species to search out its mate, and to provide for their infant progeny: these, in truth, may be called solitary and unsocial animals, solely brought together by the impulse of a short-lived passion, without which they would not themselves have existed; others form temporary associations among themselves only in cases of extreme necessity,—as the wolves of the Alps, when sorely pressed by hunger, unite into packs, and descend on the villages of the plains. Many unite when about to visit distant regions. The sexes of other tribes will separate for a season, although at other times they live in company; while a few seem impelled to associate occasionally, for the sole purpose of enjoyment,—as the inhabitants of a village meet to dance upon the green, after each has performed the labours of the day. To all such associations we apply the term of *imperfect societies*: those, on the contrary, whose communities are *perfect*, not only spend their lives together, but unite their labours in the production of a dwelling common to all

* Anim. Biog. vol. iii. p. 379.

the fraternity. It is among these social communities that the most astonishing intelligence—or, more properly, instinct—is developed. Some few instances occur in the vertebrated animals; but by far the largest and the most gifted portion are to be found in the insect world. Solitary and gregarious creatures are also met with in the molluscous or aberrant circle of animals; but their senses are so imperfect, and their actions so confined, that, beyond the phenomena resulting from their great vitality, little interest, comparatively, attaches to their history.

(282.) In treating of imperfect societies of animals, we shall arrange our observations under the following heads:—1. Associations formed only during the season of breeding, by animals which, at other times, live solitary. 2. Associations for the purpose of hunting for food. 3. Associations for performing migratory journeys. 4. Associations of one of the sexes only, during the breeding season. 5. Associations apparently for mutual enjoyment and recreation. 6. Permanent associations, apparently induced by the love of society. From these latter, we exclude such animals as unite in constructing a common habitation; and we shall, under each head, distinguish the two great divisions of vertebrated and annulose animals. Those intermediate shades of difference, by which the whole scheme of nature is knit and interwoven together, is as apparent in the habits of animals, as in the characters by which they are distinguished as genera, or as species; and we shall, consequently, find many which unite in themselves two, or even three, of the above properties so completely, as to render it difficult to decide under which section they should be arranged. Progression, in its most perfect sense, is one of the great characteristics of nature; and although we may comprehend, theoretically, the leading series of her chain, we are frequently baffled in discovering that precise point where one link fits into that which succeeds it.

(283.) 1. Animals which only seek the company of

each other during the season of love, may justly be termed solitary. The impulse which brings them together is one of the irresistible laws of nature, and is totally distinct from those ordinary feelings and passions on which the permanent and habitual happiness of life depends. If, among mankind, we find the most cruel and ferocious for a season laying aside their evil propensities, when under such influences, we can feel no surprise at witnessing the same in the brute creation. But, so soon as the sensual flame has consumed itself, the habitual repugnance to community with its fellow creatures returns; and the gloomy, if not the malevolent, propensities of their nature, flow in their accustomed course. Everything by which we are surrounded, under one shape or other, is an emblem of good or of evil. We gather not "grapes from thorns, nor figs from thistles;" neither can we expect that gentleness and innocence should accompany moroseness and misanthropy. Hence we find that the most unsocial animals in existence are among those which seek the lives of others, and live upon their flesh. The lion, the tiger, and the whole family of *Felidæ* — to which these destructive quadrupeds belong — are eminently solitary and unsocial. The rapacious order — by which they are represented in the feathered creation — are equally distinguished by their repugnance to associate with their kind, save at the breeding season. When this is past, and their progeny can provide for themselves, the parents separate, lose all pleasure in mutual society, and seek again their food in solitude and silence. The gloom of night is more congenial to such habits than the bright and cheerful day; and we accordingly find that the majority of carnivorous quadrupeds, typifying the worst portion of our own species, emerge from their retreats during the shadows of evening, "making night hideous" by their deeds of violence and bloodshed. The falcon tribe, indeed, hunt during the day; but nearly the whole family of owls — not to mention the equally numerous one of goatsuckers (*Caprimulgidæ*) —

are nocturnal ; while both, without a single known exception, are solitary.

(284.) But, as all carnivorous creatures are not nocturnal, so all that are nocturnal are not necessarily carnivorous. Here, as in other things, extremes meet ; for the night seems to be as favourable for the stealthy movements of the feeble, as it is for the depredations of the violent. We pretend not to explain this ; we look merely to facts. Nearly the whole family of mice — the most timorous and the most feeble of all quadrupeds — choose the night as their season of activity ; and it is at this time, only, that the poor defenceless earth-worm ventures to rise above the surface of the ground, and draw to the entrance of its hole the fallen leaves of autumn. In Australia, as the late Mr. Lewin informs us, there is a family of moths, which are distinguished, in their caterpillar state, by precisely similar habits. It seems that the great enemies of these caterpillars are the different species of *Mantis* and *Phasma*, better known by the common name of *walking-leaf* insects. To avoid these, which are carnivorous insects, the caterpillars in question remain, during the day, concealed in their cells, where they devour the produce of the preceding night's excursion in ease and security.

(285.) Among the carnivorous quadrupeds, typically so termed, we have none which can be called social. Affection for their young, while helpless and incapable of procuring food, belongs to all animals,—and is as conspicuous in the female lion and the tiger, as in the ox or sheep ; but the male of the latter is stated, occasionally, to devour its own offspring, when not concealed by the mother. The hamsters seem to have the social principle less than almost any other quadrupeds. Pennant remarks, that they live in separate burrows ; and that, excepting during their short season of courtship, they have no intercourse with one another ; — nay, that they will even fight, kill, and devour their own species, as well as other lesser animals. The growth of the young is very quick ; and, at the age of

three weeks, the old ones force them out of their burrows, to take care of themselves. Even the mother shows little affection for them; and, instead of protecting her offspring in the season of danger, seeks her own safety by burrowing deeper. As another instance of animals which are peculiarly solitary, and, at the same time, timid and defenceless, we have only to look to the sloths, — those extraordinary animals, which Nature has designed to live only among trees, from the branches of which they are constantly suspended. But, on looking to the whole class of quadrupeds generally, we shall find the largest proportion of solitary animals among the carnivorous order; and hence the same peculiarity may be traced throughout the whole circle of vertebrated animals, — this order being the second, or subtypical type. It is on this principle that the shrikes (*Laniadæ* Sw.), as a whole, are much more solitary than the thrushes (*Merulidæ*); the woodpeckers more so than the parrots; and the herons (*Ardeidæ*) more than the sandpipers (*Tringidæ*). Among annulose animals the same principle pervades. The *Aptera*, or wingless orders, give us no instances of even imperfect associations of the species; while, in the *Ptilota*, or winged division, we have numerous examples of all the modifications of the social principle.

(286.) 2. Associations for the purpose of hunting, show us the next step in the development of the social instinct. These transient meetings should not be confounded with such as are common to the ruminating quadrupeds, as well as to others, where the association continues after the wants of nature are satisfied, — and where a higher principle, beyond the mere gratification of hunger or revenge, seems to be a moving cause. The intercourse of which we are now speaking is chiefly confined to carnivorous animals, or their representatives; it is generally occasioned by the pressing calls of hunger, and by an instinct which leads individuals to unite their strength for accomplishing an act of rapine or of bloodshed. While engaged in this pursuit, good fel-

lowship, it may be, continues ; but when the booty is obtained, all community is dissolved, and they either quarrel among themselves over their prize, or at once disperse. There is not, in fact, any other motive for uniting together than mere selfishness. How truly, unfortunately, does this typify the temporary union of those of the human species, who unite, in lawless bands, to pillage and destroy ; — who carry misery and bloodshed among the innocent, for the sole gratification of their insatiable appetites. The hyænas, the wild dogs, the wolves, the jackals, and the hunting leopards, are all striking and familiar instances of such associations. So long as food can be supplied by individual exertion, each appears to provide for itself ; but when this becomes scarce, or a herd of peaceful antelopes are passing on their migration, they instinctively unite into bands, and commence a simultaneous attack upon their innocent prey. These habits are so well known, that to cite individual instances would be superfluous. It may be, that the dog, in his wild state, not only hunts, but lives, in packs : but this does not diminish the force of the observation ; because, as this animal is intended by nature to typify the ruminants in its own family, we should naturally expect it would give us the strongest example of docility and tractability, under man, of any to be found among carnivorous quadrupeds.

(287.) 3. Among birds, many of the falcons, and other birds of prey, unite for the same purpose. The innumerable flocks of quails, rollers, bee-eaters, and other birds, which annually perform two migrations from and to the shores of Africa, are always followed by great numbers of the lesser sized falcons, which hang on their flanks and rear, picking up the stragglers, or such as, through weakness, cannot keep up with the main flock. We have repeatedly witnessed assemblies of this sort, at such seasons, in the island of Sicily, — where fifteen or twenty falcons may be seen together, high in the air, having all the appearance of sociability, but which disperse and become solitary so soon as the quails

have reached the point of their destination. Nor are the poor wanderers exempt from nocturnal enemies, — for even the night is almost as dangerous to them as the day ; and this, by reason of the numerous owls, which form predatory bands for the same purpose as the diurnal falcons, and arrive in Sicily precisely at the same time. The well-known associations of vultures over the dead carcase of an animal are of this description ; — they are drawn together by hunger, and hunger alone, without any of that kindly feeling towards each other, so often manifested among our domesticated animals.

(288.) Among insects, and other annulose animals, we have no very striking instance of associations for rapine ; but these, more than any other creatures, are drawn together for the mere purpose of feeding in concert. Their office, in the economy of nature, renders this association absolutely necessary. Is a mass of animal or vegetable substance hastening to decay, and therefore essential to be removed ; — it is immediately attacked by a whole party of flies, beetles, or wasps, which come suddenly together from we know not where, and unite their labours in accelerating that decomposition which Nature has ordained. This done, — the feast provided for the labourers devoured, and the evil removed, — the guests depart, and each pursues “ its trackless course in space.”

(289.) 4. Associations of the male sex, during the season of pairing, are not very frequent, and will therefore require but a short notice. Among vertebrated animals, this propensity is most remarkable in the tribe of ruminating quadrupeds. Dr. Richardson, speaking of the arctic reindeer *, observes that, in May, the females proceed towards the sea coast ; and towards the end of June, the males are in full march in the same direction : soon after their arrival on the coast, the females drop their young ; they commence their return to the south in September, and reach the vicinity of the

* *Reiniger Arctica*, North. Zool. vol. i. p. 241.

woods towards the end of October, — where they are once more joined by the males. Except in the rutting season, the bulk of the males and females live separately; the former retire deeper into the woods during winter, while herds of the pregnant does stay on the skirts of the Barren Grounds, and proceed to the coast very early in the spring. It is singular, also, that the males, in general, do not go so far north as the females. The long-tailed deer of the same work (*Cervus leucurus*) go in herds from November to April and May, when the female secretes herself to bring forth.* Even the common stag illustrates this peculiarity in our own country. Major Smith remarks that, “on the return of spring, the hinds withdraw into concealment to drop their calves, and the stags to shed their horns and regain them: the younger and the brockets (or young males) remain together, till they also part to *mew*, or cast theirs.”†

(290.) Among birds, we find that the most striking examples of these associations occur in the rasorial order, or in that division which corresponds to the ruminants. M. Audubon, in his interesting history of the wild turkeys of America, mentions that, “early in the middle of February, the females separate, and fly from the males: the sexes roost apart, but at no great distance from each other. After impregnation has taken place, the males make such an entire separation from the hens, that one might suppose they had entirely deserted their neighbourhood: this separation, however, would appear to continue but a short time, since we find our author observing, that, “when a male and female have come together, I believe the connection continues for that season.”‡ All the species of grouse, so far as our information on their habits extends, appear to separate themselves, at the same season, and much in the same manner; and the remark will, doubtless, be found, hereafter, to extend to the largest

* North. Zool. vol. i. p. 232.

† Griff. Cav. vol. iv. p. 93.

‡ Orn. Biog. vol. i. p. 4.

portion of the order. The male chaffinches (*fig. 76.*),



as is well known, fight among themselves, most obstinately, during the season of pairing. In the kingdom of Sweden, the females associate together in large flocks, distinct from the males, and spread over various parts of Europe. This takes place towards the end of September: in the following April, they

return once more to their mates, — who, all this time, have remained stationary. With us, in general, both the sexes of the chaffinch are permanent residents; but White of Selborne affirms that he has witnessed large flocks near that village about Christmas, which were composed almost entirely of females. It is singular that this species, which bears such an analogy to the gallinaceous order, is of a rasorial type.

(291.) The insects which are thought by Messrs. Kirby and Spence to exemplify these associations among annulose animals, are chiefly the flower-eating beetles (*Petalocera Thalerophaga*), vulgarly termed chafers. The common cockchafer (*fig. 77.*) and the



fernchafer (*Melolontha vulgaris* and *solstitialis* Fab.) at certain periods of the year, and hours of the day, hover over the tops of trees and hedges like swarms of bees; and the males of another species (*Hoplia ar-*

gentea Fab.) assemble by myriads, before noon, in the meadows, — when, in their infinite hosts, you will not find even one female: after noon the congregation is dissolved, and not a single individual is to be seen in the air; while those of *Melolontha vulgaris* and *solstitialis*

are on the wing only in the evening. The associations of the *Ephemera*, or day flies, do not properly come under the present head, since the sexes seem to be by no means separated in their aerial dances.

(292.) 5. There are certain animals which assemble together for mutual enjoyment, and in such a manner, that they can only be compared to human beings enjoying the pleasures of relaxation by dancing and singing. This development of the social principle is apparent both among vertebrated and annulose animals; but is, perhaps, more striking in the latter than the former. Everybody who has lived in the vicinity of a rabbit warren, must have remarked the playful and even frolicsome nature of these pretty creatures: the gregarious marmots of North America (*Arctomys*), according to Dr. Richardson*, gambol much in the same manner; but they generally have the prudence to station a sentinel of their species on an adjoining eminence, who gives notice of the approach of danger. Among birds, however, these sorts of meetings are of a more decided character. Le Vaillant gives the following amusing account of the African damask parrot (*Psittacus infuscatus* Sh.): — "Every day, at the same hour, these parrots fly to the water to bathe themselves, — in which operation they take great delight: all the flocks of the whole canton assemble towards evening, with much noise and animation, — and this is the signal for their visit to the water, which is often at a great distance, since no other than the purest water will please them. They are then seen huddling or rolling over each other, pell-mell, on the banks of the water, frolicking together, dipping their heads and wings into the water, in such a manner, as to scatter it over all their plumage, and exhibiting a most entertaining spectacle to the observer. This ceremony being over, they revisit the trees on which they previously assembled, where they sit in order to adjust and preen their feathers; and this being finished, they fly off in

* North. Zool. vol. i.

pairs, each pair seeking its particular retreat in the woods, where they wait till morning." Of all perching birds, the family of parrots are the most social; and this is one of the innumerable analogies by which they represent the domestic *Rasores* and the ruminating quadrupeds.

(293.) But this disposition to unite in parties of pleasure is much more conspicuous in the insect world. Every one must have remarked the little black shining beetles so frequently seen on the surface of ponds and clear ditches, particularly on a warm spring day, wheeling round and round, in and out of a circle in every possible variety of figure, yet never impeding each other, however crowded their numbers: these are of the genus *Gyrinus* Lin., and are usually called whirlbeetles or whirlwigs: they seem to have no other object in this animated dance upon the waters, than mere pastime,—for they are never seen, on such occasions, to pursue other insects for their prey, although they are known to be carnivorous. But of all assemblies of joyous insects, none are more beautiful or more animated than the innumerable tribes of gnats which assemble on the evening of a bright sunny day, even when the earth is covered with snow. While we contemplate their intricate and rapid evolutions,—rising and falling, each threading the compact maze made by its companions,—we cannot but feel a portion of this animal pleasure reflected upon our own minds. "To see these little airy beings apparently so full of joy and life, and feeling the entire force of the social principle even in that dreary season when the whole animal world appears to suffer, and the rest of the insect world is torpid, always conveys to my mind the most agreeable sensation." * The different *Ephemera*, or day flies, unite themselves in a similar way into assemblies of innumerable individuals,—often so abundant as to resemble little moving clouds alternately rising and falling in the air. Kirby and Spence describe a spectacle of this kind, witnessed

* Int. to Ent. vol. ii. p. 4.

by them on the 1st of September, 1811, and another on the 9th of the same month. These celestial dances were indescribably beautiful: they scarcely resembled, as our authors observe, anything material; "they reminded us of angels and glorified spirits drinking life and joy in the effulgence of the Divine favour."*

Another family of little black flies, forming the Linnean genus *Empis*, in May and June (their season of love), may be seen wheeling in airy circles over ponds and stagnant waters, or even near hedges, with a rush resembling that of a hasty shower driven by the wind.†

(294.) We now come to those *permanent* societies, where the individuals of a species live together continually; and whose dwellings, if not common to all the community, are, at least, so contiguous as to resemble a little hamlet or village. We exclude from this section all those which, by joining in the construction of a common habitation,—like the beaver, the ant, and the bee,—form among themselves *perfect* societies. On looking to QUADRUPEDS, we find the greatest number of these societies are composed of the gnawing or rodent order (*Glires* Lin.); they are the smallest and weakest of their class; and, by living in communities underground, seem to have that instinctive feeling, common to the timorous among us, that there is some degree of additional safety in numbers. We have, in our own country, a familiar example of these associations in the common meadow or short-tailed mouse (*Mus arvalis*),—more abundant, indeed, in France than with us, since, there, they have been known almost to destroy the crops over a square of near forty leagues. The burrows of these animals, we are told, which serve both as retreats and depositories for their stores, are neither spacious nor deep,—but are divided into two or three apartments. The galleries, occupied by several families or small colonies, are not contiguous; there is always a space between them. If the inhabitants of one burrow abandon it, or perish, others are not found to occupy the same,

* Int. to Ent. vol. ii. p. 6.

† Id. ibid. p. 7.

but each colony prefers providing a domicile for itself. These retreats are not, in general, more than from six inches to a foot from the surface; but the pregnant females will sometimes deepen the excavation to upwards of two feet by a very small alley or aperture, — which, after making several sinuosities, terminates in a little chamber as big as a fist, furnished with a soft bed of vegetables for the accommodation of the young. The economic mouse, from the interesting history of its manners given by Pallas, seems to have the social instinct still more developed, — since they seem to have one common chamber for assembling in, near which are others appropriated to receive the stores supplied by their industry for winter food. We have already spoken of the extraordinary migrations of this little creature, which appears habitually to live in very large societies. It has been said that the common domestic mouse is not a social animal, because “each lives insulated.” The fact, however, is notoriously otherwise: suffer them but to increase, and they will, as every body knows, form little colonies, — not, indeed, inhabiting the same common dwelling, but with their burrows close to each other, like houses in a street, and approached by one or more roads common to all the members of the community. The bobac marmot has, nevertheless, more sociability than our little domestic pest: this species seems to live in societies of from twenty to forty. By consulting the valuable pages of Dr. Richardson’s first volume*, it will be seen that the greatest number of the American marmots, and similarly shaped quadrupeds, are particularly and permanently social; even the American field mouse (*Mus leucopus*), while laying up its hoards of provisions, seems to act in concert; “for the quantity laid up in a single night is so great as nearly to equal the bulk of a mouse, and renders it probable that several individuals unite their efforts to form it.” The burrows of the *Arctomys pruinosus*, or whistler marmot, are close together; for

* Northern Zoology.

the animals form themselves into little foraging parties, and may frequently be seen, in autumn, on the sides of grassy hills, cutting hay, — “which is regularly carried to their burrows, either as food, or as a lining to their dwellings.” While a party of them are thus employed, a sentinel keeps vigilant watch upon an adjoining eminence,—who, on the first approach of an enemy, gives an alarm to the rest of the party by a shrill whistle, which may be heard at a great distance; and, that all may participate in the warning, “this signal of alarm is repeated from one to another as far as their habitations extend.” In these little animals, the social principle of mutual enjoyment is not only developed, but a regard is manifested for the welfare and safety of each other. The villages of the short-tailed marmot of the same regions (*Arctomys brachyurus*), according to Lewis and Clark, on the plains of Columbia, sometimes occupy 200 acres of land. The burrows, like separate houses, are distinct; each containing, upon an average, from ten to twelve inhabitants: the entrances to these are by three or four distinct holes, in the centre of which is a hillock about two feet high; this is used as a watch tower, upon which one of the family takes its station as sentinel, while the rest are employed in gathering food for the mutual benefit of all.* The wood chuck (*Arctomys monax*) is another of those social marmots which form villages in the sides of hills; the burrows extend to great distances under ground, and terminate in several chambers, inhabited by different members of the same family. In short, it will be needless to particularise further instances of the social disposition of this family, since it is more or less prevalent in nearly every species. The prairie dogs of Lewis and Clarke (the genus *Cynomys* of Rafinesque) construct their burrows in large clusters, resembling villages,—and they are so called by the hunters; and these villages sometimes cover an extent of many miles. But the common rabbit of this country is one of the best examples we can have to

* North, Zool. vol. i. p. 152.

illustrate these social communities. Their warrens, in fact, are villages; the burrows have usually several entrances, and are common to many individuals; but all, as it is said, are of the same family. When these warrens are very populous, the burrows are separated by very slight intervals, and sometimes even communicate with each other. "We are assured, on the authority of those who have paid great attention to the subject, that rabbits are not merely social, but evince an interest in each other, and even have something like respect for the rights of property. In their republic, as in that of Lacedæmon, old age, parental affection, and hereditary rights are respected; the same burrow is said to pass from father to son, and lineally from generation to generation; it is never abandoned by the same family without necessity, — but is enlarged as the members of the family increase, by the addition of more galleries or apartments."* The large Brazilian water cavy, or *Capybara*, is said to live in families, and never to quit the vicinity of the spot where they were born.

(295.) From quadrupeds, we may now turn to Birds. Of all those which inhabit Europe, the crow family (*Corvidæ*) are the most social; for, although numerous others live, for the most part, in companionship the greatest part of the year, yet, when the period of incubation arrives, they separate and disperse. With the rook, however, it is different: the social principle is permanent; and they accordingly form aerial villages, fabricated on the summits of the loftiest trees, and rear their young in a perpetual scene of bustle and excitement. Their attachment to these spots is very remarkable, and has frequently given rise to obstinate battles between the last possessors and stranger flocks, who have attempted a usurpation of the domain. The common heron, although now comparatively scarce in this country, likewise builds in the same manner; although at other times, from the nature of its food, it is a so-

* Griffl. Cuv. vol. iii. p. 219.

litary bird. Heronries were formerly preserved in England with great care, as the birds were esteemed royal game. The passenger pigeons of America, whose extraordinary migrations we have already detailed, perhaps exceed all other birds in the extent of their societies, and in the number of individuals which compose them. The sociability of the swallow tribe, particularly during the breeding season, is known to every one: in many of the foreign species, the nests are so close together, that they may be compared with more propriety to a large house with innumerable chambers, than to a village having distinct habitations. The hangnests of America (*Icterinæ* Sw.) form their dwellings in the shape of long purses, — suspending them so close to each other, that we have frequently seen thirty upon a single tree. The weaving birds of Africa (*Ploceanæ* Sw.), as we have elsewhere shown, do the same; and most of these tribes constantly live in permanent societies. Aquatic birds, with few exceptions, are solitary, like all such as live upon other creatures; but the gulls and the terns are exceptions, — and they probably breed in large communities. We know, by the relations of voyagers, that the penguins are eminently social; and that their breeding places are so crowded with nests, that it is almost impossible to walk over the ground without destroying either their eggs or the young birds. Numerous, however, as are these instances, they offer no example of one common dwelling, like the hives of bees, constructed by the united efforts of the whole community; for, in all the above instances, each pair of birds provide their own materials, and build their own habitation, — and this is never larger than is necessary to contain their own young. It is curious to observe how the social propensity is varied among the feathered tribes. The starling, the redwing, and the fieldfare are well known to be gregarious, at all times except during the breeding season; when each pair becomes solitary; while the heron, and numerous other birds, live by themselves, and only form societies when

they are to rear their young. Throughout the whole of this class, we, at present, know but of one species which may be said to unite in constructing one habitation for the whole community, and thus forming a perfect society.

(296.) There are many families of INSECTS which may be placed under the class of associations we are now considering, although their labours do not appear strictly to regard themselves alone. The truth is, that although we have, for the sake of precision, drawn a distinction between perfect and imperfect societies, yet—as in all natural series—it is extremely difficult, if not impossible, to determine where the one should cease, and the other commence. Nature seems to abhor sudden and strongly marked divisions in the development of brute faculties, no less than in the structure of their bodies: both are gradual, and sometimes scarcely perceptible. Thus the *Scarabæus pilularis*, or a species nearly allied, never labours to remove the round balls of dung they are so frequently removing, by itself; two individuals are always engaged in the task,—and these are, probably, the sexes. We have repeatedly been amused by watching the efforts of these resolute little creatures,—for more than one species is common in the island of Sicily; but, conceiving that the history of so remarkable an insect was well known, we neglected to prosecute any researches in the matter. Do these insects live in societies? and are these balls conveyed to their common dwelling? This question, we believe, cannot, at present, be positively answered. Somewhat similar to this are the operations of the grave-digging beetles (*Necrophaga*), which will assemble round the dead body of a mole, or other small quadruped, and join their labour to bury the carcase in the earth, before they begin to devour it, or to deposit their eggs. In either case, the work to be performed appears to be beyond the skill or strength of an individual; yet we can scarcely place such insects in the list of those which form perfect societies. Others, again, live in vast as-

sociations in one stage of their existence, but not in another; and this, without undertaking any work which is to prove beneficial to the community. As these instances have been narrated, with much animation, by Messrs. Kirby and Spence, we shall conclude the present section with their account of the caterpillars of certain moths, which present us with a mode of association almost unique. We regret not having had the opportunity of stating these facts from personal observation.

(297.) Among the most remarkable insect associations are those formed for the purpose of marching in order. "Though these creatures move without beat of drum, they maintain as much regularity in their steps as a file of soldiers. It is a most agreeable sight," says Bonnet, on whose authority this statement rests, "to see several hundreds of the larvæ of the *Bombyx Neustria* marching after each other,—some in straight lines, others in curves of various inflections,—resembling, from their fiery colour, a moving cord of gold stretched upon a silken riband of the purest white. Equally amusing is the progress of another moth—the *Pityocampa*, before mentioned. They march together, from their common citadel, in a single line: in following each other, they describe a multitude of graceful curves of varying figure;—thus forming a series of living wreaths, which change their shape every moment. All move with a uniform pace,—no one pressing too forward, or loitering behind; when the first stops, all stop,—each defiling in exact military order."

(298.) The processionary bombyx moth, in its caterpillar state, presents a still more singular and pleasing spectacle: it is a native of France, and inhabits the oak. Each family consists of from 600 to 800 individuals; these may be termed a regiment, and they march out to forage. When young, they have no fixed habitation, but encamp sometimes in one place, and sometimes in another, under the shelter of a common web; but when they have attained two thirds of their

growth, they weave for themselves a common tent. About sunset the regiment leaves its quarters — or, to make the metaphor harmonise with the trivial name of the animal, the monks their *canobium*. At their head is a chief, by whose movements their procession is regulated; when he stops, all stop, — and proceed when he proceeds: three or four of his immediate followers succeed in the same line, the head of the second touching the tail of the first; then comes an equal series of pairs, next of threes, and so on, as far as fifteen or twenty. The whole procession moves regularly on with an even pace, each file treading upon the steps of those which precede it. If the leader, arriving at a particular point, pursues a different direction, all march to that point before they turn. Sometimes the order of procession is different: the leader, who moves singly, is followed by two; these are succeeded by two; then come four, and so on. When the leader — who in nothing differs from the rest, and is, probably, the caterpillar nearest the entrance to the nest, followed as I have described — has proceeded to the distance of about two feet, more or less, he makes a halt, during which those which remain, come forth and take their places; the company then form into files, the march is resumed, and all follow as regularly as if they kept time to music. These larvæ may occasionally be found at mid-day, out of their nests, packed close one to another, without making any movement; so that, although they occupy a space sufficiently ample, it is not easy to discover them. At other times, instead of being simply laid side by side, they are formed into singular masses, in which they are heaped one upon another, and as it were interwoven together. Thus, also, they are disposed in their nests. Sometimes their families divide into two bands, which never afterwards unite."* These marching insects may be said to form perfect societies, inasmuch as they unite in building their common habitation, and live under the same roof: but these asso-

* Int. to Ent. vol. ii. p. 24., copied from Réaumer, Mém. t. ii. p. 180.

ciations last but for a season ; the caterpillar changes to a moth, and the bond of their society is dissolved. We have introduced these examples in this place, as they serve to conduct us, by the most graduated steps, to others which, in like manner, show the first development of perfect societies,— the subject which will next engage our attention.

CHAP. X.

ON PERFECT SOCIETIES OF ANIMALS.

(299.) WE have already intimated the different gradations of animal society, and the nature of those distinctions by which we arrange the social animals under two great divisions; we are now brought to consider those which constitute, among themselves, *perfect* societies. It is among these wonderful creatures that we trace a degree of order, intelligence, and ingenuity, which has baffled so many in drawing an unexceptionable difference between reason and instinct. It is an extraordinary circumstance, that the greatest development of this sort of intelligence should be found in a division of the animal kingdom, whose structure is totally different from that of man — the being to whom his Creator has given the power of *knowing himself*; and who, consequently, exhibits the highest development of intellectual endowment in the creation. Of all creatures belonging to the animal world, insects exhibit the nearest approach to the reasoning powers of man: this fact, which the following details render incontrovertible, is one out of the many indirect evidences that man forms no part of the *animal* kingdom. His great distinction—his typical perfection — is REASON; in other words, the highest

degree of intelligence which has been given to finite beings. Now, as Nature, in all her groups, advances to the full development of their peculiarities by slow and finely graduated steps, it would follow, if man was truly the type of the animal circle, that those forms which made the nearest approach to him, would also be the most intelligent of the brute creation ; — that they would show us the graduating stages between mere ordinary instinct and reflective reason ; — that we should trace, in fact, through the families of the monkeys and apes, the graduated development of those mental powers which finally burst forth, in all their varied and astonishing splendour, in man. This, we maintain, is what the unvaried course of the system of Nature, in all her other works, would lead us to conclude. Why, then, should there be a solitary exception ? and why should this exception, moreover, be made in that particular group, which, as standing at the head of the whole creation, is pre-eminently typical, — and, consequently, that in which we should expect, by every analogy of reasoning, the primary laws of nature would be most perfectly developed ? In all other groups, those which are pre-eminently typical of their respective circles are also pre-eminent examples of the gradation of structure, of habits, and of instinct ; they are also those which Nature appears to have delighted in making the strongest evidences of her general laws. Yet here, in the very zoological circle in which some naturalists are disposed to place man, we should find him surrounded with beings which possess not the hundredth part of the intelligence of an ant, a bee, or even a spider ! The truth is, that animal intelligence, or instinct, is not one of the great characters of vertebrated animals ; their perfection, on the contrary, lies in the complicated nature of their structure, the paucity of their numbers, and the great size of the individuals. The greatest perfection, on the contrary, of the annulose or insect kingdom, is their intelligence ; while, in the comparative simplicity of their structure, the excessive minute-

ness of their size, and the immensity of their numbers, they present us with characters diametrically opposed to those just mentioned. These remarks, however they may appear somewhat disconnected with our present subject, are not strictly so; they tend to explain, and to account for, the remarkable fact of not more than two perfect societies being yet found among the whole of the vertebrated animals, while those in the insect world are numerous, wonderful, and highly interesting.

(300.) Among QUADRUPEDS, the beaver may be almost termed the only genus which gives us an example of a perfect society. They unite in building a common habitation, labouring in unison, aiding and assisting each other in the carriage of the materials, and minutely depositing, in one common storehouse, the provisions gathered in summer, for the support of the republic during the dreary and famishing season of winter. As we shall have occasion to notice this interesting animal in another part of our work, we must confine ourselves, in this place, to a few particulars. The American beaver, according both to Herne and Richardson, is seldom found in societies exceeding ten or twelve individuals, of which four are the patriarchs. Their houses are so substantially built, that they resist the cold even of an arctic winter, and the walls are frequently from five to six feet in solid thickness; each contains several apartments, all of which have their entrance from the water: but, besides these, there are a number of hiding holes in reserve, to which they retreat whenever any injury is offered to their common habitation. The number of apartments in one of these houses, examined by Herne, amounted to a dozen; and, two or three only of these excepted, none of them had any communication with each other, except by water. As there were beavers enough to inhabit each apartment, it is more than probable that each family knew their own, and always entered at their own doors, without any further connection with their neighbours than a friendly intercourse, and to

join their united labours in erecting their separate habitations and building their dams.* A more particular account of these dwellings will be found elsewhere. The American musquash (*Fiber Zibethicus* Cuv.), although far inferior in its social instincts to the beaver, must, nevertheless, be included in the same list. Dr. Richardson informs us†, that these ingenious and prolific animals join their labour in erecting, for their mutual accommodation, a cone-shaped dwelling or house, the chamber of which they take care to raise sufficiently high above the level of the water to obviate the effects of inundation. "The chosen spot is generally amongst long grass, which is incorporated with the walls of the house, from the mud being deposited amongst it; but the animal does not appear to make any kind of composition, or mortar, by tempering the mud and grass together: there is, however, a dry bed of grass deposited in the chamber. When ice forms over the surface of the swamp, the musquash shows an admirable instinct in perforating it, for the purpose of making breathing holes; and these holes are again protected from the frost by a covering of mud. This is their winter habitation; but, with the return of milder seasons, our little animal constructs a summer residence: he excavates or burrows, in the banks of the lake or morass near to his winter habitation, several branched tunnels, many yards in extent; at the extremity of these — which, probably, all terminate ultimately in a point — is a small chamber, and in this the young are brought forth and nursed. When its house is attacked in the autumn, — the usual season for hunting the poor creature, — it retreats to these passages; but in the spring," observes Dr. Richardson, "they are frozen up."‡ Before quitting these pre-eminently social quadrupeds, it will be interesting to notice that, in the circle of the order *Glires*, they occupy a station perfectly analogous to that of the

* North Zool. vol. i. p. 110.

† Id. *ibid.* p. 113.

‡ Id. *ibid.* p. 117.

order *Hymenoptera* in the circle of the class *Ptilota*, among insects; and that, consequently, the analogy of the beaver to the bee is not merely a supposition, but a demonstrable fact, founded upon analysis, — the only true test of natural analogies, — and established by the parallel relations of the other divisions in the two circles.

(301.) The most perfect societies that are known among BIRDS, are inferior to those which we have just described. They are, indeed, so few as to be confined to one genus — or, at least, to one division of a family (*Fringillidæ* Sw.); and so little is known on the economy of even these, that only one solitary instance is of sufficient authenticity to be recorded: this is



the republican grosbeak (fig. 78.), a small finchlike bird, discovered in the interior of Africa by the late colonel Patterson, during his botanical travels in those regions; and mentioned by him in the following words: —

“ The method in which these birds fabricate their nests is highly curious. In that of which I have given a plate, there could be no less a number than eight hundred to a thousand residing under the same roof. I call it a roof, because it perfectly resembles that of a thatched house; and the ridge forms an angle so acute and so smooth, projecting over the entrance of the nest below, that it is impossible for any reptile to approach them. Their industry seems almost equal to that of the bee: throughout the day they appear to be busily employed in carrying a fine species of grass, — which is the principal material they employ for the purpose of erecting this extraordinary work, as well as for additions and repairs. Though my short stay in the country

was not sufficient to satisfy me, by ocular proof, that they added to their nest as they annually increased in numbers, still, from the many trees which I have seen borne down by the weight, and others which I have observed with their boughs completely covered over, it would appear that this really was the case. When the tree, which is the support of this aerial city, is obliged to give way to the increase of weight, it is obvious they are no longer protected, and are under the necessity of rebuilding in other trees. One of these deserted nests I had the curiosity to break down; so as to inform myself of its internal structure,—and I found it equally ingenious with that of the external. There are many entrances, each of which forms a separate street, with nests on both sides, at about two inches distant from each other. The grass with which they are built is called the Boshman's grass, and I believe the seed of it to be their principal food; though, on examining their nests, I found the wings and legs of different insects. From every appearance, the nest which I dissected had been inhabited for many years,—and some parts of it were much more complete than others. This, therefore, I conceive nearly to amount to a proof that they added to it at different times, as they found necessary, from the increase of the family—or rather, I should say, of the nation or community.* Our author further observes, that these little republicans select a particular species of acacia tree as the site of their city,—the structure of which they are led, by instinct, to perceive is peculiarly adapted for the purpose. The stem of this tree shoots up to the height of near thirty feet from the ground before it sends out any branches; while the stem, being covered with a smooth and polished bark, effectually secures the birds from the attacks and injuries of all the snakes, lizards, and other reptiles which swarm around their habitations,—many of which, could they but ascend the glassy surface of the stem, would suck the eggs and

* Trav. in Africa, p. 133.

destroy the young. The branches of this acacia are also remarkably long and wide-spreading,—thus allowing sufficient room for the increasing colony; for these little birds appear to be extremely prolific.* Such is the brief but highly interesting account which colonel Paterson has left us of these remarkable birds,—the only authenticated instance, in the feathered creation, of a perfect society. Unfortunately, no detailed description of the plumage has been furnished by our author; and the consequence is, that, to this day, we know not whether the species he alludes to in the above account is in our museums. The probability, however, is, that several of the same genus possess similar habits: this may be gathered from the vague and unsatisfactory notices which occur in the *General Synopsis* and the *General History of Birds*,—where several species, obviously distinct, are classed under one name, merely because they build similarly shaped nests. Mr. Barrow †, likewise, intimates the existence of others, with which we are at present totally unacquainted. But, whatever difficulty we have in ascertaining the species of these birds, the discoveries that have been effected regarding the geographic distribution of the feathered class, leave us in no doubt in respect to the family, and very little as to the genus, to which they all belong. The weaving birds (*Plocianæ* Sw.) are strictly confined to the hot latitudes of Africa and India—or, more properly speaking, to the Old World; they form a distinct division (and that a typical one) of the great family of finches (*Fringillidæ* Sw.). Now this family, as may be seen by the analysis we have elsewhere given ‡, occupies an aberrant station in the circle of the *Conirostres*, or conic-billed order, precisely analogous to that station which is filled by the beaver among the *Glires*, and the order *Hymenoptera* among the *Ptilota*, or winged insects. It thus appears demonstrable that the bee,

* Trav. in Africa.

† North. Zool. vol. ii.

‡ Id. *ibid.*

the beaver, and the republican grosbeaks mutually represent each other,—not merely in possessing, above all other animals in their respective classes, the greatest development of the social instinct,—but equally so, presuming that no such quality belonged to any of them.

(302.) We now come to the PERFECT SOCIETIES found in the insect world. It is among these little creatures that the social principle is developed to such an extraordinary degree, as scarcely to yield to that which is implanted in man, under all the advantages of cultivated reason and high civilisation. When we find all those feelings which sooth or agitate the human breast—love, patriotism, affection, kindness, forbearance, and disinterestedness—on one side; and anger, courage, self-denial, temperance, and toil, on the other; possessed of foresight, and with the power of communicating ideas to their fellows, sufficient for all the purposes of life or enjoyment,—how are we astonished at the intelligence of these extraordinary creatures! and how powerfully and irresistibly do the phenomena of Nature proclaim the wondrous perfection of her God! “Go to the ant, thou sluggard; consider her ways, and be wise,” is addressed, by the inspired writer, to him who negligently and slothfully makes no use of those powers bestowed on him by his Creator. But the same sentence may be addressed, with equal force, to the sceptic and the infidel—to him who doubts, and to him who openly disbelieves, that Divinity itself has produced such creatures for our instruction—emblems of all those moral virtues which give strength, unity, and true greatness to a nation, and promote the peace, the happiness, and the contentment of the individual. To do justice, in the following narrative, to the astonishing history of these insect communities, is quite impossible: neither the space which we can devote to the subject, nor the accumulated facts that have been contributed to it by many and eminent writers, will permit us to do more than condense the most striking circumstances regarding their history. For these we

are mainly, and almost exclusively, indebted to Messrs. Kirby and Spence, who have devoted a large portion of the second volume of their admirable work to this subject; and who have collected and digested, with great industry and skill, everything that has been written on this matter. Whatever facts, in the following pages, are not stated as the result of personal observation, must be considered as taken from the *Introduction to Entomology*, or from other original sources, equally authentic.

(303.) In regard to social insects, generally, we cannot but observe, that the nature of their food, and habits, correspond with their peaceful and orderly disposition. With the exception of the wasps, — which, as types of the *Carnivora*, in the order *Hymenoptera*, derive part of their sustenance from the bodies of smaller insects, — the whole of these tribes live upon vegetables. The bees feast upon the nectar of living flowers; the *Termites*, or white ants, upon the fibres of decayed or decaying wood; and the common ants chiefly upon seeds and grain. Most of the latter, however, in tropical countries, appear omnivorous, — devouring everything that comes in their way; — at least, we had painful experience of this in South America, where many boxes of fine insects, incautiously left open for the purpose of drying, were, in one night, totally destroyed by these creatures; the same misfortune happened to the celebrated Smeathman, whose name we shall have frequent occasion to mention, while prosecuting his researches on the western coast of Africa; — while some species of *Termes* appear equally capable of feeding both upon animal and vegetable matter.

(304.) We shall contemplate the different societies of insects under the following heads: — 1. Those which, at first, erect a common habitation for themselves, but separate and disperse in the subsequent periods of their existence. 2. Those in which the work is performed by larvæ. 3. Those whose workers are neuters. To the first of these belong most of the social *Lepidoptera*; the second comprises the white ants; and the third in

cludes the majority of bees : the two latter, from living in society during all their life, are pre-eminently social.

(305.) 1. That the caterpillars of several butterflies and moths live in large societies, under shelter of a common habitation, fabricated by their united skill, has been already intimated. It is by these temporary associations, complete in their nature, so long as they continue, that Nature marks the transition from imperfect to perfect societies. To preserve this series, we shall now place the remainder of these tent-spinning caterpillars in the present section. The gold-tailed bombyx moth, mentioned by Reaumer, is of this description ; and they belong to a family, the females of which always envelop their eggs in hair plucked from their own body. As soon as one of these young caterpillars is disclosed from the egg, it begins to feed ; another quickly joins it, placing itself by its side. Thus they proceed in succession, till a file is formed across the leaf. A second is then begun ; and after this is completed, a third : and so they proceed until the whole upper surface of the leaf is covered. But as a single leaf will not contain the whole family, the remainder take their station upon the adjoining ones. No sooner have they satisfied the cravings of hunger, than they begin to think of erecting a common habitation, — which, at first, is only a vaulted web, that covers the leaf they inhabit ; but, by their united labours, in due time grows into a magnificent tent of silk, containing various apartments, sufficient to defend and shelter them all from the attack of enemies and the inclemency of the seasons. As our caterpillars, like eastern monarchs, are too delicate to adventure their feet upon the rough bark of the tree upon which they feed, they lay a silken carpet over every road and pathway leading to their palace, — and this extends as far as they have occasion to go for food. To the habitation just described they retreat during heavy rains, and when the sun is too hot : they likewise pass part of the night in them ; and, indeed, at all times, some may be usually found at

home. Upon any sudden alarm, they retreat to them for safety; and also when they cast their skins. In the winter they are wholly confined to them, — emerging again in the spring; but in May and June they entirely desert them, and, losing all their love for society, live in solitude till they become pupæ, — which takes place in about a month.* De Geer mentions the caterpillars of a saw-fly, which “join in making a common nest by uniting leaves together by silken threads; each, however, spins a tube, of the same material, for its own private apartment, in which it glides backward and forward upon its back.”† Several of the British butterflies spend the early period of their larva state much in the same manner. The young of the peacock (*Pavo Io* Fab.), when a few days old, inclose themselves in a fine web, — drawing, at the same time, the leaves to cover them, that they may still receive the benefit of their shade. They change their skins frequently, — and on these occasions desert their former tent, and construct a new one in another part of the plant: this continues until they are clothed in their last skin, — when the society is dissolved by mutual consent, and each individual separates and feeds by itself. The great and the small tortoiseshell butterflies live much in the same manner. And, not to multiply instances, the *Papilio cinxia*, in its larva state, lives in societies of about a hundred, within a pyramidal tent, containing several apartments of their own spinning. We now proceed to the perfect societies of insects.

(306.) 2. The *white ants*, generally, are chiefly found in the tropical latitudes of the Old and the New World; in both of which they live in vast communities, — destined, by an all-wise Providence, to accelerate the destruction of dead vegetable matter, so abundant in climates where vegetation is so rapid and luxuriant. In Europe, it appears, two species have been found, — one of which we met with in the island of Sicily. “The great end of the societies of insects,” it has been

* Int. to Ent. vol. ii. p. 21.

† Id. ibid.

judiciously observed, "being the rapid multiplication of the species, Providence has employed extraordinary means to secure the fulfilment of this object, by creating a particular order of individuals in each society, which, freed from sexual pursuits, may give themselves wholly to labour, and thus absolve the females from every employment but that of furnishing the society, from time to time, with a sufficient supply of eggs to keep up the population to its proper standard. In the case of the white ants, the office of working for the society devolves upon the larvæ; the neuters being the soldiers of the community." Numbers are also essential to the full development of the instinct of all social animals; and where these are to act in complete unison, according to their several offices, it seems absolutely impossible that this object can be attained without the reciprocal communication of ideas: hence, as Huber justly observes, "this can scarcely exist without the intervention of language; for such may be called every mode of expressing their wishes, their wants, and even their ideas,—if that name may be given to the impulses of instinct." It would be difficult to explain in any other way that concurrence of all wills to one end, and that species of harmony which the whole of their institution exhibits.

(307.) The history of the *Termites*, or white ants, replete with some of the most astonishing and interesting facts in animal economy, was first made known to the world by Smeathman, — an able entomologist and intrepid traveller, who, for many years, braved the pestilential climate of Western Africa in the pursuit of his favourite science. It is of the various species which he met with in those regions that we are about to speak; for, although others, no less remarkable, are found in myriads on the opposite coast of America, their economy has never been properly investigated; and so many other objects claimed and almost distracted the attention, during our own researches in those countries, that the little original information here added is par-

tial and imperfect. The traveller who visits the pestilential regions of Western Africa, will be struck by the appearance of clusters of conical huts, generally about twelve feet high, rising from the plain, and covered with mud: these, he will conclude, are the hamlets of the negroes; — but they are the dwellings of a far more industrious race, — they are the cities of the white ant, fabricated and inhabited by them, and constructed, internally, with a knowledge of architecture unknown to the simple negro; and containing an immense population, divided into those distinct grades of society which, in human affairs, have been found most conducive to the general good. Upon the astonishing structure of these dwellings we cannot, at present, dilate. But their inhabitants are no less extraordinary. It should be previously observed, however, that the species under consideration is named, by Smeathman, *Termes bellicosus*, — a designation which, by every rule of justice and scientific nomenclature, should be retained; seeing that Linnæus applied that of *fatalis* to two, if not three, different species. The community is divided, according to Smeathman, into *three* distinct orders; — 1. the labourers; 2. the soldiers; and, 3. the perfect insects. Messrs. Kirby and Spence, on the contrary, make these *three* into *five*. We shall retain this latter arrangement, — more for the sake of clearness, than as establishing that marked distinction which belongs to Mr. Smeathman's view; whose *three* orders perform *three* different offices in the community. First, as being the most numerous, we place the *labourers*, or *workers*, — upon whom devolve the erection and repairing of the buildings, the collecting of provisions, the care of conveying the eggs to the nurseries, feeding the young progeny, and attending to all the wants of the regal pair. These, in scientific language, are the *larvæ*, corresponding in rank to the neuters among bees: they are immediately known by their small size, round heads, and short jaws. Next to them are the *nymphs* or *pupæ*, — differing only from the former in

having the rudiments of wings : this great similarity induced Smeathman (according to the opinion of Latreille), erroneously, to call them neuters. Thirdly, rank the true neuters, or the soldiers : this warlike race are the guardians of the community : they are in the proportion of about one to every hundred labourers ; and are at once distinguished by the enormous size of their heads, armed with long and sharp jaws. Lastly, come the males and females ; which are the insects arrived at their perfect state, and capable of producing their kind. As there is but one of each in every separate community, they may more properly be termed the king and queen of this insect population ; for, like the sovereigns of mightier kingdoms, they are exempt from all those labours and duties which belong to their subjects. From the remarks of Mr. Smeathman, it would seem that the circumstances attending the first establishment of a colony of white ants in Africa, is much the same as those in the tropics of America ; we shall therefore give the result of our own observations.

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The winter or rainy season of Brazil generally begins early in February,—at which time the *Termites* become perfect insects, furnished with four long narrow wings, folded on each other (*fig. 79.*), and emerge from their retreats in countless myriads. We always observed they selected a rainy day for their transformation ; and although they began to mount from the earth at about one o'clock in the day, they continued to increase every hour, thousands on thousands, darkening the air, and flying into the houses. Meantime, all the species

of insectivorous birds, particularly the tyrant flycatchers (*Tyranninæ* Sw.), as if by an instinctive knowledge, assemble round those spots from whence the insects emerge, and commence a simultaneous attack upon them in all directions. Poultry join in the destruction ; lizards run about after the hundreds which fall to the

ground ; and as many more are drowned in such ponds of water as happen to be near. The wings are so slightly affixed to the body, that they fall off, almost at the slightest touch, — so much so, that we could scarcely collect a dozen specimens in a perfect state : the sun immediately makes them shrivel, — and on this account the insects never emerge from the nest but on a rainy or very cloudy day. Thus far we can speak as an eye-witness : we must now return to Mr. Smeathman's narrative. The next morning, and even the latter part of the same day, those that have escaped their numerous enemies, deprived of their wings, crawl for shelter into the nearest retreat ; but here, again, they encounter a fresh host of enemies, in the numerous ants which swarm in all parts of tropical countries. It should be observed, however, that so soon as the white ants fall upon the ground, by the loss of some of their wings, "they are seen running about, with the rest dangling upon them, the male after the female : sometimes two are seen chasing one, — each contending with great eagerness, regardless of the innumerable dangers that surround them, who shall win the prize." * This fact we have not witnessed. So sweeping is the destruction, that not one pair in many thousands escape death. If, by chance, the labourers happen to meet with one of these, they treat them with their customary respect and homage ; and, conveying them to a place of safety, they are elected sovereigns of a new community. This done, their new subjects begin to build them a small chamber of clay, the entrance of which is just sufficient to admit themselves and the neuters, but much too small for the royal pair to pass through ; this chamber, in fact, becomes their palace, their prison, and probably their grave, — for beyond its walls they never again emerge.

(308.) The colony being now established, the female begins her office, and soon furnishes it with a large population : as her size gradually increases, the la-

* *Int. to Ent.* vol. ii. p. 35.

bourers progressively enlarge her cell, and, at the same time, supply her and their king with food and every thing needful. The abdomen of the female progressively increases, until it becomes 1500 or 2000 times larger than the rest of her body, — thus making her bulk equal to 20,000 or 30,000 of her own subjects: her abdomen, in fact, is now a vast magazine of eggs, which are sometimes protruded at the rate of sixty in a minute, or more than 80,000 in twenty-four hours. For how long a period oviposition continues, we are not informed; but the ordinary period, usually observed in other insects, would give a number almost incalculable. During this period, the royal chamber is a scene of busy activity; crowds of the attendant labourers are passing and repassing, sedulously engaged in receiving the eggs from their prolific queen, and depositing them in distinct chambers or nurseries, where they continue to show them unremitting attention, and supply them with food, until they are of an age to procure it themselves. Meantime the soldiers, as if to preserve order in the royal presence, are mixed with the rest of the attendants in the presence chamber, and seem to constitute a body-guard to the royal pair: the adjacent apartments or anterooms, are occupied by other labourers and soldiers in waiting, “that they may successively attend upon and defend the common father and mother, on whose safety depend the happiness and even existence of the whole community, — and whom these faithful subjects never abandon, even in the last distress.”

(309.) All the operations of these extraordinary creatures are carried on under cover of their walls; and it was only by breaking these, that Mr. Smeathman was able to prosecute his observations. Not only is the city itself thus fenced in from all external enemies, but none of its inhabitants ever expose their soft and tender bodies to the light of day, — at least habitually, or for any considerable time. How, then, it may be asked, do they wander about, and manage to

procure a sufficiency of food for so many thousand individuals? The method they adopt is most singular, and has been verified by our personal observations. From the citadel or common nest, radiating and branching in all directions, are innumerable tunnels or covered ways: those which unite the greatest number of lateral communications may strictly be compared to our high roads, — their diameter is frequently wider than the bore of a large cannon; others, on the contrary, are much narrower, and resemble our lanes or cross roads. Messrs. Kirby and Spence are in error when they intimate * that the white ants cannot well mount a surface quite perpendicular. The fact is, that, in certain parts of Tropical America, these covered ways may be seen, in innumerable instances, carried up the perpendicular stems of lofty trees to the height of thirty or forty feet; but as these are evidently a distinct species from the *T. bellicosus* of Western Africa, a variation of habit or economy may naturally be expected. Their great highways are, as Smeathman observes, “generally concealed at the depth of three or four feet below the surface, and extend to no great distance from the bottom of their nests: the lesser roads, however, extend to great lengths, and, when carried above the earth, are covered over, in the form of an arch, with tempered mortar; which, to deceive the eye, is always incorporated with particles of the substance upon which it reposes, — so that, the colour being precisely the same, few persons would detect the masonry, even when immediately before him.” There is an extraordinary circumstance connected with this part of their labours, which does not appear to have struck any one of the authors who have written upon these creatures. If, as there is every reason to believe, they do not venture beyond their covered ways, by what means do they discover the best and the shortest road to any particular object — a decayed tree, for instance, which is adapted for their nourishment, and which they consequently mean to attack? When

* Vol. ii. p.

hid within these tunnels, they can neither *see* such an object, nor is it probable that they can *smell* it, — since the compactness of their walls, impervious to rain, might be supposed, also, to intercept the particular odour which would guide them in what direction to make their engineering approaches, — in other words, to carry on their tunnels. Have they no reconnoitring parties, which proceed, under cover of the darkness of night, to explore and examine the neighbourhood, and to bring a report to the rest of the community as to the best and nearest supply of food to which they should next direct their attention? This seems to us an object worthy of future research; for in what way can we otherwise account for the positive fact, that their roads to a given object are always found to be the shortest, the best, and the most judicious of any that could have been chosen? They could not, indeed, be better planned, even if they had been laid out by a distinct class, trained and educated as civil engineers. Such, at least, were our thoughts, while contemplating these creatures in the forests of Tropical America; and, although the circumstance is not alluded to by Smeathman, there is no reason to doubt that the African species do not possess the same unaccountable faculties. Independent of these numerous roads, — which must be constantly extended and varied, as supplies of food are exhausted and discovered, — the labourers have ample employment in enlarging and improving their common dwelling, in proportion as its population increases, and further accommodation is required: the royal chamber, as before intimated, must undergo many alterations; the nurseries must be removed and increased; and, sufficient supply of provisions procured for the whole society. It has been generally supposed that these consisted of the fibres of wood, for, whenever the *Termites* have been at work, there is always a quantity of coarse dust, resembling filings; but it appears by recent examination, that these, when examined with a microscope, “are found to consist chiefly of gums and the

inspissated juices of plants, which, formed into little masses, are stored up in magazines made of clay.



(310.) Let us now bestow some attention upon the soldiers (*fig. 80.*),— whose duties, although less laborious or varied, are, nevertheless, equally important and curious. The military life is not remarkable for steady and persevering regularity in the daily performance of allotted labour; it is either a state of comparative idleness, or of violent and perilous exertion: and this picture is exemplified in the insect army now under consideration. The sole duties which devolve upon them appear to be, keeping a listless guard over the royal cell or the more active labourers, and defending the city. The first seems more allied to form than to usefulness, for no observation has yet detected any fact which would indicate intestine broils, or civil commotions, in these peaceful societies; but the second duty, or that which in military language is called *active service*, is one of danger, and calls forth all their courage and energy. If their habitation is attacked, and a small breach made in the outer walls, the labourers become exposed to view,—but these, being incapable of fighting, immediately retire, and give the alarm; upon this a soldier makes his appearance, obviously for the purpose of reconnoitring,—which done, he also retires for a moment or two, and then returns with two or three others. The alarm having now become general within all the intricacies of the city, the soldiers begin to pour out at the breach,—particularly if the attack is continued; for it is remarkable that the extent of their numbers is always in proportion to the injury that has been committed. These little heroes present a most astonishing, and, at the same time, a most amusing, spectacle; they seem to be influenced by the most determined fury, and show the greatest rage; but, being blind, they cannot wreak their vengeance on anything which does not come within their touch.

Thus embarrassed, they move their heads about, all the while extending their long pointed jaws to the utmost, ready to fasten upon the first enemy that comes in their way: at this time the disproportionate size of their immense heads, and their awkward gait, give them a most ludicrous appearance. It is really laughable to see them, sometimes, in their eagerness to push forward, tumbling over each other,—when they begin biting any stick or substance which lies in their way; to those of their own kind, however, they do no injury. We have frequently put a stick in their way; they immediately fastened upon it so firmly, that no force could disengage the jaws without causing the destruction of the animal. From this fact, we may readily conceive the extreme danger which would result from an incautious exposure of the human body to such resolute enemies. So soon as the injury has ceased, and no further interruption is given, the soldiers retire, supposing the enemy has departed; their place is then filled by the labourers, who immediately begin to crowd the aperture, each carrying in his mouth a load of tempered mortar half as big as himself, which he lays on the edge of the orifice, and immediately hastens back for more. Not the space of the tenth part of an inch is left without labourers working upon it at the same moment; crowds are hurrying to and fro; yet, amid all this activity, we observed the greatest order,—no one impeded the other, but each seemed to thread the mazes of the multitude without trouble or inconvenience.

(311.) The soldiers, in the mean time, although the great body had retired, were yet observed to be intermixed, acting as sentinels or overseers, but taking no part whatever in the labours of the workers. They seem, in short, although to all appearance blind, stationed to watch the proceedings of the labourers, walking leisurely in and out of the aperture, with closed jaws and peaceful mien: this we have repeatedly witnessed. Mr. Smeathman further adds, that

every now and then, at the interval of a minute or two, the soldier on these occasions makes a peculiar noise, by lifting up his head and striking his jaws against the wall of the nest; no sooner is this done, than all the labourers (which appear to regard this noise as a signal for despatch or greater diligence) answer by a loud hiss, apparently increasing their pace, and applying to their work with renewed diligence. The celerity, indeed, with which these astonishing creatures, by their union of labour, can repair their dwellings, is not the least remarkable part of their history. Mr. Smeathman ascertained that, in a single night, they will restore a gallery of three or four yards in length. "If, attacking the nest, you divide it in halves, leaving the royal chamber,—and thus lay open thousands of apartments,—all will be shut up with their sheets of clay by the next morning; nay, even if the whole be demolished, provided the king and the queen are left, every interstice between the ruins, at which either cold or wet can possibly enter, will be covered; and, in a year, the building will be raised nearly to its pristine size and grandeur."^{*}

(312.) In the history of another African species, the *Termes viarum*, or marching white ant, there are some very peculiar characteristics. The *Termes bellicosus*, last described, lives and works entirely under cover of its own walls. These, on the other hand, expose themselves to the day. Mr. Smeathman, on one occasion, while passing through a dense forest, suddenly heard a loud hiss like that of a serpent; another followed, and struck him with alarm; but a moment's reflection led him to conclude these sounds proceeded from white ants, although he could not perceive any of their huts around. On following this noise, however, he was struck with surprise and pleasure at perceiving a prodigious army of these creatures emerging from a hole in the ground, and marching with the utmost celerity. Having proceeded about a

^{*} Int. to Ent. vol. ii. p. 39.

yard, this immense host divided into two columns, chiefly composed of labourers, about fifteen abreast, following each other in close order, and going straight forward. "Here and there was seen a soldier, carrying his vast head with apparent difficulty, and looking like an ox in a flock of sheep, who marched on in the same manner, at the distance of a foot or two from the columns; many other soldiers were to be seen, standing still, or pacing about, as if upon the look out lest some enemy should suddenly surprise their unwarlike comrades. But, the most extraordinary and amusing part of the scene was exhibited by some other soldiers, who, having mounted some plants ten or fifteen inches from the ground, hung over the army marching below, and by striking their jaws upon the leaves, at certain intervals, produced the noise above mentioned: to this signal the whole army returned a hiss, and immediately increased their pace. The soldiers at these signal stations sat quite still during these intervals of silence, except now and then making a slight turn of the head, and seemed as solicitous to keep their posts as regular sentinels. After marching separately for twelve or fifteen paces, the two columns of this army again united, and then descended into the earth by two or three holes. Mr. Smeathman watched them for more than an hour, without perceiving their numbers to increase or diminish. The soldiers, however, who quitted the line of march, and acted as sentinels, became much more numerous before he quitted the spot. It should be observed, that both the labourers and soldiers of this species are furnished with eyes.

(313.) There is another race of white ants, which, unlike the two former, fix their habitations in trees and dwellings. These are the *Termites arborum* of our author; but it is probable several species inhabit Africa, and that those of America are also different. We must confine our notice of these to a few particulars mentioned by Mr. Smeathman, adding some remarks of our own upon those found in Brazil. Regarding those of Africa,

our author particularly mentions one species, which is not only more destructive, but more difficult to guard against, since they make their approaches under ground, — descending below the foundations of houses, several feet from the surface, — and, rising again, enter the dwelling through the floors. Sometimes they work into the bottom of the posts composing the framework of the house, and bore quite through them, — following the course of the fibres of the wood from the bottom to the top, — and then enter the building by lateral perforations. While some are employed in gutting the posts, others ascend by the roads thus made, and attack the rafters. If the roof is composed of thatch, — a common covering to the slight-built houses of the country, — these persevering creatures immediately bring up wet clay, or build their galleries through the roof in all directions; taking up their permanent dwelling, and remaining in this nest of congenial food, until they know it will no longer support their weight. This destruction of the roof very soon ruins the house, — for not only will the top fall in, but the posts become so perforated as to resemble an old ship's bottom after being bored by sea worms (*Teredo*); although the fibres and knotty parts, being the hardest, are left untouched. In this operation they are guided by an astonishing instinct, which teaches them to know that the main posts or supports of a house have a considerable weight to support; and that, consequently, if they wish to gain possession of the roof (which is their favourite station), they must not destroy the props by which it is supported. Here is a perception of consequences, — a knowledge of cause and effect, — which is altogether inexplicable. How, then, do they counteract the evil, and still feast upon the wood? Their method could not be excelled by the most skilful architect among us. To give sufficient strength to the timber, they carefully fill up all those excavations with tempered mortar, — leaving only such of their roads as are necessary for carrying on further operations. All

other parts of the woodwork, as fast as it is eaten away, is filled up by these skilful masons; and their cement is so admirably tempered and worked together, that no human art could render it more compact or durable.

(314.) In houses which, from having been otherwise injured by them, have been pulled down, and the posts examined, all the softer kinds of wood are reduced to a mere shell,—the greater part appearing as if transformed from wood to clay, as solid and as hard as many kinds of our freestone. It is much the same when the *Termites bellicosus* get into a chest or trunk; for, if there is any considerable weight upon it, they will substitute clay cement for the wood or other substance which they devour,—carrying their roads in various directions. The arborial white ants, however, when they get within a box, will often turn it into a nest, and, being once in fair possession of the whole, devour its contents at their leisure. They are no less expeditious in destroying the shelves, wainscoting, and other fixtures of a house, than the house itself. They seem universal destroyers,—but they always commence at first with the softest substances. If a shelf, for instance, has nothing upon it, they will not perforate the surface, but artfully preserve it quite whole, eating away all the inside except a few fibres, which barely keep the two sides connected together: to the eye, there is no external injury, and the board appears perfectly solid; touch it, however, and it crumbles into dust, and a thick plank is reduced to the weight of two sheets of paper. They are as persevering as they are intelligent; and the injury they can cause in a single night is inconceivable. Sometimes they will enter a new house from the floor. If you detect the attack, destroy their works, and even make a fire upon the spot, they will return to the charge the next night, and make an entry in another place. When they attack trees or branches in the open air, they exhibit new features of intelligence. If a stake in a hedge has

not taken root and vegetated, it becomes their business to destroy it; if the bark is good and sound, in order to preserve it so, they enter at the bottom, leaving all the external part as a support to their own operations, — so that it eventually becomes as thin as paper, and is destroyed by the first wind that blows. If, on the contrary, their instinct teaches them that the bark is too weak to be trusted while they are devouring the inside, they proceed immediately to strengthen it with a stucco of their mortar, — giving it the appearance of being covered with a coat of dried mud. Under this cover they work, leaving no more of the stick and bark than is barely able to support it; frequently, indeed, devouring every particle, — so that, upon being touched by your walking-stick, a thick stake — apparently, strong enough to require a hatchet — falls into dust at your feet, and disappears like a shadow.*

(315.) The European white ants require much investigation; Latreille discovered one species, — the *Termes lucifugus*, — at Bordeaux, in considerable numbers; but instead of erecting artificial nests, they make their lodgment in the trunks of pines and oaks, where the branches diverge from the tree. They eat the wood nearest the bark, or the alburnum, without attacking the interior, and bore a vast number of holes and irregular galleries. That part of the wood appears moist, and is covered with little gelatinous particles, not unlike gum arabic: the proportion of soldiers is about one to every twenty-five of the labourers.† In the South of Europe, particularly in the island of Sicily, we discovered, many years ago, another species, which we have named *Termes Siculus*, whose habits at once point it out as distinct from the above. It is only found in houses, and constructs its nests, like some of those before mentioned, in trunks, bales, and other similar articles; sometimes it is found in the rafters and posts of the house, which it ultimately destroys: it is the more dangerous to the inhabitants, as it makes

* Phil. Trans.

† Int. to Ent. vol. ii. p. 43.

no external nest. In a box of clothes, which had not been opened for several months, we had the misfortune to discover a colony of these insects; they had made their lodgment at the bottom, and were gradually eating upwards, through woollen and linen cloths, which were perforated with holes, and soiled with their cement in every part. There were many thousands; so that, to prevent the escape of any, we were obliged to pour kettles of boiling water into the trunk, — an operation which prevented, indeed, the escape of any individual, but debarred us from the pleasure and instruction of studying their history. We must now take our leave of these wonderful little creatures, and proceed to notice the *true* ants, — in whose economy we shall find fresh matter to excite astonishment.

(316.) The family of ants (*Formicidæ* Sw.) is unquestionably the most numerous, in regard to individuals, of any in the whole circle of winged insects (*Ptilota*); for, while the *Termites* are almost exclusively tropical, the ants have their colonies thickly planted over the greatest part of the habitable world. There is scarcely a field in Britain that does not contain millions, — while in tropical regions their numbers are so vast, that the rooms of inhabited houses are daily infested by their inroads. Our knowledge of the *Termites* cannot be increased by personal observation, but the histories of the ants can be verified by ourselves: we see these little industrious creatures in our summer walks; we cannot rest upon a bank without reclining upon the walls of their cities, and we may contemplate their proceedings while reposing after the fatigues of a walk. The practical naturalist will, therefore, feel an additional interest in the proceedings of creatures surrounding him, — whose operations are carried on in his native soil, and, perhaps, in his own garden. In the following pages we shall, therefore, carefully note such species as are natives, without passing over, too succinctly, the wonderful economy of many that are foreigners.

(317.) The different ranks of which a society of ants is composed, are three, — namely, the *males*, the *females*, and the *workers*, and their respective offices are as follows:— The *males*, which at the time of swarming are exceedingly numerous, provide for the propagation of fresh colonies, and then die. The *females* furnish a constant supply of eggs for maintaining the population of the old nests, as well as of the new: while the *workers*, which are the most numerous, not only perform the labour, but also undertake the defence of the community; thus uniting in themselves the duties of

citizen and soldier—which, among the white ants, belong to two distinct ranks. Among the labourers (*fig. 81.*) there is often observed great inequality of size in the individuals,—some being twice or even three times larger than the generality: in all probability, this is connected with some peculiarity of economy; but hitherto



the mystery has not been solved.

(318.) The nuptials of the ants — for so the event may not improperly be termed — is a beautiful sight; and as with this we commenced the history of the *Termes*, we shall follow the same plan on the present occasion. In the warm days of summer, between July and September, the nests of the ants in general become a scene of bustle and animation; swarms of these little creatures, newly provided with their glossy wings, having now reached their perfect state of existence, are seen hurrying to and fro, preparing to quit for ever the scene of their nativity and education. Everything is in motion; and the silver wings, contrasted with the jet bodies, of the creatures composing this animated multitude, give beauty to the scene. When all are prepared, the males rise into the air, as if by a general impulse; and the females, in another body, immediately follow them. “The whole swarm alternately rises and

falls, with a slow movement, to the height of about ten feet; the males fly obliquely, with a rapid zigzag motion, — while the females, though they follow the general movement of the column, appear suspended in the air like balloons, seemingly with no individual motion, and having their heads turned towards the wind. Sometimes the swarms of a whole district unite in myriads; and, seen at a distance, produce an effect resembling the aurora borealis. Rising with incredible velocity in distinct columns, they soar above the clouds," and they are dispersed by the slightest zephyr. The females continue majestically sailing in the centre of these numberless males; each successively selects his partner, and the nuptials are consummated in mid-air. After this dance of love is celebrated, the males disappear, — probably dying, or becoming food to other creatures; certain it is, they never return to their nests. This, also, is the fate of many females, for they lose their wings and fall to the ground; such, however, as escape, become the founders of new colonies, — some making for themselves a single cell, while others join their labours in constructing a larger one in common. Such is the foundation and first establishment of those populous societies of ants, which comprehend millions of individuals.

(319.) The history of such females as outlive the period of their nuptials may be thus briefly stated. The majority, indeed, emerge in their winged state, as already described; but many remain, not from choice, but by constraint. The instinct of the labourers teaches them that the very existence of the community would cease, if it was left without mothers to produce a new generation; they therefore forcibly detain some that have been impregnated in or near the nest, by pulling off their wings, and compelling others to return into the nest, before they had time to join the party already mounted in the air. This force, however, is not exerted so as to produce the least injury to the females; for no sooner are they again conducted into the interior

of the formicary, than they are attended and fed by the neuters with the most sedulous care. By degrees, these females become reconciled to their fate, and lose all desire to quit the common city, their abdomen enlarges, and they are no longer looked upon as prisoners. Each is attended by a single ant, who appears her body-guard and especial attendant upon every occasion. He occupies a very curious station, being mounted upon the abdomen of the female, with his posterior legs touching the ground. The more especial duty of this sentinel, who is frequently relieved, seems to be that of watching the moment when the female begins the important event of laying her eggs, and thus to be ready to carry them off. Oviposition continues through the greatest part of the year, during which time it is computed that the female lays between four thousand and five thousand.

(320.) The conduct of the labourers to the impregnated female is very similar to that which the bees render to their queen: they pay her the greatest homage, press round her person, offer her food, and conduct her by her mandibles through the difficult or steep intricacies of the common dwelling. Sometimes, indeed, they carry her about, without any exertion of her own: this is effected by suspending her upon their jaws, the ends of which are crossed; the queen coils herself up, and thus packs herself so close as to give very little trouble to her carrier. When he sets her down, others of her subjects surround and caress her, one after the other, tapping her on the head with their antennæ. "In whatever apartment," says Gould, "a queen condescends to be present, she commands obedience and respect; a universal gladness spreads itself through the whole cell, which is expressed by particular acts of joy and exultation." They have a particular way of skipping, leaping, and standing upon their hind legs, and prancing with the others: these frolics they make use of, both to congratulate each other when they meet, and to show their regard for the queen. Some of them

gently walk over her, others dance round her; and she is generally surrounded with a cluster of attendants, who, if you separate them from her, soon collect themselves into a body, and inclose her in the midst. "Nay, even if she dies,—as if they were unwilling to believe it,—they continue the same attention to her, sometimes for months, treating her with the same courtly formality as if she were alive—and they will brush and lick her incessantly." It seems that some species have only one queen; while others, as stated by Huber, have several: these, according to the same author, live peaceably together, without showing any spirit of rivalry. The female lays her eggs in different apartments,—thus frequently changing her situation and attendants; and, as there are always to be found many apartments void of eggs, but full of ants, she is never at a loss for an agreeable station, and a submissive retinue.

(321.) We must now turn to the labourers,—the most numerous and industrious portion of the community, and to whom are committed the offices of workers and soldiers. Were not the facts collected together with so much industry by Messrs. Kirby and Spence, sanctioned by such names as Huber, Gould, De Geer, &c., we should deem ocular demonstration absolutely necessary to authenticate, in the estimation of the general reader, the wonders which belong to these intelligent creatures. When he is told that they communicate information to each other, engage in war, possess spies, become robbers and slave-makers, and have their own sports and amusements, he will be almost tempted to doubt the existence of such beings in creation. Let him, then, himself become a naturalist, and he will soon discover that the wonders of nature are inexhaustible.

(322.) That ants communicate their ideas, on every needful occasion, will be apparent from the following facts:—On disturbing the surface of their nest, the first thing which strikes us is the excessive quickness

with which a knowledge of the injury has been communicated to the whole society. No noise is heard — no sound is emitted ; yet, in a few minutes, many thousands, stationed in a remote part of the city, are informed of a calamity which has occurred in the suburbs. Now, nothing can account for this, but the possession of a sort of language, communicated and understood between themselves, not by sound, but by touch. On these, and similar occasions, the ants may be observed to strike each other's head, or bring their antennæ into contact : this, then, is their language ; for these acts are followed by a change of purpose in the individuals to whom the information is conveyed. M. Huber, who, to study these creatures more closely, had portable nests of them in his house, plunged one of his artificial formicaries into a pan of water ; this proved a source of great enjoyment to these little captives, — for they are a very thirsty race, and lap, as Gould observed, like dogs. One day, when he observed many of them tripping very merrily, upon disturbing them, the greater part went in a fright to the nest ; but some, more thirsty than the rest, continued their potations. “ Upon this, one of those which had retreated returns to inform his thoughtless companions of their danger : one he pushes with his jaws, another he strikes first upon the belly, and then upon the breast, and so obliges three of them to leave off their carousing and to march homewards ; but the fourth, more resolute to drink it out, is not to be discomfited, and pays not the least regard to the kind blows with which his companion, solicitous for his safety, repeatedly belabours him ; at length, determined to have his way, he seizes him by one of his hind legs, and gives him a violent pull. Upon this, leaving his liquor, the loiterer turns round, and opening his threatening jaws with every appearance of anger, goes very coolly to drinking again ; but his monitor, without further ceremony, rushes before him, seizes him by his jaws, and at last drags him off in triumph to the formicary.” The warlike or predatory

ants — whose history we shall subsequently touch upon — are known to send out spies in the enemy's quarters; and the movements of the invading army are regulated accordingly. Even upon the march, communications are constantly going on between the van and the rear; and Huber, upon whose authority this statement rests, expressly asserts that, during the battle, if the invaded appear too strong for their foes, couriers are despatched for reinforcements to retrieve the battle. Bradley relates a striking instance of the facility with which ants communicate to each other the discovery of a store of provisions. "A nest of ants, in a nobleman's garden, discovered a closet, many yards within the house, in which conserves were kept, which they constantly attended until the nest was destroyed. Some individuals, in their rambles, must have first made the discovery of this depôt of sweets, and informed their companions. They always went to the closet by the same track, scarcely varying an inch on either side, though they had to pass through two apartments; nor could the sweeping and cleaning of the rooms discomfit them, or cause them to pursue a different route."

(323.) When in Tropical America, we had frequent occasion to admire the ingenuity of these little creatures, although at no very trifling cost. Some of the first insects we had collected, were stuck upon setting boards; and these, with the hope of preserving them from the ants, were suspended perpendicularly from the rafters of the room by a single piece of string, upon going to bed. The precaution, however, was of no avail; for, upon looking to them next morning, we had the mortification of seeing the board covered with small black ants, who had destroyed nearly every specimen in the night, and were then busily passing and re-passing the piece of thin string by which the setting board was suspended. But the most curious part of their proceedings follows: — As the board was hung perpendicularly, it naturally resulted that the legs and wings of the specimens, so soon as the body to which

they belonged was eaten away, fell to the ground, — having nothing to support them, — and the ants would thus be deprived of half of their booty : but their sagacity was not to be thus baffled. They must soon have discovered this loss ; for, upon looking on the floor immediately under the board, we beheld another party busily employed in carrying off the limbs which their companions above had separated from the bodies, and which they were then conveying to the little holes in the floor, which formed the entrance to their nests. All this happened between ten at night and five in the morning. Gould relates a story somewhat similar ; but Ligon's account of the heroic ants of Barbadoes, who drown themselves that their companions may make a bridge of their bodies, is surely a most exaggerated statement. We always found that tables, whose feet stood in pans of water, were perfectly secure from ants, though not from cockroaches ; for these latter pests, finding that they cannot crawl up the sides, betake themselves to their wings, and greedily devour any entomological specimens which the unsuspecting collector may think he has left secure upon the table. The manner in which ants communicate their ideas has already been intimated. Touch seems to supply to them the deficiency of sound ; the different motions of the antennæ, and the striking of the jaws upon particular parts of the body, seem to be varied according to the nature of the information to be communicated. Nor can we feel surprise that various ideas can be imparted without sound or language, properly so termed, when we know that persons born deaf and dumb can be conversed with for hours through the medium of signs.

(324.) Whether these extraordinary creatures experience attachment to individuals of their own species, has been a question of much interest ; and, however improbable it may at first appear, the recent observations of M. Huber seem to establish the fact, to a certain degree. He had separated a number of ants from

the common nest for four months, and then brought them together. He describes their gesticulations as very amusing; and affirms that the two parties immediately recognised each other, mutually saluted by touching their antennæ, and united again in the same nest. M. Latreille, also, upon one occasion, "cut off the antennæ of an ant; upon which its companions, evidently pitying its sufferings, anointed the wounded member with a drop of transparent fluid from their mouth." These facts evidently show a recollection of former companions, and a compassionate love of such as stand in need of assistance. That they communicate to each other the discovery of any favourite food, has been already seen; and that they will do the same on occasions where *pleasure only* is to be enjoyed, is proved by the following experiment of M. Huber:—On one occasion, he produced an additional degree of heat in a part of one of his nests, by means of a torch; the ants, who happened to be in that quarter, after enjoying it for a time, hastened to convey the welcome intelligence to their companions,—whom they were so desirous should share in the pleasure, that they carried them upon their jaws (their usual mode of transporting each other) to the spot, till hundreds might be seen thus laden with their friends.*

(325.) The ants are no less extraordinary as a war-like than as a social race. Like most other insects belonging to the same order, they are capable of inflicting a venomous sting, and their strong toothed jaws—amazingly large and powerful, in comparison to the size of the body—render them formidable to the insect world. To these offensive and defensive weapons they add the most determined and heroic courage: they turn not from an enemy, be he large or small,—a mite or an elephant,—nor will these pigmy heroes be daunted by man himself. We have before apprised the reader, that the labourers, in this family, likewise perform the duties of soldiers; for the males

* Int. to Ent. vol. ii. p. 67.

and the females seem to be "very peaceable creatures, and always glad to get out of harm's way." Their subjects, however, are sometimes quarrelsome and pugnacious: and this brings us to notice the wars of the ants; the occasions which produce them; and the modes in which they are conducted. It has been well observed, that "to these little bustling creatures a square foot of earth is a territory worth contending for." And when it is considered how very close different communities bring their nests, we cannot wonder that dissensions should arise, and quarrels ensue. These wars are sometimes civil,—that is, between different parties in the same nest; but they usually are carried on against different species. It will be necessary, however, to discriminate the peculiarities of some, that they may not be attributed to others; and for this purpose we shall take a rapid survey of the habits of the red ant (*F. rubra*) and of the rufous species (*F. rufa* Lin.), as given by Gould and Huber,—the two most unquestionable and veracious authorities on this subject.

(326.) "The red ant," observes Gould, "is the only sort I could ever observe to feed upon their own species. You may frequently discern a party, of from five or six to twenty, surrounding one of their own kind, and pulling it to pieces. The ant thus attacked is generally feeble, and of a languid complexion, occasioned, perhaps, by some disorder or other accident."* Hence our author concludes, that so soon as age or infirmity renders the individuals of a nest incapable of labouring for the general good, the rest set upon and destroy them. However this may be, certain it is that the same peculiarity of instinct is known to be possessed by many of the ruminating quadrupeds. Mr. Kirby says, "I once saw one of these ants dragged out of the nest by another, without its head; yet it was still alive, and could crawl about. A lively imagination might have fancied that this poor ant was a criminal, condemned, by a court of justice, to suffer the extreme sentence of

* Gould, p. 104.

the law: it was more probably, however, a champion that had been decapitated in an unequal combat. At another time I found three individuals that were fighting with great fury, chained together by their mandibles; one of these had lost two of the legs of one side, yet it appeared to walk well, and was as eager to attack and seize its opponents as if it was unhurt. This did not look like languor or sickness.* It does not appear, however, from the above instances, or from any other notices upon record, that the fact of intestinal wars taking place in the nests of the red ant is sufficiently verified. To us it appears much more probable, if Gould's theory be rejected, that these combats are more of the nature of private quarrels between two or three individuals, differing in no respect from those of other animals, who, nevertheless, habitually live in peace with each other.

(327.) The rufous ant (*Formica rufa* Lin., fig. 82.) is one of the most remarkable of those which make war on their own species. Messrs. Kirby and Spence have given such a lively abridgment of Huber's original account of these proceedings, that we shall quote their words. "Figure to yourself two or three of these ant cities, equal in size and population, and situated at about a hundred paces from each other; observe their countless numbers, equal to the population of two mighty empires: the whole space which separates them, for the breadth of twenty four inches appears alive with prodigious crowds of their inhabitants. The armies meet midway between their respective habitations, and there join battle: thousands of champions, mounted on more elevated spots, engage in single combat, and seize each other with their powerful jaws; a still greater



* Int. to Ent. vol. ii. p. 70.

number are engaged, on both sides, in taking prisoners, which make vain efforts to escape, conscious of the cruel fate which awaits them when arrived at the hostile formicary. The spot where the battle most rages is about two or three square feet in dimensions : a penetrating odour exhales on all sides ; numbers of ants are lying dead, covered with venom ; others, composing groups and chains, are hooked together by their legs or jaws, and drag each other, alternately, in contrary directions. These groups are formed gradually : at first, a pair of combatants seize each other, and, rearing upon their hind legs, mutually squirt their acid ; then closing, they fall and wrestle in the dust : again recovering their feet, each endeavours to drag off his antagonist. If their strength be equal, they remain immovable, till the arrival of a third gives one the advantage. Both, however, are often succoured at the same time, and the battle still continues undecided ; others take part on each side, till chains are formed of six, eight, or sometimes ten, all hooked together, and pertinaciously struggling for the mastery : the equilibrium remains unbroken, till a number of champions from the same nest arrive at once, compel them to let go their hold, and the single combats recommence. At the approach of night, each party gradually retreats to its own city ; but before the following dawn the combat is renewed with redoubled fury, and occupies a greater extent of ground. These daily fights continue, till, violent rains separating the combatants, they forget their quarrel, and peace is restored. In these engagements," observes M. Huber, " the combatants exhibit the greatest fury, being absorbed by one sole object, — that of finding an enemy to attack. What is most wonderful in this history, — though all are of the same make, colour, and scent, — every ant seemed to know those of his own party ; and if, by mistake, one was attacked, it was immediately discovered by the assailant, and caresses succeeded to blows. Though all was fury and carnage in the space between the two nests, on the other side

the paths were full of ants going to and fro, on the ordinary business of the society, as in a time of peace; and the whole formicary exhibited an appearance of order and tranquillity — except that, on the quarter leading to the field of battle, crowds might always be seen, either marching to reinforce the army of their compatriots, or returning home with the prisoners they had taken, — which, it is to be feared, are the devoted victims to a cannibal feast.”*

(328.) The wars of ants belonging to different species, according to M. Huber, generally take place between combatants of unequal size. When the great attack the small, — as in the case of *Formica herculeana* and *sanguinea*, witnessed by M. Huber, — they seek to take them by surprise (probably to avoid their fastening themselves to their legs); and, seizing them by the upper part of their body, they strangle them with their jaws: but when the small have time to foresee the attack, they give notice to their companions, who rush in crowds to their succour. Sometimes, however, after suffering a signal defeat, the smaller species are obliged to shift their quarters, and to seek an establishment more out of the way of danger. In order to cover their march, many small bodies are then posted at a little distance from the nest. As soon as the large ants approach the camp, the advanced sentinels instantly dart upon them in the greatest rage; a violent struggle ensues; multitudes of their friends come to their assistance, — and, though no match for their enemies singly, they prevail by force of numbers, and the assailants are either slain, or led captives to the victors’ camp.

(329.) There is still another kind of warfare carried on by the slave-making ants, — a tribe which, however incredible it may appear, is known to make war upon others for the sole purpose of procuring *slaves*, who literally and truly labour for them, and perform all the daily domestic duties of the community. Nay, more, — to heighten the wonder, most of these slave-dealers are

* Int. to Ent. vol. ii. p. 73.

ruddy or reddish, while those which are captured to become their servants are black ! The whole history — of which we are compelled to give but an abstract — appears so incredible, that few names below that of Huber would be considered sufficiently unimpeachable to satisfy mankind that this “almost incredible deviation of Nature from her usual laws” was actually true. But let M. Huber, the first discoverer of these extraordinary facts, speak for himself. “My readers,” says he, “will, perhaps, be tempted to believe that I have suffered myself to be carried away by the love of the marvellous ; and that, in order to impart greater interest to my narrative, I have given way to an inclination to embellish the facts that I have observed. But the more the wonders of nature have attractions for me, the less do I feel inclined to alter them by a mixture of the reveries of imagination. I have sought to divest myself of every illusion and prejudice, of the ambition of saying new things, of the prepossessions often attached to perceptions too rapid, the love of system, and the like ; and I have endeavoured to keep myself — if I may so speak — in a disposition of mind perfectly neuter, — ready to admit all facts, of whatever nature they might be, that patient observation should confirm. Amongst the persons whom I have taken as witnesses to the discovery of mixed ant-hills, I can cite a distinguished philosopher (professor Jurine), who was desirous of verifying their existence, by examining, himself, the two species united.”* Unfortunately for the British entomologist, none of the slave-making species are natives of this country, although abundant in many parts of the Continent. He will, however, receive satisfaction in knowing that Mr. Kirby, when in France, had an opportunity of completely verifying Huber’s account of one of these species (*Formica rufescens*), whose history, together with that of the red species (*F. sanguinea*), we shall now enter upon, — these being the two which more especially engaged the attention of M. Huber.

* Huber, p. 287. Ent. to Ent. vol. ii. p. 75.

(330.) The rufous or rufescent ant (*F. rufescens* Lat.), as well as the red species, do not undertake these marauding expeditions for the purpose of enslaving adults, but to get possession of the helpless infants of the colony they attack, — that is, the larvæ and pupæ. These they educate in their own nests, till they arrive at their perfect state, when they commence their servitude. The species now under consideration do not go on these expeditions until the males are ready to emerge into the perfect state; and it is very remarkable, that, if any individual attempt to do this before, they are detained by the slaves they already possess, who will not suffer them to proceed. Without this wonderful provision of Providence, the black colonies would soon be extirpated, — for they would be pillaged when they contained only males and females; while their assailants would derive no benefit, since they would find no neuters. It is generally about five o'clock, on a fine, warm summer afternoon, that these expeditions take place. Previous to marching, there is reason to think they send out spies, who return with information of the route to be pursued. They have various preparatory signals, — such as pushing each other with their head or jaws, or playing with the antennæ; the object of which is, probably, to excite their courage, to give the word for marching, or indicate the route. The advanced guard usually consists of eight or ten ants; but no sooner do they get beyond the nest, than they move back, wheeling round in a semicircle, and then mix with the main body, while others succeed to their station. They have “no captain, overseer, or ruler,” as Solomon observes; their army being composed entirely of neuters. Thus all, in their turn, take their place at the head, and then, falling into the rear, make room for others. This is their usual order of march; and the object of it may probably be, to communicate intelligence more easily through the whole army. After wending through the grass for about thirty feet from their nest, they disperse, and, like dogs upon the scent,

explore the ground with their antennæ. The negro colony—the object of their search—is soon discovered; the sentinels of which, keeping guard at the avenues, dart upon the foremost of their assailants with inconceivable fury. The alarm being given to the assailed city, crowds of its swarthy inhabitants rush forth from all the avenues: but their valour is exerted in vain; for the besiegers, suddenly darting forward, compel them to retreat within, and seek shelter in the lowest story: great numbers of the enemy thus enter the gates, while others make a breach in the walls, through which the victorious army marches into the heart of the city. In a few minutes, by the same passages, they hastily evacuate it,—each carrying off in its mouth a larva, or pupa, which it has seized, in spite of its unhappy guardians: thus laden, they return home by their former route.

(331.) There is another community of ants which these marauders attack for the same object; these have been called, by Messrs. Kirby and Spence, the miners (*Formica cunicularia*),—which, being much more courageous than the last, require more caution in the attack. On these occasions, the rufous ants are observed to march in more compact columns; and in what the military term *double quick time*. On their approach to the city of the miners, its inhabitants rush out by millions, and attack them with great fury; but a chosen band of the assailants, watching their opportunity, force a passage through the contending parties, and make direct for the interior, where they seize the larvæ and pupæ, and then retreat as soon as possible: but, on reaching the outside of the nest, they have to defend their prize,—which is often so vigorously contested, that the robbers are obliged to relinquish their booty. These mining ants seem to be a most courageous race,—darting upon their assailants with determined fury, fighting them foot to foot, disputing every inch of territory, and defending their progeny with the greatest rage. When the kidnappers, laden with what they can make off with, retire, they preserve the same

compact order in their retreat as in their advance ; for their indignant enemies will frequently pursue them, and harass their retreat for a considerable distance. " During these combats, the pillaged ant-hill presents, in miniature, the spectacle of a besieged city : hundreds of its inhabitants may be seen making their escape,—some carrying off in different directions, to a place of security, the young brood, while others take care of the females which are newly excluded ; but when the danger is wholly past, they bring them back to their city, the gates of which they barricade," and station a strong detachment to defend the entrances. The assault which Mr. Kirby witnessed in the *Bois de Boulogne*, near Paris, made by the rufous ants upon a colony of the negroes, seems not to have been conducted, on the part of the latter, with their usual courage. The assailants marched rapidly from their nest, in two columns, " all the while exploring the ground with their antennæ, as beagles with their noses, evidently as if in pursuit of game. Those in the van," as Huber also observed, " kept perpetually falling back into the main body. When they had passed this inclosure, they appeared for some time to be at a loss, making no progress, but only coursing about ; but, after a few minutes delay,—as if they had received some intelligence,—they resumed their march, and soon arrived at a negro nest, which they entered by one or two apertures. We could not observe that any negroes were expecting their attack outside the nest ; but, in a short time, a few came out at another opening, and seemed to be making their escape. Perhaps some conflict might have taken place within the nest, in the interval between the appearance of these negroes and the entry of their assailants. However this might be, in a few minutes one of the latter made its appearance with a pupa in its mouth ; it was followed by three or four more ; and soon the whole army began to emerge as fast as it could,—almost every individual carrying its burden. Most of those I observed seemed to have

pupæ. I then traced the expedition back to the spot from whence I first saw them set out; which, according to my steps, was about 156 feet from the negro formicary. The whole business," observes our author, "was transacted in little more than an hour." *

(332.) The blood-coloured or sanguine ant (*Formica sanguinea* Lat.) is the second species of the slave-making race, whose history has thus been given by Huber. It requires, as before intimated, a distinct notice, — from possessing many peculiarities not found in the rufous sort. On the 15th of July, at ten in the morning, our indefatigable author observed a small band of these ants sally forth from their city, and march rapidly towards one of those inhabited by the negroes, — around which it dispersed. The inhabitants, rushing out in crowds, attacked them, and took several prisoners: this seemed to check their proceedings; for those who escaped made no further advance, — apparently waiting for reinforcements; nor did they long wait in vain. Small detachments kept frequently arriving; and, thus strengthened, they turned the blockade of the city into a siege, and once more advanced, — previously detaching more couriers to their city for large supplies of warriors: these spread a general alarm; and a large reinforcement immediately set out to join the besieging army. Yet, rendered prudent by their former defeat, they did not then immediately begin the assault. In the mean time, almost all the negroes, coming out of their fortress, formed themselves, in front, into a compact body about two feet square, and thus awaited the attack. Frequent skirmishes were the prelude to the general action, which was begun by the negroes. Long before success appeared dubious, they carried off their pupæ, and heaped them up at the entrance of their nest, on the opposite side to that of the field of battle. The young females, also, fled to the same quarter. The assailants at length rushed upon the negroes, and, attacking them on all sides, force them to retreat. Thus beaten, the negroes

* Ist. to Ent. vol. ii. p. 79. note.

renounce all defence, and endeavour to save their pupæ, or young ; but they are pursued, and their enemies now strive to possess themselves of the great object of their attack. Many also enter the city, and begin carrying off the young brood that had been left in it. Long chains of contending ants, each assisting his comrade, are now seen contending with determined courage ; and the battle is sometimes even continued during part of the night. Victory at length decides for the sanguine ants ; and, a garrison being left in the captured city, the pillage of the brood is carried on at leisure the following morning. Sometimes the conquerors find their new territory so commodious, or pleasantly situated, — for to these pigmy multitudes a field becomes a world, — that they emigrate to it with all their families. The predatory excursions of this species are not continued longer than a month in the year, during which period they make five or six of these expeditions ; generally travelling about 150 paces beyond their own dominions.

(333.) The subsequent treatment of the ant slaves, thus obtained by rapine and violence, singularly contrasts with the sanguinary conflicts which we have just detailed. In this respect their example reflects disgrace and shame upon those of the human race with whom the slavery of their fellow creatures is still sanctioned : and here, again, is the voice of Inspiration addressed to us, — “Go to the ant ; and be wise.” The young and tender captives — whom it is marvellous should escape unhurt amid all the contentions of the field of battle — are carried to the cells of their new masters, and treated with the same care and attention as the offspring of their lords. So soon as they have reached — may we say manhood ? — “their life is passed in much the same employments as would have occupied them in their native residence.” They are the builders and repairers of the city ; not only collecting food, but attending to the females ; and undertake the proper care of the eggs, which are daily brought within the influence of the warm sun. Nor is this all, — for they

have actually to feed their masters, and carry them about the nest. These diversified labours are generally shared by the negroes and the miners; so that, when slaves have been captured from both colonies, three distinct races will be found in the same dwelling. So indolent are all the habits of the slave-making ants, except when engaged on their predatory excursions, that they appear unwilling either to feed themselves, or even to be at the trouble of walking. They are wholly dependent, in fact, for everything, upon their slaves; and these, in consequence, — as among mankind, — frequently seem to be the masters, and exercise in their turn an authority over them. “They will not suffer them, for instance, to go out before the proper season, or alone; and if they return from their excursions without their usual booty, they give them a very indifferent reception, — showing their displeasure by attacking them; and when they attempt to enter the nest, dragging them out.” To ascertain what they would do when obliged to trust to their own exertions, M. Huber shut up thirty of the rufous ants in a glazed box, supplying them with larvæ and pupæ of their own kind, with the addition of several negro pupæ, excluding very carefully all their slaves, and placing some honey in a corner of their prison. Incredible as it may seem, they made no attempt to feed themselves; and though, at first, they paid some attention to their larvæ, carrying them here and there, — as if too great a charge, they soon laid them down again: most of them died of hunger in less than two days; and the few that remained alive appeared extremely weak and languid. At length, commiserating their condition, he admitted a single negro; and this little active creature, by itself, established order: it made a cell in the earth; collected the larvæ, and placed them in it; assisted the pupæ that were ready to be developed; and preserved the lives of such of the rufous ants as still survived. What a picture of beneficent industry, contrasted with the hateful effects of sloth, does this interesting anecdote

afford! Another of M. Huber's experiments rendered the contrast equally striking. He put a large portion of one of these mixed societies into a woollen bag, in the mouth of which he fixed a small tube of wood, glazed at the top, the other end being fixed to the entrance of a kind of hive. The second day the tube was crowded with negroes going and returning: the indefatigable diligence and activity manifested by them in transporting the young brood and their rufous masters, whose bodies were suspended upon their mandibles, was astonishing. These last took no active part in the busy scene,—while their slaves showed the greatest anxiety about them, generally carrying them into the hive; and if they sometimes contented themselves with depositing them at the entrance of the tube, it was that they might use greater despatch in fetching the rest. The master ant, when thus set down, remained for a moment coiled up without motion; and then, leisurely unrolling itself, looked all round, as if it was quite at a loss what direction to take: it next went up to the negroes, and, by the play of its antennæ, seemed to implore their succour, till one of them attended to it, and conducted it to the hive.*

(334.) On some extraordinary occasions, however, the slaves are carried by their masters. M. Huber notices an instance of the rufous species, who, wishing to emigrate from their own to a deserted nest, reversed the usual mode of proceeding on such occasions, and took upon themselves the task of carrying all their slaves to the new habitation they had chosen. The sanguine ants are more industrious than the others,—as they will assist their negroes in building their nests, and in collecting the honey furnished to them by the *Aphides*. They treat their vassals, indeed, with peculiar affection; for, if their nest is invaded by an enemy, “they show their estimation for these faithful servants by carrying them down into the lowest apartments, as to a place of the greatest security.”

* *Int. to Ent.* vol. ii. p. 85.

(335.) Regarding the slave-making ants of Tropical America, we can, fortunately, communicate a few original notices, which, however imperfect, after those we have detailed, will be so far interesting,—since it does not appear that any author has made known the existence of these extraordinary insects in the New World; and because the sequel will show that, however widely the geographic distribution of these races extend, their general habits remain the same. We must premise, however, that the species found in Brazil are totally different from those of Europe: and it is very probable, when the natural affinities of the family have been worked out, that these slave-making ants will form a distinct and natural group. The reader, perhaps, will be better pleased by a simple extract from our journals, written at the time, than by a more elaborated statement. He will perceive that we were not then acquainted with the true nature of the conflict described. The admirable volumes of Messrs. Kirby and Spence had not then been published; and the foreign works of Huber and Latreille, seventeen years ago, were little known in this country. A traveller, moreover, engaged in exploring wild and uncivilised regions, has no means of carrying or consulting books. But to our narrative.

“Agua Fria, Pernambuco, June 8. 1817. — This morning I was suddenly called by one of my Indians to see a large troop of ants, which were marching in a narrow but compact column towards the steps of the outhouse, where they immediately went into some little holes in the earth, — these being the obvious entrances to another nest. For some little time they continued pouring in their troops into these open gates of their enemies' city, — which they seemed to have taken by surprise, for none of its inhabitants were to be seen outside. Presently, however, the invading party again emerged, and soon the whole column began to make a precipitate retreat. There must, consequently, have been a severe battle in the interior of the nest; for now the besieged ants showed themselves for the first time, coming out

of their own nest, and furiously attacking their baffled enemy. This seemed very extraordinary, — for these little courageous creatures were not more than half the size of their adversaries: Yet it was astonishing to see the determination, and even fury, with which they fell upon them: they got hold of some part of their body, their head, but principally their legs; keeping their grasp, notwithstanding the disproportionate size of their adversary. I did not remark that any were left dead upon the field at the time; but, on tracing the first species (the invaders) to the hole from whence they had at first issued, I observed a great many of them most wofully mutilated. Heads, legs, and bodies were scattered promiscuously along their line of march. The vitality of such as were maimed and wounded was really astonishing; for I observed many, which had actually lost their bodies, still endeavouring to follow the retreating army; while others, which had lost all their legs but two, still tried to hobble after their comrades. The invaders had obviously been beaten off, although several of them carried off the uninjured bodies of the red species; and I observed that these latter were all of a larger size than those which fought at the entrance of their nest, — few or none of which were killed. After these little heroes had thus fairly gained the victory, and driven off their enemies, they began to block up the holes, by which they had entered, with tempered clay, — and in a quarter of an hour not an orifice was to be seen. Leaving these, I again turned to watch the movements of the retreating army, — which, I observed, had begun another march, entering into every little hole they met with in their road, probably with the wish of discovering some other nest, which they might attack and pillage with more success.”

“In another part of the premises I observed, the same morning, another numerous army, of the same species, marching in the same order through some flower beds; but these were conveying their young, apparently just hatched, carefully between their mandibles, and were

shaping their course in a different direction. I handled several, but they neither stung nor bit my fingers."

(336.) On attentively considering the above facts, there cannot, we think, be any doubt that the invading ants first mentioned were of the slave-making race, who had been completely beaten in their assault, — not having captured a single pupa, although their line of march was strewn with their dead and wounded comrades. But then comes a very interesting question: for what purpose were they conveying away, as if in triumph, the uninjured prisoners they had taken, — all of which were of a larger size than the generality of those who had repulsed them from the nest? This mode of warfare seems to be unknown among the European races, and indicates some peculiarity of economy which cannot, at present, be explained. The second column of the same species may possibly have been a detachment from the same community; or — what is more probable — an army from a different nest, returning from a successful expedition, and loaded with the infant progeny of the nest they had pillaged, and which they were conveying to their own. Not being then acquainted with the slave ants, it was natural for us to conclude, at the time, that these pupæ rightly belonged to those who were conveying them; and whom we supposed were their parents. The passages to which these remarks allude, in the foregoing account, are printed in *Italics*. We regret that no opportunity subsequently occurred for prosecuting our observations on these and innumerable other ants, which swarm in every part of the soil, and which would, of themselves, alone, require the undivided attention of any naturalist. We must now return to the formicaries of Europe, and touch upon another extraordinary part of their history.

(337.) The loves of the ants and the *Aphides* is not a mere poetic illusion, but is founded on the absolute fact of the greatest intimacy and friendship existing between these two families. The reader need hardly be informed that the *Aphides* — or honey-flies, as we

shall here term them—are those little green-bodied creatures which pack themselves so thick and close on the stems of plants—particularly rose-buds—during summer; and often in such numbers as to disfigure the plant and destroy the flower. As we shall speak of these insects elsewhere, it is merely necessary to inform the reader, in this place, that they eject a sweet honey-like fluid, which may be correctly termed their milk. It is this fluid, secreted in drops, which is so particularly grateful to the ants, that they attend on the honey-flies for the sole purpose of gathering it. Linnæus, long ago, observed this,—and truly remarked, that the ant ascends the tree that *it may milk its cows*. This is literally done; for not only do the ants watch the moment when the honey-flies, at regular intervals, eject their milk, but they absolutely possess the art of making them yield it at their pleasure,—or, in other words, of milking them. On these occasions, their antennæ are used as fingers; with these they pat the abdomen of the *Aphis* alternately on each side, moving them very briskly; a little drop of fluid immediately appears, which the ant takes into its mouth. When it has thus milked one, it proceeds to another, and so on, until, being satisfied, it returns to the nest. But the most extraordinary part of these proceedings is the fact that ants “make a property of these cows, for the possession of which they contend with great earnestness, and use every means to keep them to themselves. Sometimes they seem to claim a right to the *Aphides* that inhabit a particular branch or stalk; and if stranger ants attempt to share their treasure with them, they endeavour to drive them away, and may be seen running about in a great bustle, exhibiting every symptom of inquietude and anger. Sometimes, to rescue them from their rivals, they take their *Aphides* in their mouth: they generally keep guard around them; and, when the branch is conveniently situated, they have recourse to an expedient still more effectual to keep off interlopers;—they inclose it in a tube of earth, or other materials; and thus confine them

in a kind of paddock near the nest, which often communicates with it.*

(338.) The most remarkable "cowkeeper" among the ants is a well-known native species, — the *Formica flava*, or yellow ant of Gould. This species is more methodical and provident than the rest, for it usually secures a large herd of *Aphides* within the common nest. The *Aphis* they select for this purpose is called *Aphis radicum*, from deriving its food more especially from the roots of grass and other plants. The yellow ant transports these honey-flies from the neighbourhood, — probably by subterranean galleries, excavated for the purpose, leading from the nest in all directions; and thus, without going out, it has always at hand a copious supply of food. On these creatures they bestow the same care and solicitude as to their own offspring. They regularly moisten the eggs with their tongue, carrying them in their mouths with the utmost tenderness, and giving them the advantage of the sun. "This last fact," observes Mr. Kirby, "I state from my own observation; for once, upon opening one of these ant-hills early in the spring, on a sunny day, I observed a parcel of these eggs, which I knew by their black colour, very near the surface of the nest. My attack put the ants into a great ferment, and they immediately began to carry these interesting objects of their care into the lower apartments of their nest. It is of great consequence to them to forward the hatching of these eggs as much as possible, in order to insure an early source of food to their colony; and they had, doubtless, in this instance, brought them up to the warmest part of their dwelling with this view."* These yellow ants are equally careful of their *Aphides* after they are hatched: for if their nest is disturbed, they carry them into its interior; and, if other ants attempt to make them their prey, they defend them with the greatest fierceness: they have been known, also, to carry them about in their mouths, either to change their pasture,

* Int. to Ent. vol. ii. p. 91.

or for some other object. When it is considered, in short, that from these honey-flies the ants derive almost the whole nourishment necessary for themselves and their larvæ, we cannot wonder at their anxiety about them; since the wealth and prosperity of the community is in proportion to the number of their cattle.*

(339.) In reference to Indian *Aphides*, general Hardwicke confirms the foregoing account in all its details; he further notices a particular large black ant of India, which, with unusually provident care, constructs its nest at the root of the plant upon which its favourite species of *Aphis* resides. We owe, also, to this enthusiastic and distinguished naturalist, a knowledge of the singular fact that the honey-like secretion of the *Aphides*, in some parts of India, is so abundantly cast upon the neighbouring plants, that the natives collect it when dry, and sell it in the country bazaars as a sweetmeat. The General kept some of this conserve, in a tin box, for near eight years, without its losing any of its sweetness.†

(340.) The ants of Tropical America derive their honey from another family of insects; a fact which, being entirely new to science, is now first stated upon our own authority. The numerous and grotesquely formed family of *Membracidae* (fig. 83.) is most abundant in the regions of Brazil, where they supply the place of the *Aphides*, — not one species of which did we discover. Many of these little *Membracidae* live in families of twenty or thirty, all clustered together on the panicles of grasses and the tops of other plants, like the European *Aphides*. These are



regularly visited by parties of a little black ant, which may be seen going and coming to their heads, and at-

* Int. to Ent. vol. ii. p. 92.

† Zool. Journ. vol. iv. p. 115.

tending them with the same sort of assiduity as M. Huber relates in the foregoing account. These may truly be called the cattle of the Brazilian ants; for not only do they furnish them with milk, but most of the species — in imitation of the ox, and other ruminating quadrupeds of that class — possess horns growing out of their heads (*Membracis ensata*, *b*). or are otherwise armed (*Bocydium clavatum*, *a*): while their large abrupt heads remind the entomologist of the physiology of the bull or cow. Our remarks did not extend to the particular mode by which these insects eject their secretion; but the surrounding leaves of the stalk they inhabit are very clammy, like those of plants infested with the *Aphides* of Europe: and the circumstance of their always being attended by ants, places the fact beyond all doubt.

(341.) The emigrations undertaken by ants, when provisions become scarce, or the population of their nests excessive, open a new field for our astonishment and admiration. Sometimes these desertions of their former dwellings are prompted by other and less worthy motives, — for they will be expelled by a neighbouring enemy of their own family, or — like the ambitious rulers of the earth — will themselves become the invaders, that they may possess themselves of the nest of another race, situated more pleasantly than their own. The indefatigable Huber has placed these facts beyond doubt; and as his is the chief authority, we cannot do better than present the reader with the substance of his observations, chiefly made upon the *Formica rufa*, already mentioned.* The first step which is taken on these occasions, is to discover and decide upon the site of the new habitation: this task is assigned to the labourers, — who do it, as M. Huber thinks, without consulting the rest of the society. Having fixed upon an eligible spot, their next business is to make it known to the rest; and they adopt a mode which has been well compared to that of raising recruits for the ser-

* Int. to Ent. vol. ii. p. 62.

vices. "With this view they eagerly accost several fellow citizens of their own order, caress them with their antennæ, lead them by their mandibles, and evidently appear to propose the journey to them. If they seem disposed to accompany them, the recruiting officer — for so he may be called — prepares to carry off his recruit; who, suspending himself by his mandibles, hangs coiled up spirally under his neck: all this passes in an amicable manner, after mutual salutations. Sometimes, however, the recruiter takes the other by surprise, and drags him suddenly from the ant-hill, without giving him time to consider or resist. When arrived at the proposed habitation, the suspended ant uncoils itself, and, quitting its conductor, becomes in its turn a recruiter. The pair return to the old nest, and each carries off a fresh recruit, which, being arrived at the spot, joins in the undertaking; thus the number of recruiters keeps progressively increasing, till the path between the new and the old city is full of goers and comers, each of the former laden with a recruit. What a singular and amusing scene is then exhibited of the little people thus employed! When an emigration of a rufescent colony is going forward, the negroes are seen carrying their masters; and the contrast of the red with the black renders it peculiarly striking. This extraordinary scene continues several days; but when all the neuters are acquainted with the road to the new city, the recruiting ceases. As soon as a sufficient number of apartments to contain them are prepared, the young brood, with the males and the females, are conveyed thither, and the whole business is concluded. When the spot thus selected for their residence is at a considerable distance from the old nest, the ants construct some intermediate receptacles, resembling small ant-hills, consisting of a cavity filled with fragments of straw and other materials, in which they form several cells; and here, at first, they deposit their recruits, males, females, and infant brood, which they afterwards conduct to the final settlement. These inter-

mediate stations sometimes become permanent nests or suburbs, which accordingly maintain a connection with the capital city. While the recruiting is going on, it appears to occasion no sensation in the original nest,—all goes on in it as usual; and the ants that are not yet recruited preserve their ordinary occupations: whence it is evident that the change of station is not an enterprise undertaken by the whole community. If the ants dislike their new city, they quit it for a third, and even for a fourth; and what is very remarkable, they will sometimes return to their original one, before they are entirely settled in the new station: when this happens, the recruiting goes on in opposite directions, and the pairs pass each other upon the road. Huber observes, “you may stop the emigration for the present, if you can arrest the first recruiter, and take away his recruit.”

(342.) Besides these, the ants have certain periodical occupations, according to the season of the year, which are too important and curious to be passed over. One of these is the sort of gymnastic exercise which they take in the spring, upon first quitting their nests after the long inactive season of winter. They usually emerge from their subterranean quarters on some sunny day,—when, assembling in crowds on the surface of their nest, they may be observed in continual motion, walking vigorously over it, and each other, without departing from home; as if their object, before they resumed their out-of-door employments, was, to habituate themselves, as Gould observes, “to the action of the air and sun. These gymnastic exercises continue some few days, and then the business of the year commences.

(343.) It has been generally supposed that the labours of the ant terminate with autumn, and that during winter they remain inactive. But this is a mistake,—for these emblems of industry not only work during every season of the year, but their labours are going on even in the night. Gould affirms, “that they even exceed the industrious bees, for the ant em-

employs every moment, by day and night, almost without intermission, unless hindered by excessive rains." Either Mr. Kirby or Mr. Spence confirm this fact by personal observations. "Having, in the day, noticed some *Aphides* upon a thistle, I examined it again in the night at about eleven o'clock, and found my ants busy milking their cows, which did not, for the sake of repose, intermit their suction. At the same hour, on another night, I observed the little negro ant (*Formica fusca*) engaged in the same employment upon an elder tree. About two miles from my residence was a nest of Gould's hill ant (*Formica rufa*), which, according to M. Huber, shut their gates, or rather barricade them, every night, and remain at home. Desirous of ascertaining this, I visited the nest one morning at two o'clock, and, to my surprise, found the ants at work; some were engaged, as usual, in carrying burdens into their nest, others going out of it, and several were climbing the neighbouring oaks, doubtless to milk their *Aphides*. The number of comers and goers at that hour, however, was nothing compared with the myriads seen during the day. It so happened, that the moon was very bright; so that whether this species is equally active on dark nights, is uncertain. To the red ant it is perfectly indifferent whether the moon shines or not, for numbers of these labour in the night. It is probable that these night workers repose at all hours indifferently, for it cannot be supposed that they are employed day and night without rest."

(§44.) On the roads and trackways of these insects we must say a few words. Every one must have observed that certain species pursue their course in a regular and beaten path, even above ground, — from which they do not wander, except upon extraordinary occasions. Some of these, from their width, may be termed their high roads; while others, diverging in different directions, resemble our lanes or foot-paths. Gould asserts that several of the high roads made by the *Formica fuliginosa* (fig. 84.) frequently extend to a

distance of near forty feet from their nest; but this distance is nothing to those of the red ants of Brazil, which will often be carried, according to our personal observation, to more than one hundred paces in a direct line. From this road, carried in a circuitous direction among the grass and herbage, branch off numerous others,—all leading eventually to the common nest. Both this and other European species remove all obstructions from these lines of communication by biting off the herbage and grass which lie in the way,—so that they may well be said to mow their walks. Huber mentions that sometimes these roadways are not merely formed by the tread of the ants themselves, but are actually hollowed out by their labour.

(345.) The strength and perseverance of these little creatures are truly astonishing. What would be thought of a man who, with another on his back, fully double his own weight, should attempt to climb up a tree? yet such feats will be performed by ants, and with perfect success. We have frequently seen those of America drag off a large dead grasshopper or cockroach, with the assistance of a few of its comrades, to the entrance of the common nest; where it would very soon disappear,—all the labour having been accomplished in a few minutes. Mr. Kirby says, “I have in my cabinet a specimen of *Colliuris longicollis* Lat., to one of the legs of which, a small ant, scarcely a thirtieth part of its bulk, is fixed by its jaws. It had, probably, the audacity to attack this giant compared with itself; and, obstinately refusing to let go its hold, was starved to death.” The same author relates that he once saw two or three ants dragging along a young snake, not dead, which was of the thickness of a goose quill. Nor is their perseverance less remarkable. Professor Afzelius observed a species of ant at Sierra Leone, which march in columns, exceeding all powers

of numeration ; pursuing a straight course, from which nothing can cause them to deviate : if they come to a house or other building, they storm or undermine it ; if a river comes across them, though millions perish in the attempt, they still endeavour to swim over it.

(346.) The perseverance of these insects, it has been affirmed, led to one of the most important political revolutions that ancient history has left us : and as there is nothing incredible in the anecdote, it is worth recording in this place. The celebrated conqueror Timour was once forced to take shelter from his enemies in a ruined building, where he sat alone many hours. While contemplating his hopeless condition, his attention was caught by an ant, endeavouring to carry a grain of corn, larger than itself, up the perpendicular wall. Numbering the efforts that it made before the object was accomplished, he found that the grain fell sixty-nine times to the ground ; but the seventieth time the persevering ant succeeded. " This sight," exclaimed Timour, " gave me renewed courage ; and I have never forgotten the lesson it conveyed."* As a further instance of the unconquerable perseverance of these animals, may be mentioned the fact of their constructing a living bridge of their own bodies. Madame Merian first made known this wonderful economy of ants ; and her apparently incredible statement has been confirmed by the veracious Azara. He informs us that the swampy tracts of Paraguay are inhabited by a little black ant, whose nests resemble conical hillocks of earth, about three feet high, and placed very near to each other. When an inundation takes place, the ants are seen collected or heaped together into a circular mass, about a foot in diameter, and four fingers in depth : and in this state they continue to float upon the water while the inundation continues. One of the sides of the mass which they form is attached to some sprig of grass or piece of wood, and when the waters have retired, the ants return to their habitation. When,

* Quarterly Review, Aug. 1816.

again, they wish to pass from one plant to another, they may be often seen formed into a bridge, of two palms length, and of the breadth of a finger, which has no other support than that of its two extremities. It would naturally be supposed that they would sink with their own weight; yet it appears certain that they do not, and that the masses remain floating during the inundation, which lasts some days.*

(347.) These living bridges are more particularly described by Mad. Merian. One ant lays the foundation by fixing itself to a piece of wood, by means of its jaws, and then remains stationary. With this a second ant connects itself, a third takes hold of the second, a fourth follows, and so on until a long connected line of ants is formed, fastened at one extremity; this floats, exposed to the wind, until the other end is blown over so as to fix itself on the opposite side of the stream, when the last ant effects a landing, and becomes moored to the shore, so that, the bridge being thus formed, the rest of the colony pass over the backs of their comrades, as upon a bridge. We must join the authors of the work so often cited in this section, in their incredulity of such a marvellous narrative; particularly as we know, from personal observation, that Mad. Merian was much given to exaggerate the real wonders she beheld in Surinam; yet the preceding account of Azara invests her story with some degree of probability.

(348.) The sports and pastimes of these wonderful creatures may not be unworthy of our attention, after the many and Herculean labours which we have so long dwelt upon. With this part of their economy we shall conclude their "strange eventful history." M. Huber informs us, that, when their labours are finished, they are very fond of stretching themselves in the sun, where they lie heaped one upon another,—enjoying, with much apparent pleasure, a short interval of repose. Gould also remarks, that they are very fond of basking in the sun; and that, on a fine morning, they may be seen

* Azara's Voyage.

conglomerated, like bees, on the surface of their nests; from whence, on the least disturbance, they will disappear in an instant. In the interior of one of M. Huber's artificial nests, in which he had confined some of this species, he saw some reposing, which appeared to be asleep, while others were variously employed. It seems ludicrous to assert that ants have their gambols and relaxations; but the following authorities, collected from unquestionable sources, are not to be set aside, and we must confess that they really "amuse themselves with games and sports." As we cannot add any original information on this part of their history, we shall give it in the words of Messrs. Kirby and Spence, who combine their own experience with that of Gould, Huber, and Bonnet. "You may frequently perceive one of the rufous ants (*Formica rufa*) run to and fro with a fellow labourer in his forceps, of the same species and colony. It appeared, at first, doubtful what would be the result; but I was soon undeceived, by observing that, after being carried for some time, it was let go in a friendly manner, and received no personal injury. This amusement," says Gould, "or whatever title you please to give it, is often repeated, particularly among the hill ants, who are very fond of this sportive exercise." A nest of ants which Bonnet found on the top of a plant, on a sunny day, amused themselves with carrying each other on their backs, — the rider holding with his mandibles the neck of his horse, and embracing it closely with his legs.

(349.) But the most circumstantial account of these sports is given by Huber. "I approached, one day," says he, "one of the nests of the red ant (*F. rufa*) exposed to the sun, and sheltered from the north; the inhabitants were heaped together in great numbers, and seemed to enjoy reposing in the warmth, — for none of them were working. The whole multitude exhibited the appearance of a boiling fluid, upon which, at first, the eye could scarce fix itself without difficulty. But when I set myself to examine each ant separately, I

saw them approach each other, moving their antennæ with astonishing rapidity; with their fore feet they patted lightly the cheeks of other ants. After these first gestures, which resembled caresses, they reared upon their hind legs by pairs; they wrestled together; they seized one another by a mandible, by a leg, or an antenna, and then let go their hold to renew the attack; they fixed themselves on each other's trunk or abdomen; they embraced, they turned each other over, or lifted each other up by turns, — and then, quitting the ants they had seized, endeavoured to catch others. I have seen some who engaged in these exercises with such eagerness, as to pursue successfully several workers; and the combat did not terminate till the least animated, having thrown his antagonist, accomplished his escape by concealing himself in some gallery." Huber compares these sports to the gambols of two puppies, and tells us that he not only often observed them in this nest, but also in his artificial one. Mr. Spence gives us the following interesting account, as having been witnessed by himself: — "Near Norwich, on a sunny day in May, I observed a large number of ants (*Formica fusca*) agglomerated in crowds near the entrance of their nest. They seemed to make no long excursions, — as if intent upon enjoying the sunshine at home; but all the while they were coursing about, and appeared to accost each other with their antennæ. Examining them very attentively, I at length saw one dragging another, which it absolutely lifted up by its antennæ, and carried in the air. I followed it with my eye until it concealed itself and its antagonist (or rather playfellow) in the nest. I soon noticed another, that had recourse to the same manœuvres; but, in this instance, the ant that was attacked, resisted manfully, while a third was inclined to interfere: the result was, that this also was dragged in. A third was drawn in by its legs, and a fourth by its mandibles. What was the precise object of these proceedings, — whether sport or violence, — I could not ascertain. I walked the same

way on the following morning, but at an earlier hour, when only a few comers and goers were to be seen near the nest: and soon leaving the nest, I had no further opportunity to attend to them.”*

(350.) We must now conclude our history of the ants. If the reader, on commencing this narrative, entertained any latent doubt that everything with which the Almighty has surrounded us was not intended to convey instruction, that feeling must surely have passed away. It is the pre-eminent distinction of the immortal soul by which we are animated, that it can be exalted and refined by contemplating the works of that Being from which it emanated; and these perceptions are followed by the natural consequence of expressing praise and adoration. That which we admire calls forth admiration in proportion as the mind is impressed with the sublimity of the subject. This sensation, alone, is the peculiar privilege of MAN. In vain may we strive to blend reason and instinct. We see animals, the most mean and contemptible to vulgar eyes, endowed with qualities which have every semblance of reason; but there is no reflection and no improvement in succeeding generations: all that gives glory to man, — the cultivation and enlargement of his mind, by which new inventions, new views, and new ideas result, — are altogether wanting. Wonderful as these faculties are, they are limited to those things only which regard the wellbeing of the creature — the preservation and enjoyment of life, and the fulfilment of their destined end. Those higher qualities, those larger expansions, which man, taught by reason and revelation, enjoys, and which instruct him in the knowledge of spiritual things, are denied to all other living beings; for the inevitable consequence of such faculties would lead to the adoration of the Creator. And yet all those practical duties which regard the wellbeing of society, and promote the temporal happiness of the individual, during his sojourn upon earth, may be learned from the

* *Int. to Ent.* vol. ii. p. 195.

humble insects before us. "Go to the ant, thou sluggard : consider her ways, and be wise." But their condition is finite, and their faculties are accordingly limited. Ours, on the contrary, whether in a state of joy or of sorrow, will be for ever ; and therefore our perceptions, as suited to such destinies, extend to the comprehension of immaterial things. The harmonies of nature are as perfect in the moral as in the physical world : powers and faculties are never given where they would be useless. Thus may we learn from the ant, and, considering her ways, become wise.

(351.) 3. We now turn to the family of WASPS, as one of the societies of two families of insects which demand our attention. Their history, indeed, is far less interesting than that which we have just told ; nor can it be compared with what has been so often related on the family of bees ; yet still, although the race is looked upon with an evil eye, we cannot but feel some interest in its proceedings. The wasps, indeed, have been aptly compared to a hoard of thieves and brigands, who seem to live by universal plunder, — devouring almost everything which we enjoy as summer food, and murdering the peaceful inhabitants of the hive. Yet, with all this love of pillage, they are not altogether disagreeable or unamiable ; for they are brisk and lively, they do not usually attack unprovoked, and their object in plundering us is not purely selfish, but principally to provide for the support of the young brood of their colonies.

(352.) The different members of a society of wasps consist of females, males, and workers. Among the first, however, are found two distinct races ; the first of these females are distinguished by a very superior size, being near six times larger than the other ; these are properly called the females, as they produce both male and female eggs : the other race is of the ordinary size, and lay only male eggs. The large females are produced later than the workers, and make their appearance in the following spring, — so that, whoever

destroys one of them at that time, destroys an entire colony, of which she would have been the founder. They are more worthy of praise than the queen bee, for our female wasp busies herself in founding the society of which she is to become the head. She is, at first, an insulated being, that has had the fortune to survive the rigours of winter: when, in the spring, she lays the foundation of her future empire, she has not a single worker at her disposal; with her own hands and teeth she often hollows out a cave, wherein she may lay the first foundation of her city; she must, herself, build the first houses, and produce from her own womb their first inhabitants; these, also, she must feed and educate, before they can assist her labours. At length she receives the reward of her perseverance, and, from being a solitary unconnected individual, in the autumn is able to rival the queen of the hive in the number of her children and subjects. The number of cells in a vespiary — for so are the nests termed — vary according to the species: in the common wasp they usually amount to about 16,000, each of which contains one individual, either in the egg, the larva, or the chrysalis state: and as three generations are raised in each of these cells every year, the number of inhabitants, making allowance for casualties, will amount, at the least, to 30,000. Even at this time, notwithstanding the number of her labourers, the queen mother continues to labour; and thus sets an example to her subjects of diligence and industry. Her life, indeed, seems to be peculiarly precious to her subjects; for if she perishes, by any accident, before the other females are hatched, her subjects cease their labours, lose their instincts, and die. The number of ordinary females in a nest often amount to several hundreds; they become perfect insects at the same time as do the males, — that is, towards the end of summer, — and are found in abundance, as every one knows, during the autumnal fruit season. They then pair; but winter soon comes on, and most of these females perish; the few that

survive remain torpid, in holes and recesses, until spring, — when they again emerge, and commence preparations for founding a new colony.

(353.) The male wasps, although much smaller than the females, are yet double the size of the ordinary workers; they are known at once by their long filiform antennæ, and by having an additional segment to their body. They do not assist in building the nest or in taking charge of their young, yet they perform a very necessary though humble post in the community, — they are, in short, the general scavengers, sweeping the streets and passages, and removing every obstruction; these duties involve the removal of the dead, — in which office they show a singular instinct: sometimes the body to be removed is too bulky for one of them to carry; on these occasions he calls another to assist him, and the work is mutually performed by both. If no assistance, however, is at hand, our wasp proceeds to lighten his load, and very adroitly cuts off the head of the dead body, and after throwing it out of the nest, returns and does the same with the carcase; the labourers appreciate the usefulness of the males; they are not, therefore, like the bee drones, devoted to a general massacre when the impregnation of the females — the great end of their creation — has taken place. All continue to live in peace and harmony, until the end of their days. — which is brought about by the chilly blasts of winter.

(354.) The labouring wasps, as before observed, compose the great body of the inhabitants of a vespiary. It is these who vex and annoy us in summer, by devouring our fruits, and flying in at our windows. We regard them with feelings of decided ill will; but their history will, perhaps, incline us to view them with forbearance, if not with kindness. As it is their duty to collect provisions for the whole community, they are incessantly and pertinaciously intent upon this object, — for they know that not only the lives of their fellow labourers working in the nest, but also the exist-

ence of their helpless young ones, entirely depend upon their exertions. On their return to the nest, they proceed to distribute the food they have acquired with the greatest generosity and impartiality. Their first portion is given to the young brood, as being the most helpless; a part is then given to the females, part to the males, and part to those labourers, who, from having been engaged all day at home in repairing the common dwelling, have not been able to seek it for themselves. The method by which this is done is highly singular and interesting,—the whole being a voluntary act, accompanied, no doubt, with pleasure both to the donor as well as to the receiver. As soon as a wasp that has been filling itself with the juices of fruits, arrives at the nest, it perches upon the top, and, disgorgeing a drop of its saccharine fluid, is attended sometimes by two at once, who share the treasure; these being satisfied, it will sometimes happen that a third is produced, which falls to the lot of others, — and thus all are satisfied. After reading this interesting trait of generosity in the wasp, we cannot help wishing that they were not so very numerous, or that they would be content to receive a *tenth* of our fruit, instead of indiscriminately attacking all. The enlargement and repairing of the nest is another important duty of the workers; and it is extremely amusing to see them thus engaged. Order and celerity are apparent in all parts of the industrious crowd. Each individual seems to have his allotted work, or task, which generally extends to about an inch and a half: he is provided with a ball of ligneous fibre, procured from posts (we have often seen these little woodcutters at this work upon our window shutters); this is carried in its mouth, and is thus ready for immediate use: the mode of working it up need not be here detailed, as it more regards our section on the habitations of animals.* Messrs. Kirby and Spence also remark that the labourers, no less than the males, take

* The limits of one volume have obliged us to omit this section, and several others, on Habits and Instincts.

a part in the cleaning of the cells, and prepare them to receive another egg, after the perfect insect is disclosed and has left it vacant.

(355.) That wasps place sentinels at the entrance of their nests, there is every reason to believe ; Mr. Knight, the well-known horticulturalist, mentions, that if a nest of wasps is approached without alarming the inhabitants, and if all communication be suddenly cut off between those out of the nest and those within it, no provocation will induce the former to defend it, or even themselves : but if one escape from within, it comes with a very different temper, and appears commissioned to avenge the public wrongs, and prepared to sacrifice its life in the execution of its orders. Heat appears to have a great effect on the energies of these creatures ; for, in very cold summers, they are benumbed and die prematurely. In rainy autumns, during which the grounds are inundated, vast numbers of nests are destroyed, as they are generally made in the banks of rivers and canals. As winter approaches, their sanguinary habits of preying upon flies and other insects subside,—as if they were already affected by old age, and knew that it was useless longer to attend to their young, or to recruit themselves at the expense of another's life. We are not informed as to the precise species upon which the foregoing observations were made. This circumstance is to be regretted ; since there is, doubtless, as great a diversity of manners in this family of insects, as in any other ; and what will be true of one, may be totally inconsistent with the economy of another.

(356.) The different HUMBLE BEES are social insects, and come next under consideration. They form an extensive family, and hold a station between the wasps and the true, or honey, bees. Their manners are in unison with this relationship ; for, although they collect honey, and make wax, they do not construct their cells with the same regularity of architecture. Whether this inferiority has originated the name of

humble, or whether *humble* be not a corruption of *bumble* (a name given to them in many parts of England, from the noise they make in flight), appears uncertain. They



are familiar, however, to every observer, by their "gay hairy jackets of yellow and black" (*fig. 85.*), in which they buzz about the gardens and pastures all the summer and autumn. The different ranks of these insects are, as usual, *three*; and they correspond to the wasps in having two races of females,—one large,

and the other small. The larger females are the founders of hives: they emerge in autumn, and pass the winter under ground, in a particular apartment, which, according to M. Huber, is separate from the nest, and rendered warm by a carpeting of moss and grass; but, as there is no supply of food laid in, the insect passes the dreary months of winter in a torpid state. The first gleams of a spring sun call them from their retreat; and, mindful of the future progeny they are qualified to bring forth, they begin to labour on the foundations of a new colony. Besides the care of her infant progeny, the queen-mother is the chief architect in the construction of the cells in which her eggs are to be laid,—which, M. Huber seems to think, the workers are not able to complete by themselves. On this point our authors—Messrs. Kirby and Spence—seem to have fallen into obscurity; because, if, as they assert, "the workers are never known to survive the cold of winter," how can they possibly assist in forming the cells for the reception of the eggs laid by the queen-mother in the following spring? "So rapidly," observes M. Huber, "does the female proceed in this business, that, in half an hour, she will build a cell, fill it with the pollen food, deposit one or two eggs, and, finally, cover them in. The workers—as the most essential part of the community—are first produced; these come forth from

their cells in May and June, while the males and females seldom appear before August. The food assigned to the grubs of the first, consists of honey and pollen mixed ; but such as are destined to become males or females, are nourished entirely with pure honey. It is a remarkable fact, that the instinct of these larger females is not developed all at once. When they are first hatched, in autumn, — not being in a condition to become mothers, — they are no object of jealousy to the small queens, and are employed in the ordinary labours of the parent nest. All this time, the building instinct seems as if it were in suspense, and does not manifest itself until the spring ; then it is that the maternal sentiment impels them at the same time to lay eggs, and to fabricate the cells which are to contain them.

(357.) The small females differ not in size from the workers, — but their office and their instincts are very different. Like those of the wasps and honey bees, these minor queens produce only male eggs, which come out in time to fertilise the young females that live through the winter, and are the founders of the spring colonies. M. Huber conjectures that these also are fed with a peculiar food : they are generally attended by a small number of male suitors, which follow in their train. M. Huber kept a nest under a glass : as he was watching this, upon one occasion, at midnight, he observed the inhabitants in a state of great agitation. Many were engaged in making a cell ; but he observed that the queen-mother, who is always very jealous of her pigmy rivals, came repeatedly to interrupt the work, and drive the labourers away. This, however, was resented ; the queen, herself, was at last driven back by the others, who pursued her to the bottom of the nest, beating their wings with the utmost fury. The cell was then completed ; and two of the lesser females deposited eggs in it at the same time. The queen-mother, however, was not to be daunted ; in a paroxysm of jealous rage, she returned to the newly-constructed cell, chasing away her more feeble rivals, put her

head within, and, seizing the eggs that had been laid, proceeded to devour them with great avidity. The same extraordinary scene was again renewed, and with the same result. After this, one of the small females returned, and covered the empty cells with wax. When the queen-mother was removed, several of the small females contended for the cell with the utmost rage,—all endeavouring to lay their eggs in it 'at the same time, as if conscious that the approaching autumn was hastening the period of their death.

(358.) The size of the males is intermediate between that of the large and the small females; they are to be known, also, by their more lengthened, filiform, and slender antennæ. We learn from Reaumer, that the male humble bees are by no means an idle race, but work in company with the rest in repairing the dwelling; and, probably, like the male wasps, it is their peculiar province to keep it clean and neat.

(359.) The labourers, or working bees, as we have already observed, are the produce of the first eggs laid by the queen-mother in the spring. By this beautiful dispensation of Providence, she is assisted, in a very short time, by a numerous and industrious class of subjects, who aid her in all the various duties of the hive. When an individual grub has spun its cocoon, and assumed the chrysalis state, the workers remove all the wax from it; and so soon as it has attained its perfect state,—which usually happens in about five days,—the empty cocoons are employed to hold honey or pollen. Into these reservoirs the bees discharge the honey they have collected upon returning from their excursions: this is done by opening their mouths, and contracting their bodies. Sixty of these honey-pots are occasionally found in a single nest; and more than forty are sometimes filled in a day. The humble bees, if they cannot get at the honey contained in a flower by its natural opening, will often have recourse to art to effect their object. For this purpose, they will frequently cut an aperture at the base of the corolla, or even

through the leafy calyx, by which that part is protected, that they may insert their long proboscis into the nectary, or that particular part of a flower in which Nature deposits her natural honey-drops.

(360.) Generosity is a virtue among insects scarcely to be expected; yet M. Huber relates the following singular anecdote, which leaves no doubt that such a feeling is known to the humble bees. He observed some hive bees paying a visit to a neighbouring nest of their humble brethren, in order, as he says, either to steal or beg their honey. This happened at a time of scarcity; and the result showed a wonderful good temper in the disposition of the humble bees. The hive bees appear to have pillaged, rather than to have solicited, food; for they had taken almost entire possession of the nest. Some of the humble bees, which remained in spite of this disaster, went out to collect provisions; and, bringing home the surplus after they had supplied their own immediate wants, the hive bees followed them, and did not quit them till they had obtained the fruit of their labours. For this purpose they licked them, presented to them their proboscis, surrounded them, — and thus, at last, by repeated solicitations, persuaded them to part with the contents of their honey-bags. After this, the generous humble bees flew away, to collect, once more, another supply of food. M. Huber asserts that, during this scene, the hive bees never once showed their stings; so that it was obviously persuasion, and not force, that produced this singular instance of self-denial. This remarkable manœuvre was practised for more than three weeks, — when, the wasps being attracted by the same cause (the scarcity of food, we are to presume), the humble bees entirely forsook the nest. The workers among this family, although constituting the most numerous portion of the community, are much less numerous than those in a nest of either wasps or honey bees. They seldom exceed 200 or 300; and those of some species, which live in comparatively small societies, do not amount to more than fifty or sixty.

(361.) The natural history of the bee involves some of the most wonderful phenomena in the animal creation. Of all the countless beings moving on the face of the earth, this little insect is that whose faculties and endowments are only excelled by those of man, the last and best of the Creator's works. From some vague notion, which associates a high degree of perfection and intelligence with corporeal bulk, we feel no uncommon surprise at the sagacity of the elephant, or of any other animal whose instinct seems proportioned to its size, or whose structure, like that of the monkey, assimilates, in some degree, to the structure of man: but to see, in a puny insect, a development of instinct which so closely resembles reason, — when we find that this little creature practises all those moral qualities which man is commanded to perform for the good of society, but which *he* is perpetually violating, — when we witness undeviating order of conduct, persevering industry, perfect subordination, harmony, and unity of purpose, peaceful demeanour, and social affection, all conspicuous in the daily life of a society of insects, — we may blush for the great mass of mankind. We must confess, not only the omnipotence of the Almighty Creator, and His goodness in teaching us wisdom by the works of His hands; but we must also acknowledge, that, did we imitate these silent little creatures, in the peaceful regularity of their lives, our days would be happier, and our lives more tranquil. "Wisdom crieth aloud," not only "in the streets,"* but through the vast expanse of earth and of air. All Nature is replete with instruction to the man of reflection and understanding; her types and symbols connect the material with the immaterial worlds; and happy will he be, who applies them to their destined use. Into this history, however, which would, of itself, occupy nearly a volume, our confined space will not permit us to enter. This is less to be regretted, as Messrs. Kirby and Spence have already used the same materials as we should have had

* Proverbs i. 20.

recourse to, in their deservedly popular and interesting volumes. The immortal works of Réaumer and of Huber, indeed, almost take away from subsequent writers the power of giving any original information on a subject they have so fully and so ably investigated. To those, therefore, we must refer the reader who wishes to consult original authorities.

CHAP. XI.

LUMINOUS ANIMALS.

(362.) Among all the provisions which have been so abundantly made by Providence for the comfort or security of its creatures, none is more singular than the power, which some animals possess, of emitting a phosphoric light from their own bodies,—thus shedding, at will, a radiance through the deepest gloom of the forest, or lighting up the depths of ocean with countless millions of moving atoms, like the spangled vault of heaven on a starlight night.

(363.) This extraordinary property is chiefly possessed, on the land, by the beetles of the glow-worm family; while that which is the most familiar to us is the *Lampyrus noctiluca* (fig. 86.), or common glow-



worm. In Britain, this insect, although not uncommon, is never abundant; but, in Italy there is another species, (we saw them in the greatest abundance round Genoa,) which, during summer light up the dusky night,—decking the earth with thousands of brilliant gems, which sparkle and glisten through the gloom. It was once believed that the fe-

male (a) only was luminous ; but it is now ascertained that the male insect (b) is so likewise, although in an inferior degree : in the males of *L. splendidula* and of *L. Hemiptera*, the light is very distinct, and may be seen in the former while it is flying.* They are all, however, enabled to extinguish or conceal their light at pleasure ; and Mr. White of Selborne seems even to imagine that they put it out regularly between eleven and twelve at night.† Another beetle, of a different genus, the *Elatr noctilucens* of the



West Indies (fig. 87.), emits its light from two little transparent tubercles on the sides of the thorax. So considerable, indeed, is this, that one of our most eminent entomologists, an eye-witness to the fact, observes, that, "carrying it along the lines of a book, I could distinctly read them ; and applying it to my watch, I could,

without difficulty, ascertain the hour."‡ In the West Indies,—but more especially in the island of St. Domingo,—we are told that the natives anciently employed these creatures instead of candles, to light them in their domestic occupations§,—a statement, however, which seems to us very questionable. They are said, also, to be still made use of as ornaments, tied upon the clothes of the young people on occasions of festivity, and thus producing, on a dark evening, a most singular but striking effect.|| Sixteen species of the luminous *Elaters* are described by Schönkerr ; the larger portion of which inhabit Brazil.¶ Besides these, which are all of the coleopterous or beetle order, there is the hemipterous genus of *Fulgora*, which boasts of

* Int. to Ent. vol. ii. p. 411.

† Nat. Hist. vol. ii. p. 279.

‡ Mr. Curtis, in Zool. Journ. No. II. p. 381.

§ Int. to Ent. vol. ii. p. 413.

¶ Zool. Journ. No. XI. p. 380.

|| Id. ibid. p. 415.

several species highly luminous. Among the largest, if not the most extraordinary, is the *F. lanternaria* (fig. 88.), or the great lantern fly of South America.



The properties of this singular insect, we believe, were first made known to the world by madame Merian, who gives the following account of her first acquaintance with it. "The Indians," she says, "once brought me, before I knew that they shone by night, a number of the lantern flies, which I shut up in a large wooden box. In the night, they made such a noise, that I awoke in a fright, and ordered a light to be brought, — not being able to guess from whence the noise proceeded. As soon as we found that it came from the box, we opened it; but were much more alarmed, and instantly let it fall to the ground with affright, on perceiving flames of fire issue out of it, — for, as many animals as came out, so many flames of fire appeared. When we found this to be the cause, we recovered from our terror, and again collected the insects, much admiring their splendid appearance." The light produced by this insect, as it is said, proceeds wholly from the hollow part, or lantern, of the head, — no other part being at all luminous. There is reason to believe, however, that this marvellous account is somewhat exaggerated. Bancroft, however, also avers that this insect is highly phosphorescent. "Two or three of this species, put into a glass vessel," he observes, "afford light sufficient to read by, without difficulty, if they are placed close to the book. Even when the insects are dead, their bodies still afford considerable light,

though it is less vivid than before ; and, if bruised and rubbed over the hands and face, they become luminous in the dark, like a board smeared with English phosphorus.* Nevertheless, it is somewhat remarkable, that, in the whole extent of our travels in the wilds of Brazil,—entomology being our chief object,—we not only never captured the *Fulgora lanternaria*, but we never witnessed any other luminous insects than a few of the *Elater noctilucens*, occasionally sparkling in the woods. *Fulgora lanternaria*, although found in Brazil, is either excessively rare in that empire, or is confined to particular localities.

(364.) The great majority of luminous animals, however, are marine, and chiefly belong to the *Radiata*, or pulpy animals. Among these is the genus *Pyrosoma*, described and figured in a valuable French work.† It is said to present a highly luminous appearance when in motion,—passing through all the colours of a bar of red-hot iron, till, at length, it becomes of what is termed a white heat ; after which it again passes into the colour of red-hot iron, and, from that, gradually declines into its original greenish hue. The length is that of several inches, and its diameter about a fourth or fifth of its length. It is found in some particular parts of the Atlantic, where it is seen in great multitudes.‡ The *Noctiluca marina*, or night-shining *Nereis*, frequently illuminates the sea with a light superior to that emitted by the glow-worm. “ While rowing at night,” observes Pennant, “ I have seen the whole element as if on fire around me ; every oar spangled with them — the water shining with more than ordinary brightness. I have taken up some of the water in a bucket, — seen them for a short space illuminate the whole, and then disappear.” This beautiful sight, indeed, may be witnessed by almost every one who is out at sea, on our own coasts, during summer ; although its appearance is irregular.

* Nat. Hist. of Guiana, p. 44.

† Annales du Muséum National d'Histoire Naturelle.

‡ Zool. Lect. vol. II. p. 126.

(365.) The phosphorescence of the Mediterranean sea has been highly admired by every naturalist who has sailed along its "dark blue" waves. Spix, the Brazilian traveller, had vessels filled with sea water in this state, with which he made some very interesting experiments. Whatever substance was wetted with this water, shone; and the vessels which held it, when shaken, were found to be full of luminous particles. When examined with a microscope, they were found to be of different sizes, some roundish, some oblong, and about the size of a poppy seed: each had, at one end, a small navel-like opening, encircled with from six to nine delicate filaments, which float within the bladder, and with which the animal seems to attach itself to other bodies. In the inside of these bladders there were many other darker spots, of different sizes: the larger ones might either be their spawn, or the remains of smaller animals which they had swallowed. These globular animalculæ, which seem to be the *Noctiluca miliaris* of Savigny, or the *Arethusa pelagica* of Peron, swim in greater or less numbers at night; and appear, to the naked eye, in sunshine, like little drops of grease: they soon died when taken from the sea, and fell to the bottom of the vessel which held them. It is very singular, that when they came near to each other, they seemed to be involuntarily attracted, and then to form compact groups. A similar phenomenon has been observed in the daytime; but this is never witnessed except when the sky is so very much clouded as to darken the sea. Neither are they to be seen in salt water taken up in the daytime; so that they probably sink to the bottom till night returns. Sometimes the sea is covered with luminous balls, as large as a hazel nut, — when every wave, which strikes the ship, enlightens all surrounding objects. There are, also, sometimes, insulated luminous bladders, like fiery balls, a foot in diameter, which rise, singly, above the water; while the striking of the waves together, at a distance from the

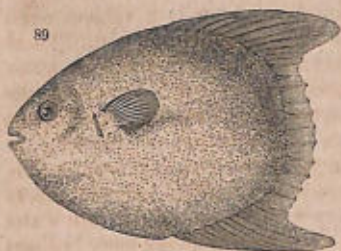
ship, produces a shallow bluish streak of light, like the reflection of lightning upon the water.*

(366.) The luminosity of FISH is a subject upon which, we believe, no author has yet touched. There are strong reasons, however, to believe that very many of these animals possess the power of illuminating the dark recesses of the ocean, if not by the same means, at least with the same effect, as that produced by the minute tribes we have just spoken of. When we consider how many hundreds of species — more especially those which live in deep water — are covered with scales of a rich and shining silver hue, infinitely more brilliant when these fishes are alive and in their native element, than as they are commonly seen after having been caught, it becomes highly probable that the brilliant radiance, with which they are clothed, is to effect some other purpose than mere ornament: and nothing seems more probable than that such families are moving lights in the bosom of the sea, at those depths through which the solar light can scarcely, if at all, penetrate. In favour of this supposition, it may be remarked, also, that the chætodons, the serrans, or sea perches (*Serranina* Sw.), the gobies, blennies, and numerous other groups, — whose bodies, instead of being changeable silvery, are ornamented with vivid, and often dark, colours, — are inhabitants only of comparatively shallow waters, close to the land: whereas such as have few tints, but bright silvery scales, are almost exclusively found in the greatest depths. Nearly the whole of the *Gymnetres*, or ribband-fish, are strong illustrations of this theory. With the exception of the genera of the *Ophidium* and *Cepola*, none of these fishes have any colour on their bodies, or even scales; and yet they are as brilliant and shining as if they were overlaid with the richest silver leaf. The different species of sun-fish (*fig. 89.*), however, according to all writers, are truly phosphorescent, and must illuminate the trackless ocean in a different manner. The thick stratum of

* Spix and Martin's Travels in Brazil, p. 44. 47.

gelatinous substance, attested by Cuvier* as found

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beneath their skin, is, no doubt, the instrument of their luminosity; and Dr. Neil appears to speak from personal observation, when he says that the haddock and herring are likewise phosphorescent. If

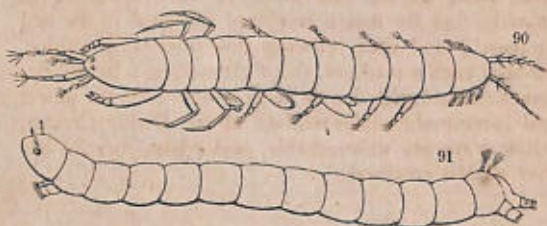
this property can be ascertained after fishes have been drawn from their natural element, and are either dead or dying, how infinitely stronger must they possess it when in the full enjoyment of health and freedom. Could the eye of the philosopher explore the dark unfathomed caves of ocean, and contemplate the wonders that they would unfold, one of these, we firmly believe, would be the enchanting sight produced by the phosphorescence of their inhabitants. In sober truth, we conjecture that the vast expanse of the "mighty deep" is but a counterpart or type of the starry vault of heaven; in this way, — that it is thickly studded with innumerable phosphorescent fishes, and other animals, of different magnitudes and varied brightness, — that these are the moving and living stars which give light to the watery element, at depths beyond the influence of the solar rays; or, it may be, only during the night. All we know of facts, few as they yet are, and all the conclusions to be drawn from them, render a theory like this anything but improbable.

(367.) The learned Viviani, in a most valuable pamphlet, devoted to this subject †, has further ascertained that there exists, even in the Gulf of Genoa, numerous other phosphorescent animals, not mentioned by other writers: of sixteen species which he describes

* Griff. Cuv. p. 569.

† *Phosphorescentia Maris*. Genue, 1805, thin 4to, with five plates.

and figures, no less than eight of these are small shrimps, or crustaceous insects, all excessively minute. The *Gammarus caudisetus* (fig. 90.), for instance, in its natural size, is scarcely larger than a pin's head. *Gam. heteroclitus* is about two tenths of an inch long. Another annulose animal (fig. 91.), which he does not



seem to have described in the text, is a striking prototype of a caterpillar, closely resembling, by its tail, some of the *Sphingides*, or hawk moth tribe. He also includes among the number of these luminous animals, two very small star-fish: the others belong to the *Annelides*, or red-blooded worms, and to the fixed polypes. Thus it would seem that phosphorescent animals occur in all the great divisions of those which are invertebrate, and sanction the opinion that this faculty is given to a far greater number of the inhabitants of the deep than is generally imagined.

(368.) It has been supposed, by two well-known entomologists*, that the luminosity of land insects may be given them as a means of defence from their enemies: we think, however, that this idea is not borne out by analogical reasoning. The chief enemies of insects are birds; and these are at rest at those hours when luminous insects are abroad and active. The owls and the goatsuckers are the only nocturnal birds which feed after sunset: but the former live upon much larger insects than those we have mentioned; while the latter always seek their game at a much higher elevation in

* Kirby and Spence, Int. to Ent.

the air than phosphorescent insects ever ascend to. We are therefore disposed to sanction the poetic idea, as founded in truth, that these emissions of light are tokens of recognition and of love among land insects ; and perhaps, also, between many marine animals. But whatever be the ends proposed, we may feel assured, from what we see and know of other qualities in animals, that the means employed are equal to the end proposed ; and thus, viewing this interesting subject through such a medium, the " glow-worm's light " becomes embued with double lustre,—it reflects the power and incomprehensible wisdom of its Divine Creator, whose ways are unsearchable, and whose mercies are over all His creatures.

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