(Photo : Anderson, Leighton Buzzard)

Dr. M. D. S. ARMOUR

EXHIBITION BUDGERIGARS

By

Dr. M. D. S. ARMOUR

SECOND EDITION

CAGE BIRDS
DORSET HOUSE - STAMFORD STREET - LONDON - S.E.1

Published for "Cage Birds" by Poultry World Ltd., Dorset House, Stamford Street, London, S.E.1, and made and printed in Great Britain by The Marshall Press, 7, Milford Lane, Strand, London, W.C.2

CONTENTS

PART I

PART II

PART III

ILLUSTRATIONS

Photographs, Sketches and Diagrams

Coloured Plates

Part I

INTRODUCTORY

IN MANY FORMS OF LIVESTOCK we recognize two distinct sections, one bred almost wholly for economic or utility purposes and the other for development of show points. That there is no correlation or at least no reliable linkage between such show points and productivity is a well-established fact; the set of a boar's tail or the thickness of his tail has nothing to do with his ability to sire young which excel in the quality of their bacon; the size of a cow's udder has nothing to do with her milk yield and neither has the straightness of her back. The exhibition cockerel is less likely to influence his wives in the production of high-yielding pullets than the common rooster. That there is some connection between show points and performance as a producer has been maintained by pedigree breeders, by breeders who turn out show winners, because it is of economic importance to them to maintain this belief. The faith in the value of show points as a means of increasing the usefulness of producers is without factual foundation.

Fortunately in the budgerigar we are concerned wholly with show points, and, apart from the young which may emerge from them in due course, the eggs laid by the budgerigar hen, her sole production, are of no economic value; we thus do not require to concern ourselves with anything other than show points, and, as a hobby which brings great pleasure and interest into many humdrum lives, the sport of budgerigar breeding and exhibiting is highly commendable. It is not devoid of educational value, and I think much could be done to further interest amongst young people by the inclusion in the curriculum of schools, of elementary teaching in Mendelian inheritance, and, as an example, the budgerigar is probably *the* most useful.

The colours are distinctive and easily recognizable; the bird itself is attractive and easily catered for, and I know of no other cage bird which provides such an instant appeal to the very young. I have many very young children who stop me on the street and say, " Please can I see your budgies some time? " The novice is attracted by the colours and mannerisms, and for a time this meets his requirements; he becomes interested in studying how the birds nest, how they lay their eggs, how they rear their young and how their young develop; for a few seasons perhaps he is engrossed in these repetitive proceedings.

The edge wears off after a bit, however, and I know of few fanciers who keep budgerigars merely to see them in an aviary after a few years. One becomes accustomed to the birds; one grows used to seeing Greens, Blues and Yellows flying around inside wire-netting enclosures, and like everything else familiarity breeds a certain amount of indifference; the breeder no longer watches the birds with his original interest; he takes them for granted; he takes it for granted that they will go to nest when given a box, that they will lay an egg every second day for a week or ten days, and that young will eventually leave the nest, and then he merely has some more budgerigars.

This sort of thing alone becomes monotonous; but there is fortunately something beyond all this, something which yields an interest never previously experienced, something to which there is no limit, in which keenness, rather than becoming dulled by the passage of time, becomes sharpened. The breeder who makes the mere multiplication of budgerigars the beginning and end of his hobby does not experience a fraction of the pleasure obtainable from the full development of budgerigar cultivation as opposed to mere increase of stock.

In most cases the time comes when the breeder visits a bird show and sees on the benches birds which surpass his own; he visits a few more shows and gets to know a number of fanciers; he himself becomes a fancier because he begins to study the Fancy Points, the show points; he listens-in to discussions of head quality, wing carriage, throat spots and feather texture, and he finds his hobby something much more satisfying than he realized.

This was my experience; I kept a few budgerigars for a year or two before I visited a bird show; I used to tame them and had them flying about in the room. I multiplied them until I had to build an outdoor aviary to accommodate the young; I next transferred the breeding pairs into this stock aviary, and there they bred whilst the young were found extended accommodation. I had no thought of anything beyond this side of the hobby until I happened to see a budgerigar on a show bill in town one afternoon. It caught my attention and, having little to do at the time, I visited the show.

I have never forgotten my amazement at the indescribable noise which met my ears when I entered the hall. I had never experienced anything like this in my humble aviaries; to me, a novice, it was almost deafening, and budgerigars, canaries, foreign birds and British songsters can, in the aggregate, create quite a noise. I had a look at the budgerigars; only a few were on show in these days, and only Greens and Yellows, mostly in pairs. They certainly looked much superior to my specimens and I began to wonder why.

I buttonholed a few strangers who seemed to know something about them, asked a lot of questions, and was initiated into the show points of the budgerigar. I was put out of the hall with the last few when closing time came, and from that afternoon I have never ceased to appreciate the vast increase in interest which followed my introduction to the budgerigar as a show bird. I became much keener than I have ever been about anything; I bought every book I could get on budgerigars, studied every drawing, went through my stock with a "fine-toothed comb," and chose the two or three which were in my estimation superior to the rest. I foolishly spent a great deal of money for a year or two after that, buying "winners," "excellent show birds," "pedigreed stock," until I realized that this was leading nowhere. Few of my purchases got into the tickets, and I realized at long last that one does not buy "winners," but that one *can* breed them. In my early years I showed at show after show and never even got within reach of a commended ticket.

Success Cannot be Bought.

It was only when I realized my folly in trying to buy success instead of working towards it that I began to have my birds noticed by a judge at a small show now and again. I have never regretted these early experiences, and I am indeed glad that my career in the Fancy was from the lowest rung of the ladder. Apprenticeship is vitally necessary.

My late father, a retired clergyman, who had bred canaries, British and mules, for several years, repeatedly dinned into me the need for good foundation stock and for the adoption of a correct system of breeding in place of the haphazard one employed by me. Eventually I listened and realized the need for this apprenticeship; I grew in humility and went out in search of knowledge from fanciers who were gaining successes on the show bench; I joined the Budgerigar Society.

I advise every breeder of budgerigars to join the Budgerigar Society. Until he becomes a member of this great fellowship of fanciers he cannot find full satisfaction in his hobby; he has no means of getting in touch with more than a few local fanciers; he cannot have accurate official guidance as to show points and the breeding methods used to establish these in his stock.

In the Budgerigar Society he will meet personally or by correspondence well-known successful fanciers whom he would otherwise never meet; in the

Bulletin he will get a wealth of information and many of the answers to his problems, and he will be contributing to the advancement of the sport.

I still read *Cage Birds* each week from cover to cover, not only the articles but even the advertisements which appear week after week in almost identical form. I go through all the show reports and note the names of those who are successful. Many of them I know personally, and their continued success over many years is a tribute to their high ability as producers of exhibition budgerigars. Many well-known names no longer appear and some will never appear again. Many grand fanciers have passed, but, in their passing, they have left behind them a grand memory of tussles for honours, of stories galore, of real good fellowship.

These old-timers were imbued with the spirit of the sport; their thought was not of financial gain so much as being able to turn out stock which was superior to that of their fellow-fanciers; they had the creative spirit with the minimum of commercialism; they had pride in their achievements not in their pocket-books, and it is comforting to see some of the old names still to the fore when one realizes that this era of commercialism which I deplore is merely a passing phase and that the true fancier will come into his own again when prices return to normal and profits are no longer considered. I feel it my duty to make these assertions as there may be young fanciers who hesitate to take up the hobby under existing conditions of stock and feeding-stuffs.

I advise them not to hesitate if they are keen to start. There is a motto, "It is later than you think," and this should be theirs; they should come into the hobby now and spend a limited amount of their capital on stock, curtail their activities until the time is ripe, and, during this period of limited activity, employ their time in studying the up-to-date show points of the budgerigar, in acquiring a thorough working knowledge of how show points can be emphasized, fixed and reproduced in what they breed. They will gain valuable experience, and even if they show only on a small scale and have little or no success they are paving the way to success in future years.

This book is mainly for those who are finding things difficult, who are having little success on the show bench, who are becoming just a little discouraged and who see no light in the darkness. I say to such, "I honestly believe that, if you follow the advice which I give in the pages of this book, apply it to your own problems, and maintain the spirit which never admits defeat, you will eventually have success which can be maintained all through the years of your hobby."

CHAPTER I

TYPE AND DEPORTMENT IN SHOW BIRDS

IN THE BUDGERIGAR as an exhibition species there is nothing particularly subtle; the show points are distinctive, easily recognizable in the main, and so, to the novice, the main features are capable of easy explanation. There is no need for me to go into a full description of the bird, since nobody is likely to read a book such as this without having had some knowledge of the bird, and there are other books which give detailed descriptions of the budgerigar.

The colours are distinctive and the markings striking; no other bird carries the necklace of jet carried by the green budgerigar, and this striking feature is found in many of the other colour varieties. It is only when the uninitiated is confronted with an unmarked variety such as the Buttercup or the Lutino that he may be pardoned for mistaking a budgerigar for a canary, and this mistake is immediately rectified by a glance at the head of the budgerigar as well as by its mannerisms. It may not emit the "sweetest music this side of heaven," but to the budgie enthusiast no song can equal its lively chatter at dawn and at dusk. One does not have to search for its beauty; this is apparent at first glance, and I know of no person who has seen budgerigars and has failed to be captivated by their charm on brief acquaintance.

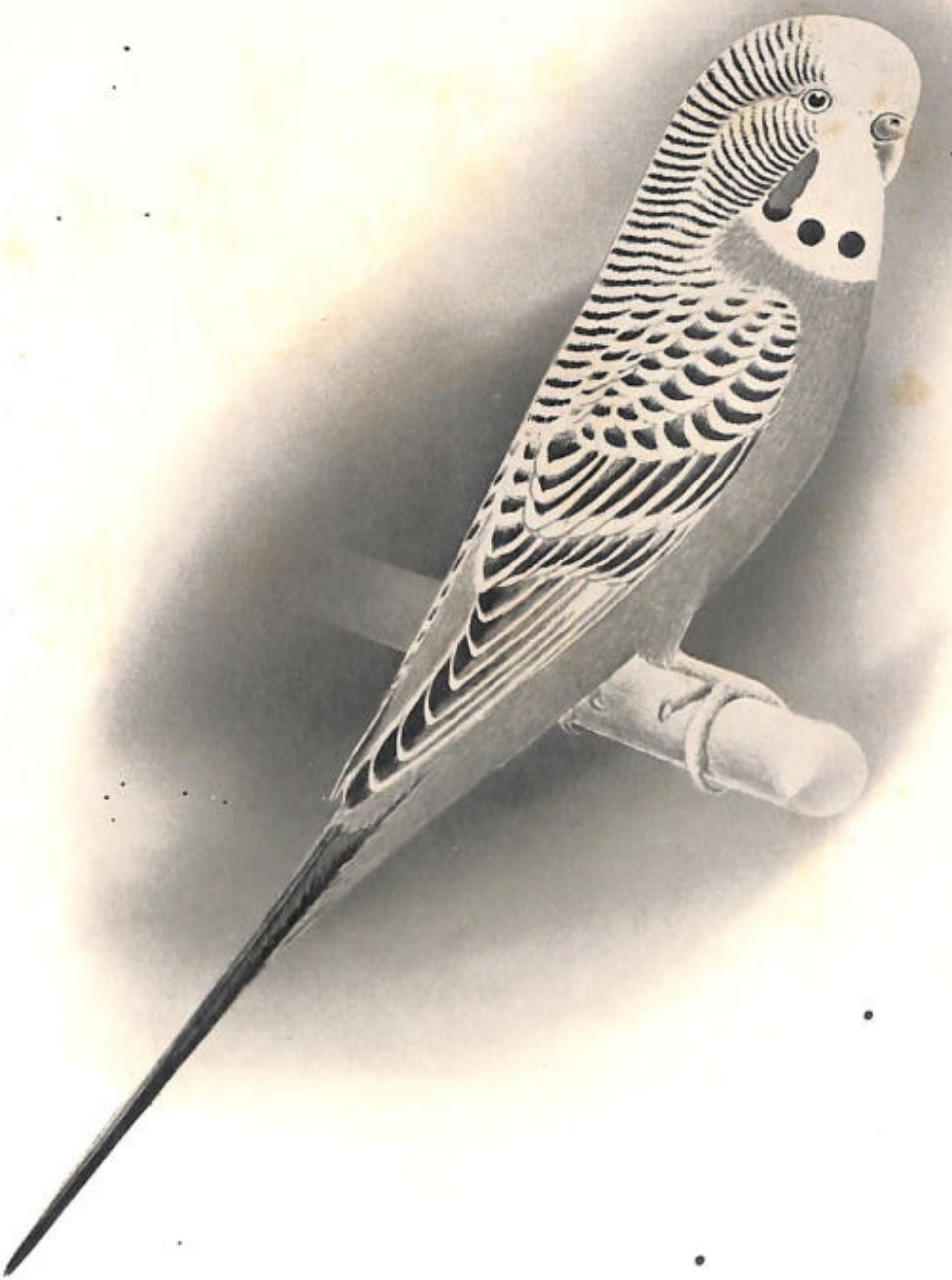
I admit frankly I cannot tell a good canary from a bad one; I can tell a Norwich from a Yorkie or a Border, but I could not pick out a good Goldie from a class, and to sort out Redpolls, Greenies or Twites would be an utter impossibility. I am wholly a specialist in budgerigars, and know very little of any other variety; I am not much interested in any variety other than budgerigars, and am not attracted by canaries or British finches on the show bench; in an aviary, as garden ornaments they are very beautiful, but unless one has enthusiasm and a love which knows no bounds for a bird or animal, one can never attain the complete pleasure which can be his lot; neither can he be successful, and I should put first and foremost that the newcomer to the hobby should limit his activities until he experiences this major urge to create something more beautiful than anyone else possesses. It will come to him in due course, and until he has this constant, daily, weekly, yearly urge and sustained enthusiasm and undying confidence that he *can* create this being, he is not a true fancier; merely to possess such an individual which excels in show points is not sufficient; he must be the creator. To buy an outstanding winner is comparatively unsatisfying, and had I to maintain myself entirely by purchases season after season I should discard the hobby.

Anyone almost could beat my purse, but I believe that I can, when the time comes, regain success which I lost through the war years. I am back to the beginner stage, but with breeding and exhibiting experience which is more valuable to me than many prefabricated winners, and I still have confidence in the future. I believe I carry a reasonably accurate mental picture of what is required, and I believe I know how to establish the necessary show points given reasonable time. If I did not believe that I could effect the necessary improvement in my stock which is little better than average at the moment, I should not write this book; what I have done in the past in a single variety I honestly believe can be done in any variety, and so I commend the views which I shall express to all who require encouragement or who are experiencing difficulties in effecting the necessary improvement in their stock, who are, to put it bluntly, getting nowhere with their present methods.

Successful established fanciers do not need advice; they have the knowledge they require, but I trust that even they may find something of interest within these pages. If they disagree with many of the things I say they are free to do so; I do not ask for approval; I merely state views based on my own experiences in the past, and I make neither excuses nor pleas for approval; this book is utterly personal, honest, and I hope instructive.

The Budgerigar Society, the guiding body in the hobby, have drawn up a standard termed the Ideal Budgerigar in each sex. There is a drawing of the Ideal cock and one of the Ideal hen; the difference is most marked in the head shape. For years I have maintained that the two sexes should not be judged alike, and those who possess that excellent book by Watmough, "The Cult of the Budgerigar,"* will note that many years ago I advocated the adoption of two separate standards. This has come to pass, and it is a great step forward; it would be presumptuous of me to criticize either of the standards, since these have been drawn up by a committee of successful fanciers who have the good of the budgerigar as an exhibition species at heart and as the standards to which we should breed we must accept them. I may criticize from time to time, but it must be realized that what criticism I make

* *The Cult of the Budgerigar*. Watmough. *Cage Birds*, Dorset House, Stamford Street, London, S.E.1.



Reproduced by courtesy of The Budgerigar Society

The Budgerigar Society's Ideal Exhibition Budgerigar Cock

The Budgerigar Society's Ideal
Exhibition Budgerigar Hen

is purely a personal expression of opinion; assertions which I make are based on my own views and have, as such, only a limited value. My desire is to keep this book a personal effort, and I shall make only limited reference to the experiences of others; I stand or fall on the judgment of those who read. If the criticism made from time to time may seem unwarranted may I be forgiven; it is the frailty of individualism.

The Ideal Models should be carefully studied and, applying the description, a genuine effort should be made to visualize exactly what is required. We note the general outline of the cock first, the proportion between head, body and tail, the proportion of the wings, the carriage of the wings, the extent of the mask both in the hood portion and in the bib, the size and spacing of the spots and the relative size and contour of the head, the size and inconspicuous fitting of the beak close to the face, the position and relative size of the eye in the head, the straight, compact tail carried in line, not with the back, but with the body axis, the clearance between the abdomen and the spar, the strong, clean legs and feet, the neck and chest line. This is vitally important and constitutes TYPE, with which I shall deal first.

Balanced Symmetry.

By TYPE we mean symmetry, this proportion between each part and the whole, this balance; without this balanced symmetry no budgerigar is truly an exhibition budgerigar; no matter how wonderful the colour, how big the whole bird, how big the spots; without perfection of outline and beautiful modelling, no budgerigar can be altogether desirable; this is THE MAJOR SHOW POINT, and no budgerigar which carries perfection of shape is a bad budgerigar. It may have other failings, but it is over 50 per cent. perfect if it is the possessor of flawless symmetry. This has nothing to do with size, and here is criticism right at the beginning, constructive criticism, however. The Scale of Points, so far as I can ascertain at the time of writing, still couples size and shape, even putting "size" before "shape," as if it were more important. This is wrong! There is no correlation or interdependence between size and shape. A budgerigar may be perfect in type without being big, and, indeed, I have seen so many big budgerigars which failed in shapeliness that *I even consider that size much beyond the normal detracts from the beauty of a budgerigar.* Until we have distinct varieties as regards size, which I sincerely hope will never happen, we should disregard this suggestion that size has anything to do with shape. Size beyond an officially specified normal should go right to the bottom of the scale of show points, and, although I do not like small budgerigars, although I have been accused of doing so, I contend that it is wholly misleading to suggest, by the coupling of a major and a minor show point, that the two are interdependent. Let us forget about size and push it out of the way; it is not important.

We come next to DEPORTMENT and wing carriage. I have no fault to find with the coupling of these two, if they are capable of being separated. I think good carriage or deportment includes good wing carriage, and you cannot have the former without the latter. An exhibition budgerigar, when in condition and adequately trained, should adopt the *attitude* shown in the drawing of the Ideal, with alert look and stance, close plumage and firmly braced but not crossed wings; the drawing is in regard to stance, in my opinion, highly commendable and a great improvement on the previous Ideal cock. This standard is not, incidentally, a fixed, final, irrevocable standard; it is subject to modification as progress is made.

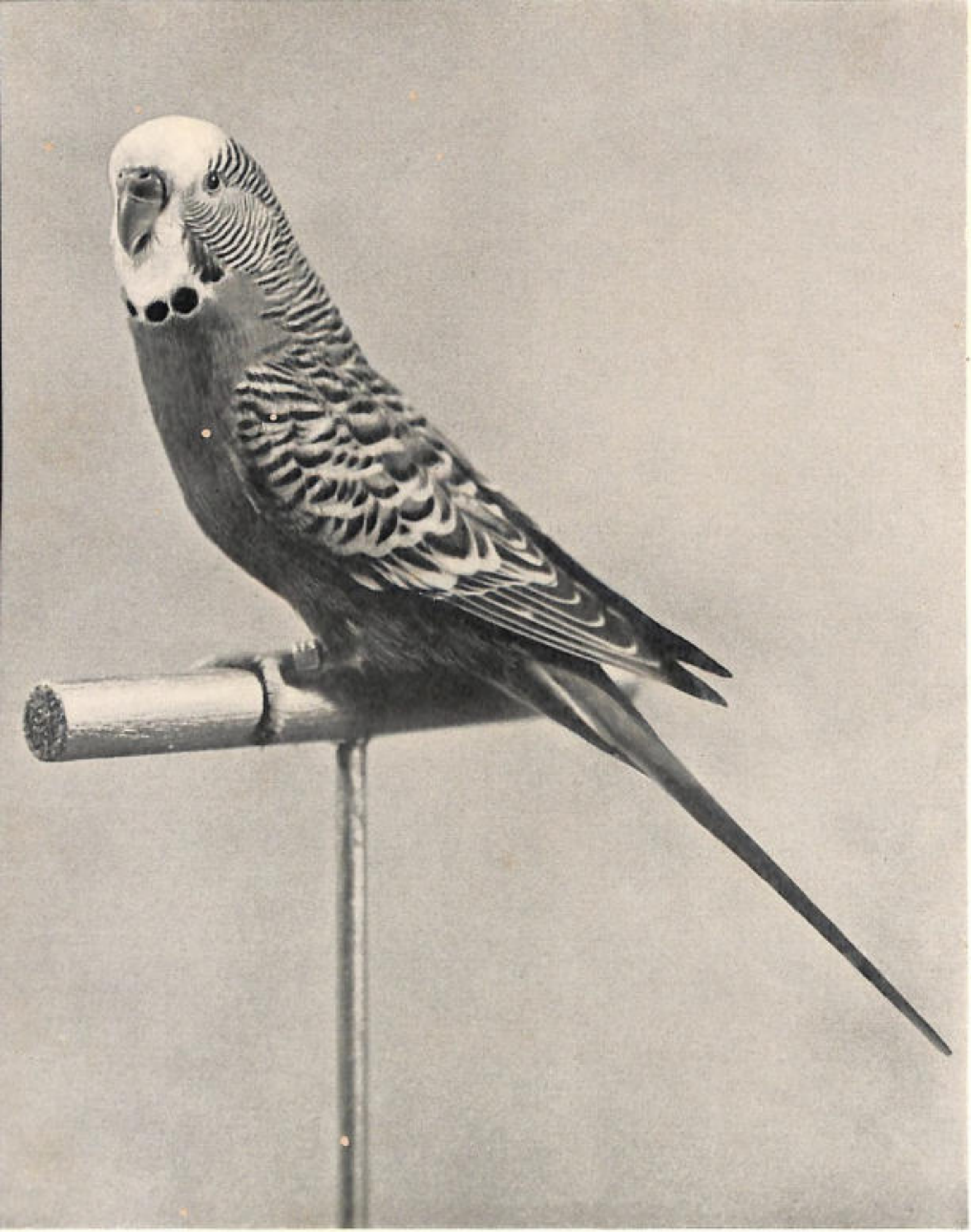
Good Heads Essential.

Size and shape of head is the next feature mentioned in the scale, and, after general symmetry, I consider head quality one of the most important show points in an exhibition budgerigar; as already stated, the differentiation between the two sexes, and the acceptance of the fact that it is not in the best interests of the budgerigar that the two should be judged to a single standard, is one of the greatest steps forward by the Budgerigar Society as a guiding body. The advancement is not so apparent as is the effect which it will have on future stocks; of that I am assured, and it is an acceptance that the part played by the hen is just as important as the cock's part in the perpetuation of highly desirable quality.

A large budgerigar should have a proportionately large head,* but many big birds fail in this balanced proportion. The head should be proportionately large, in keeping with the whole; it should be high in dome in the case of the cock, free from pointedness in the brow region and from flattening in the back-skull; it should be rounded without being round; it should not be flat on top, and there should be a browiness in the frontal region just above the cere, although this need not be so marked as in the case of the hen.

* *Any apparent lack of height in the head in the accompanying plates is due entirely to perspective, the result of placing the camera on a level with the spur, the most convenient position, and its proximity to the bird.*

Showing the correct, confident attitude of the trained show bird; the desired carriage of tail and wings, with the belly clear of the spar.



The trained attitude in a bird of more racy type, a quality which must be preserved in a show bird. Some over-spotting is evident although the spots are fairly even in size, and the wings tips are carried too high.

Viewed from the front, the dome should be high and rounded and, although there should be no narrowing or suggestion of pinching of skull or cheeks, extreme width should not be sought after, as I have found in the past that the effort to get in cocks the extreme width so desirable in the case of the hen, tends to produce a bull-headed top-heavy type of bird, frequently "short-coupled" or dumpy in body. The lateral view of the cock is most important, but as already stated there should be no "wedge-face" appearance from the front. In the case of the hen, the dome need not be so high; in fact, I do not like hens with high domes and particularly hens with rounded domes like cocks. There is a definite correlation between head shape and breeding capacity in the hen, and I have found the high-headed cock-type hens unreliable as producers of good budgerigars. The hen should be definitely browy above the cere; there should be a forward bulge before the upward and backward sweep into the top of the head. The hen's head should be flatter but by no means flat, and the criticism I offer of the drawing of the Ideal hen is to the effect that an *appearance* of flat-headedness has been produced in the drawing by emphasizing the frontal bulge, and this has tended to suggest a pointed head. I think it is the emphasis placed on the frontal bulge which produces this impression of a flat head, but it is the Standard, so let us accept it.

Viewed from the front, the hen should have a very wide head, full cheeks and a browy lateral overhang on each side; the eyes should be barely visible simultaneously from straight ahead, so prominent should this browiness be, and if we can establish this wide browy head in all our hens we cannot fail to produce good budgerigars. Viewed from the side, the hen should have good back-skull and there should be no nipping of the neck.

CHAPTER II

POINTS FOR COLOUR

UP-TO THE PRESENT we have been dealing with features of the exhibition budgerigar for which the allocation of points for maximum quality is uniform throughout all the varieties; for size and shape we have 25 points, for deportment and wing carriage 12 points, and for size and shape of head 23. These figures apply equally throughout the various colour varieties. In column 4 we come to COLOUR, and it is here that no general assessment is possible; no single figure can be made to apply to all varieties, and it is just and right that there should be variation of points value, that more points should be awarded for colour in certain varieties than in others. In Yellows, for example, we have 40 points awarded for colour, whereas in Greens the figure is 15. To attain excellence of colour in a Yellow is more difficult than is the same achievement in a Green in which really bad colour is an exception.

Again, in Yellow-wings and Whitewings we have 18 points for body colour and 18 for wing purity with, in the last column, the allowance of 4 points for mask and spots, making up the total of 40 which is given to colour in Yellows. Whether in Yellow-wings and Whitewings the 4 points are provided for prominence of throat markings, or for freedom from them, I cannot definitely state, but I rather think that the 4 points are for freedom from mask decoration.

Still further down the list of varieties we have an allocation of only 12 points for colour in Opalines, 12 for mask and spots and 1 for wing markings, again making up the residue of 40 points after the 60 for size and shape, deportment, wing carriage, and head quality, have been apportioned equally throughout the varieties.

One may wonder why those who drew up the Scale of Points should provide only 12 for body colour in an Opaline as against 15 in a normal Green; surely body colour in an Opaline is just as important as it is in a Light Green; my reply to that is "Try to work out the Scale of Points in a more just fashion than has been done and then criticize." This I did, and I find it impossible to be any more just in dividing up the points than has been done in the scale. After all, the Scale of Points is for the guidance of breeders and exhibitors as to relative values of show points in the various varieties, and I think that *as a guide* the Scale of Points is excellent. Affairs are in a much more satisfactory state than they are in any other section of the Fancy, and I have the greatest admiration for the way in which this difficult task of indicating comparative values of show points has been handled. In Whitewings, for example, we have 18 points for wing purity, and in Cinnamons, in which wing colour is important, we have the fair allocation of 16 points. Cinnamons have spots, and we are given 14 points for mask and spots, a just award I think: body colour in Cinnamon is not so vitally important as in a Light Green or an Olive, but for this we get 10 points. In general I see nothing wrong with the Scale of Points provided by the Budgerigar Society, and I should advise breeder-exhibitors, those who breed their own exhibition birds, to study the scale carefully and get a clear picture of the relative values of show points in the varieties which they breed. As a guide it is excellent; as a yardstick whereby a judge may " measure " the quality of show birds before him it is useless.

All Weighed Up.

A judge knows instinctively the relative values of show points; he perhaps does not carry the exact figure which applies to any show point, but he knows that head quality is more important than wing markings in any variety and just as important as " size and shape." He appreciates the difficulty in effecting purity of colour in Yellows, and he naturally discards a Yellow which fails badly in colour, not because he deducts 30 or 35 points from the 40 provided for this feature, but because he knows colour *is* vitally important in Yellows.

I have overheard novices discussing these relative values at shows, and it is because I know there is some doubt as to the part played by the Scale of Points in exhibiting budgerigars that I deal with this matter. It plays no part in judging; it is invaluable in the production of show birds and in the selection of specimens which may be acceptable by the judge.

Let us now deal with the varieties on the basis of colour, mask and spots, and wing markings, the three remaining show points. Let us consider the GREEN CLASS, comprising Light Green, Dark Green and Olive. The Light Green and the Olive are true-breeding colour varieties, and the Dark Green is the hybrid between the two and is therefore not a true-breeding variety; neither is it midway between the two in colour depth; I regret the abolition of the old term Laurel for this so-called Dark Green, as it was most descriptive of the correct colour required in this bird; there is no more justification for retaining the term Olive, and we might as well have called this the Darkest Green at the same time. This is merely a passing thought, however, and our concern is with the correct colour in these three subdivisions of the Green Class. In the Light Green the body colour should be bright, even grass green with plenty of sparkle and sheen, plenty of polish in the fully conditioned show bird. The rump colour should be the same bright green, and there should be no flecking or marbling of the colour. It should be neither yellowish nor bluish, just a clean bright green with a satiny finish.

In the Dark Green the shade should be the colour of the leaves of the laurel, and I can provide no better description. It should not be dark and flat; it too should have plenty of sparkle and polish and, like the Light Green, be even in tone throughout body and rump; there should be no flecking with olive or grass green nor should there be a bluish rump colour. In the Olive the colour should be a warm, rich olive colour, the colour of olives I suppose, but only of certain olives; there is more variation in the colour of olives than there is in laurels and, I repeat, there is no justification for abolishing the term Laurel and retaining the term Olive as descriptive of the body colour.

Valuable Colour Charts.

Personally I like the warm, mustard olive colour of good, even depth rather than the harsh bronze colour which frequently carries flecking of green on the rump and lower abdomen. The Budgerigar Society Colour Charts, when available, should assist greatly in defining the desirable colour quality, and I leave it to this organization and its colour committee to lay down the standard as it applies to colour. I have already stated that the standard is not fixed and final, so let us be critically constructive, but let us accept whatever ruling is laid down by the committee in question.

In the BLUE CLASS we have three colour qualities distinct from each other, again the Light, the Dark and the Intermediate; the Light shade is the skyblue, the Dark is the mauve and the Intermediate the cobalt. Just as in the Green Class the dark green is not true-breeding, the Cobalt in the Blue Class is a hybrid between the Skyblue and the Mauve and is not a true-breeding colour; it is heterozygous for the factor DARK. The Skyblue is homozygous for the absence of the factor Dark; the Mauve is homozygous for the presence of the factor Dark and the Cobalt is the heterozygote for this factor.

The Skyblue should be a light, bright even blue, almost a cerulean blue and quite away from any suggestion of cobalt; again there should be the satiny sheen on the plumage and there is no question about the inheritance of this quality; this highly desirable "accessory" show point, if we might refer to it as such, can be bred into a stock. In the absence of this quality, which depends on feather texture mainly, no amount of conditioning and spraying can put on the final polish which is so necessary. Reference to the manner in which this can be bred-in will be made at a later stage in this book.

No matter how much we may admire a Skyblue which tends towards the darker colour, the desirable colour should be definitely light, not a pale washed-out bleached tint, but a definite solid light blue.

The colour in the Cobalt should be definitely cobalt blue; a good solid metallic cobalt free from any suggestion of light flecking and as deep and bright, as intensely blue, as possible; there should be no smudging with mauve or leaden colour and the rump should be free from the common flecking with the colour of the Skyblue. The colour should not be pale on the chest and deepening towards the abdomen; it should be solid and even in depth throughout. It is the colour of the hybrid and it should be possible to breed this colour uniformly even since uniformity in the first cross between two dissimilar true-breeding varieties is the rule in livestock breeding whether the show point being bred for is colour or contour.

No Flecking in Mauves.

In the so-called Mauve the colour should be a sparkling deep pinkish grey, almost a mixture of grey, blue and red; the Standard Colour Charts will define the desirable shade, so I shall make no further comment other than to point out that again the colour should be even in tone over the body and free from cobalt flecking and leaden patching such as we frequently see in specimens which fail in colour. Always look for sparkle in the finished product, the sheen like satin which differentiates the first-class exhibition bird from the ordinary specimen. Breeding for shows is a problem; *one must get the very highest aggregate of show points into the individual which is being benched,* and this sparkle in the plumage will sway the balance between two birds which are otherwise equal and difficult to separate on quality. If the reader would care to refer to the chapter which deals with "Yellow and Buff in Budgerigars" at this stage it might serve to emphasize in his mind the division which exists between the two qualities of feather; the one texture has sparkle and "kick"; the other is by comparison lifeless.

In the VIOLET which finds expression mainly in the hybrid form in the Blue

Class, the body colour should be deep, even, purplish violet, quite distinct from the Cobalt and this intense violet should flow into the rump and tail root. The sparkle which I mentioned should be more evident in this than in, perhaps, any other variety; the violet should simply glow with colour; I cannot express it better than this.

In the GREY GREEN we have a colour which approximates the desirable olive shade, and again I commend the reader to the Budgerigar Society Standard as regards colour for the shade desired in a show bird. In the GREY we have a very beautiful bird, chaste in colour but by no means dull; the body colour here should be a smooth even leaden grey free from all suggestion of blue, but again with a sheen in the plumage; personally I prefer the grey colour to be on the light side as this provides good body/wing contrast; the depth and quality of the body colour varies with the basic colour whether the basic colour be skyblue, cobalt or mauve. The bird may be a pure dominant Grey or a Grey/Blue and the colour quality varies with the recessive which the bird carries.

Of SLATES I have no practical experience and I would refer the reader to the colour chart for the desired shade.

With the exception of some of the newer varieties such as Pieds and Harlequins, this completes the list of varieties which carry full depth of body colour and I have taken them in the given order because to do so simplifies description. The Scale of Points rather follows the evolution of the various show varieties, and no harm has been done by my re-grouping into (a) varieties which carry full body colour and (b) those which, through the action of modifying factors, carry less or have normal distribution affected by their presence.

CHAPTER III

MASKS, SPOTS AND WING-MARKINGS

LET US DEAL with the next show point in these full-depth varieties as this will render more concise the descriptive matter which I shall apply to the remaining varieties. The action of a modifier is to modify colour depth or distribution and so, having gained a mental picture of what is desirable in the full-depth varieties, we shall obtain more easily the picture of the others.

Mask and Spots is the next show point and I would refer the reader to the drawing of the Ideal which depicts the extent of mask and distribution and size of spots which we require in the perfect example of the budgerigar. This picture sets at rest the controversy regarding size and spacing of the spots which has long been maintained. The picture shows that the desirable spots are not the outsize closely packed markings which literally obliterate the intervals on the lower border of the mask. I have never regarded these outsize spots as being desirable and I am glad that definite pictorial ruling has been given on this disputed point. In the drawing of the Ideal hen the spots are larger but not outsize; there are still distinct intervals between the spots and my long-held view that the spots should, in diameter, approximate the spaces is justified by these two drawings.

The mask should be spacious, extending well back over the dome and ending in a definite margin at the commencement of the back-skull. This gives an impression of massive proportions to the head; an abbreviated hood portion or a hood which merges into the striations of the back-skull without a reasonably clean line of demarcation detracts from the apparent quality of the head. The bib portion should extend well down on to the upper chest and end again in a clean cut margin; it should be symmetrical and the spots should be placed near this lower margin. The spots themselves should be round, jet black and uniform in size. They should not be pear-shaped or drop-shaped, as we frequently see, and they should be free from raggedness, as if trimming has been practised. Over the whole area of the mask the colour should be even in tone, free from striations in the hood area, and free from flecking or lacing on the bib. There should be no ticking or spots other than those shown in the drawing of the Ideal on each side of the bib. In the Green Class and in the Blue Class the cheek patches should be violet in colour and in the Grey Classes they should be greyish-black.

With regard to the final show points, wing markings, these should, in the Green Class be black with clean yellow edging; each wing feather other than the flights should be black, and each feather should carry a narrow, regular yellow edging as shown in the Ideal. In the Blue Class and in the Grey Class the wing markings should be black but the feather edging should be pure white. Much of the beauty of the wings of the budgerigar is due not only to the colour of the markings with their striking contrast of black and yellow in one case and black and white in the other, but to the orderly attractive arrangement of the feathers in rows as shown. Irregularity in the feather arrangement or the absence of feathers spoils this neat orderly appearance.

The Yellow Varieties.

Let us turn now to the varieties with which we have not so far dealt; let us look at the YELLOW CLASS; in this class there is only one exhibition variety, the Light Yellow. The Dark Yellow is not recognized as a distinct show bird nor is the Olive Yellow. I think this is merely because good specimens come within the category of Yellow-wings, and as such they are catered for.

I see no object in perpetuating Yellows which are neither good Yellows nor good Yellow-wings, which carry too much body green to be good Yellows and too heavy wing lacing to be good Yellow-wings; we therefore have only the Light Yellow to consider. Taking the show point colour, we have here, along with the Lutino, Albino, and White of Light Suffusion, the only variety whose colour is assessed at 40 points. In the Light Yellow, the Buttercup Yellow as I and many others call it, the colour should be rich deep yellow, free from all suggestion of green; the body colour of a good exhibition Light Yellow should equal that of a good Lutino, and this is the standard of purity at which we should aim. It can be done; there is no doubt about that, and the time will come when no Lutino can be claimed to have greater purity in body colour than that of a good Light Yellow. We must not forget that, as an exhibition bird, the Buttercup Yellow has been neglected; its progress was halted by those who tried to improve its colour by using cinnamon; the sparkle was lost, and it is only now slowly returning to its place as the finest of all exhibition varieties, the most difficult to breed, the most difficult variety in which to establish and fix the necessary colour purity. I am glad to state that Yellows are already back on the road to their pre-war excellence. As a show variety they are regaining favour and there is no variety which has given me so much pleasure and satisfaction to breed as has the exhibition Light Yellow. The highest skill in selective breeding is required; there can be no let-up at any time and, if one has the urge to do the really difficult things in budgerigar breeding, let him take up the breeding of Light Yellows.

There are two colour depths which come within the category of Light Yellow, the pale lemon-coloured birds, usually rather large and somewhat coarse in feather, and the deep rich buttercup. The reader should once more refer to the chapter on "Yellow and Buff in Budgerigars," where he will find the Light Yellow used as a striking illustration of this division into two qualities within a class—also to the coloured plate. Only the deep rich, true Buttercup is the exhibition bird, and breeders should strive to maintain this rich depth of colour and keep it free from all trace of green. Mask and spots rightly get no points; the exhibition Yellow has neither. Wing markings likewise are not provided for, complete freedom from green on the wings being the standard of perfection. Exactly similar statements apply to the Lutino.

Temporarily Out of Favour.

The Albino should be equally pure, but white. The standard for the White of Light Suffusion is that for the Light Yellow; the White of Light Suffusion should be as nearly pure white as possible but, of course, black-eyed, not the red-eyed Albino. Cinnamon has again been used in the production of Whites of Light Suffusion, but I have failed to see many of these specimens of late and I do not consider a serious attempt has yet been made to produce these birds as a distinct variety for the show bench. Likewise the Albino seems to have fallen from favour—I trust only for the present. There is just as great an opportunity to improve the Albino as there was in the case of the Lutino and there is no question about the advancement which has been made in Lutino breeding. Although it is not one of my favourites I admire the skill which has been necessary to effect the improvement and hope that the Lutino will long remain a prominent show variety. I trust the Albino will take its place alongside in the near future.

We come next to WHITEWINGS and YELLOW-WINGS including WHITES of DEEP SUFFUSION; only the Whitewings and Yellow-wings are true exhibition varieties and I shall confine my remarks to them. The ideal Whitewing should have wings of snowy whiteness with body colour of normal depth: blue, cobalt, mauve, violet or grey; the reader might well study the coloured plate which depicts a Whitewing Cobalt hen for the standard in this variety. There should be striking body/wing contrast, and this is the main show point as I see it in this variety. The same applies to Yellow-wings in which the wings should be pure rich yellow and the body deep rich green. Much can be done yet to improve these two show varieties and really good specimens are incomparably beautiful; were I to take up any variety other than the Buttercup Yellow in which it was so vitally necessary to practise selective breeding and effect fixation, I should certainly adopt Whitewings and Yellow-wings as being the next most attractive. They are exactly at the opposite end of the scale from the Buttercup Yellow yet the same breeding principles are employed.

Possibly the Yellow-wing Light Green and the Whitewing Cobalt are the best examples of exhibition birds in varieties where body/wing contrast is so necessary for perfection. In both the body colour is brilliant and full of sparkle and good examples are probably the most decoratively beautiful budgerigars in aviary or cage. There is a wonderful opportunity for the skilful breeder who is not afraid to face up to and overcome early difficulties. The coloured plate shows what should be aimed at; the breeder who attains this perfection will be well repaid for all his efforts.

Greywings, Cinnamons, etc.

In the GREYWING CLASSES our standard should be midway between full colour and zero; the wing markings should be exactly half the depth of the normal wing markings in Greens and Blues; the body colour should also be approximately half the depth of the normal; the markings on the wings should therefore be grey, not green as in a bad Yellow. The body colour should be similar in quality to that of the full colour depth bird, but only 50 per cent. of the depth. The factor is a dilution modifier and only 50 per cent. of the normal all-over colour depth is desirable.

In the CINNAMON CLASSES, we have again this 50 per cent. depth of body and wing colour, but in this case the modifier is Cinnamon, which operates both as a dilution factor and as a colour modifier; the grey wing markings of the Greywing become brown under the influence of cinnamon; the body colour is changed to a less extent; the throat spots, grey in the case of the Greywing, in the Cinnamon become brown; the shafts of the feathers, grey in the case of the Greywing, become brown under the influence of cinnamon, so we have the standard as being midway between normality and zero so far as depth goes and brown where, in the normal, the colour is black. The wing markings become brown on a yellow ground in the case of the Cinnamon Green and brown on a white ground in the case of the Cinnamon Blue while the body colour resembles that of the Greywing. FALLOW is a variety of which I have no practical experience so I must refer the reader to the standard for this variety.

PURE YELLOW RED-EYE and PURE WHITE RED-EYE have been dealt with under the titles Lutino and Albino and further comment is unnecessary.

In the OPALINE CLASSES we have the effect of a body-colour diluting factor together with a colour-distribution factor; the body colour is paler than in the normal varieties and it has a brilliant sheen in a good specimen; each wing feather is margined with green in the Opaline Greens and with blue in the Opaline Blues, whilst the yellow and white of the hood portion of the mask in each case extends back into the neck and down the back between the shoulders to form the highly prized Vee.

Beautiful Coloration.

Usually the white of the hood merges into a bright light blue on the back-skull and back of the neck, and this area should be free from striations. In the Opaline Greens the yellow of the hood merges into a lovely irridescent green on the back of the head and neck, and this colour is carried down into the Vee. The reader might with advantage refer to the coloured plate which shows an Opaline Light Green cock and an Opaline Cobalt hen. The picture specially shows the two aspects of this variety to demonstrate the colour depth and the colour distribution on the back. Opalines are, at the present time, great favourites and are certainly brilliant, showy birds both in cage and in aviary; they usually carry very prominent throat spots. I think the wing markings are more intensely black than in other varieties, but this may be due mainly to the contrast provided by the dilute body colour.

The Opaline Grey is a really lovely bird and deserves to be more widely cultivated as also does the Opaline Violet.

In the GREY CLASS the wing markings are intensely black as also are the tail feathers and spots. The shade of grey which is approved will be evident from the colour charts and should be accepted as the standard for which to breed. In Grey Greens we have a distinct modification of the green body colour by the operation of the grey factor. Grey Greens looks rather like Olives except that the cheek patches and tails are black.

The YELLOW-FACE is still another bird in which a modifier is at work. Although its presence is most evident in Blues, Cobalts and Mauves and the modifications of these such as Opalines Blue, Cobalt and Mauve, we can have the factor present in Greens in which it does not find clear visual expression since the face is already yellow. In many Yellow-faces, Blue, Cobalt and Mauve the yellow colour is unfortunately not confined to the mask area as it should be, but we find the yellow suffusion flowing into body and wings giving a pale greenish colour to areas which should be blue and black. Personally, as it is dominant to normal, I consider the Yellow-face factor to be a highly dangerous one to import into a stud of birds of normal colour; since it may be present in a Green without showing itself, and as it is a dominant it can become disseminated throughout the entire stock. I consider it a modifier which is dangerous and difficult to control; it is something for the specialist in one single variety. Admittedly it is a beautiful bird, but I feel it necessary to point out the dangers which attend its introduction into a stud of normal birds; if these dangers are appreciated and steps taken to isolate this variety from normal stock so that no single bird bred from Yellow-faces is brought into the normal strain, there is no reason why this variety should not maintain its popularity.

I trust I have dealt sufficiently thoroughly with the standard as it applies to the various varieties to give the reader a fair picture of the requirements in each, and I shall close this section by giving what I regard as sound advice to the breeder-exhibitor—advice which he can take or reject as he sees fit. It is this: Preserve a sense of proportion in everything; maintain no more stock than you can accommodate; spend only as much as you can afford on your hobby; do not be led astray by striving for undue prominence of one or more show points at the expense of any; work up quality all round instead of piecemeal.

Do not accept that enlargement much beyond normal is a show point; it is not, and never will be. Preserve proportion and symmetry in your birds and you have nothing to fear; we all have our fads and fancies but we must never lose our sense of proportion; a clear mental picture of what is required, and rejection of any departure from this, will keep you on a firm foundation.

CHAPTER IV

UNDESIRABLE FEATURES

LET US NOW CONSIDER those things which *detract* from high quality, which spoil the bird as a first-class exhibition specimen. They are many, some inherent and permanent, others of a temporary nature which age or careful management will correct. The former are those which concern us in this chapter; the latter are dealt with in the chapters on housing, breeding and management.

The first feature which in my opinion mars a budgerigar is disproportion between head and body. This is particularly noticeable in budgerigars which are much above average in size, and I for one advise breeders, and particularly those who are relatively inexperienced, to eschew this mythical value of size and concentrate on breeding shapely, vivacious, attractive budgerigars. Were we breeding poultry or turkeys for the table we should possibly have some justification for breeding outsize birds, but where show points are valued in place of bulky body substance we must relegate this bigness to the background. The bird of proportion will beat the larger less well-proportioned bird every time; any attempt to enlarge much beyond the average will result in disproportion between head and body, in coarseness of feather, in general lowering of all-round quality. I have no fault to find with the big well-proportioned bird carrying bright colour, of good carriage and conveying that impression of grace and symmetry which is so necessary, but, until such time as these features are present in high degree in smaller birds generally, we should not seek to regard as a show point something which mars excellence instead of enhancing this.

Lack of proportion, of balance, is therefore probably the most glaring fault in a budgerigar. The next fault which is frequently present is bad carriage, failure on the part of the bird to adopt the attitude required by the standard, failure to stand at the correct angle on the perch, failure to hold its head correctly, failure to carry its wings correctly, misalignment of the tail with the body axis; these are features which can be collectively classified under the heading Faulty Carriage.

As faulty shape goes hand in hand so frequently with faulty carriage, and as symmetry and proportion are so dependent on the bird adopting the correct stance, I feel that it would have been better in the Scale of Points if, instead of Size and Shape, we had Shape and Carriage under one heading. Beauty of shape may be enhanced or marred by carriage, and shape is so dependent not only on the shape of each individual part but on the proportion of one to another that we cannot dissociate shape and carriage; we may have a budgerigar with a big, shapely body but with faulty head or one which, although excellent in body shape and in head quality, yet adopts a crouching stance; we may have an excellent bird of perfect stance which crosses its wings in scissor fashion; we may have a bird of excellent body and head shape and which carries its wings in the approved manner; it may be irreproachable apart from the fact that its tail hangs down. If any of these faults are present in a budgerigar from any angle it is not a shapely budgerigar.

If one is present the bird is not according to the Standard; it is unshapely so, although we have head and wing carriage in other columns, we must wrap up, for the purpose of fault-finding, all things which may mar general shapeliness. A raised rump may spoil an otherwise excellent bird; a hanging tail is one of the most disfiguring faults in a budgerigar; wings which cross markedly and which are held high above the rump ruin the symmetry, and so all these features are to be condemned. Almost all can creep into the stock and only with difficulty be eliminated. The presence of even one should be justification for discarding, as a foundation bird, the fault carrier. There are two faults which would decide me in discarding a bird which carried either.

These are raised rump, giving a twisted appearance to the spine, and hanging tail, and both these faults are directly handed down from parent to offspring. Until a breeder knows how to eliminate these two faults he should discard every specimen which exhibits either fault even in minor degree.

Faults in head shape are again concerned with proportion between the various aspects of the head, height relative to width, position of eye relative to height and shape of dome, size and fitting of beak, size and character of eye, extent of mask in hood and bib areas, freedom from flecking and striation; since these purity and distribution features may make or mar the head appearance, we cannot again dissociate certain features. A bird which carries a finely domed head may have this marred by the presence of striations, or by limitation of the backward extent of the hood portion. A budgerigar cannot have a really beautiful head if its beak juts out and mars the smooth outline and, although the beak is barely mentioned, it can, in itself, mar if not make a good head. One of the worst features in a budgerigar's head is pinching of the face when viewed from the front; the budgerigar with a narrow, pinched face is a miserable specimen no matter how good it is otherwise, no matter how big its spots, no matter how big its body. The next fault is flattening of the crown, and lack of back-skull; we frequently see birds which, when viewed from the front, appear to have excellent heads, reasonably wide and often seemingly high; when looked at from the side they often fail badly; the high frontal is not carried back into a high, sweeping full dome but slices away straight down to the neck; I intensely dislike this type of head, and yet we see it frequently in combination with great size and enormous spots.

I feel that owners set too high a value on size and spots, and this alone is justification for condemning the craze for size *of anything* much above the average until such time as we can breed better all-round birds. Big spots are an attraction to the novice and may induce him to bring into his stock birds which carry very large spots but which fail badly in head quality; were I given the choice between a budgerigar which had excellent head shape but pin-point spots and one which carried "spots like saucers" but which had this cutaway head, I would never hesitate to go for the pin-pointed one.

Matter of Throat Spots.

While we are dealing with this portion of the bird we might run over some of the faults which are not faults in physical contour; these are, as already mentioned, faults in mask shape, extent and purity; we may have small spots, too large spots or irregularly sized and spaced spots; these are all faults as are multiple spots which are so frequently the consequence of striving to attain excessive size of spots. The punishment for this excessive enlargement is duplication, and this entails trimming and weeding of the unwanted, a process which is easily detected though not readily admitted. When I detect a specimen which has been trimmed in the bib area I have no hesitation in " downing " it for an award. I would prefer to have such a bird shown with its full, honest complement of spots even if they are defacements. Trimming is not allowed and it is not difficult to detect; an exhibitor who trims his birds is dishonest and presents an untrue picture of his stock; it is a fake and should be treated as such; were such a bird entered with a catalogue price I should unhesitatingly report the matter as attempted fraud since the purchaser will assess its value on the bird's looks for the moment.

With the aid of a lens it is easy to detect spot-trimming, and this practice should cease forthwith and the penalty for such practice be made so severe that no one will attempt it.

A minor fault in the mask is slight lacing (not ticking) in which each of the lower bib feathers carries a very fine, dark edging; some people tend to admire this or perhaps disregard it; it is not in the description of the Ideal and constitutes a fault; ticking comes under the heading of multiple spots already dealt with. Ticking in the hood portion may be permanent, and I have seen several hens which carried this ticking but which were excellent breeders of non-ticked young. It may be an accident of moulting or it may be a temporary condition due to some debility. It is frequently seen towards the end of a hen's sexual life. It is a fault, and one which detracts from excellence of head quality.

The main colour faults are: Patchiness where uniformity is desirable as the main fault and, where colour quality within a class is an exhibition feature, any departure from the standard as laid down by the Budgerigar Society. It is expected that, in the near future, this organization will publish colour charts which will define exactly what colour is required in each variety. Until these are available we must rely on description of the faults. I shall take each colour class by itself and commence with the Green Class, comprising Light Green, Dark Green and Olive.

Colour Faults in Greens.

The main faults in Light Greens are dullness of plumage, lack of lustre and sparkle, green which is either too yellowish or carrying too much blue. The former is termed being too "soft" in colour and the latter too "harsh," and these terms are descriptive of the effect which the presence of too much yellow or blue causes. The green which has too much yellow is rather pale in shade and it lacks the solidity of colour of the correct shade. The green which has too much blue, on the other hand, not only tends to approach the dark green in colour, but even if the blue is present only in slight degree, it looks too cold and again frequently, but not invariably, lacks finish and polish. We frequently see this harshness of colour in Greens which have been bred from Cobalt x Green matings or from matings in which one partner is a Dark Green, i.e., from a mating where the factor D is present on one side or on both.

This is not an invariable rule. I have had, and seen, some excellent Light Greens from matings where the D was present. In order to permit of selection of birds of the correct shade it is advisable that, for production of Light Greens of irreproachable colour the matings should be Light Green to Light Green. For several years during the early thirties it was almost impossible to get Light

A very old cock, long past breeding though still reasonably active. Note the pear-shaped spots which are not at all attractive.

Here is a hen whose chief failing is to be found in her throat-spots. She is grossly over - spotted, and these exaggerated adornments spoil her appearance.

Another example of a much over - spotted bird. Here indeed is clearly seen how a breeder by accentuating any one feature can ruin the balance of a bird's general make-up.

This illustration portrays a hen with multiple throat-spots which are a veritable eyesore. Her other failings are a barred forehead and a mean, narrow face.

Greens which were free from recessives; this was due to the great demand for Blues and other newer varieties; this state has now changed and in place of being regarded mainly as a producer and improver of new varieties the Light Green is probably the finest exhibition bird on the show bench to-day.

In the Dark Green the main colour fault is patchiness and, on the rump, flecking with olive or blue. We frequently see Dark Greens which carry a great deal of deep blue colour in the lower abdomen and vent region. The Dark Green of correct shape and colour is a handsome bird and I regret that so few really good specimens are available to-day. The yellow of the mask should be deeper and richer than in the Light Green. Probably the best mating for production of Dark Greens of the correct colour is Light Green and Olive. Were I to specialize in breeding Dark Greens for exhibition I should certainly choose this mating as it not only tends to produce birds which are fairly uniform but it gives a larger number from which to choose than does the mating of Dark Green and Olive, Dark Green and Mauve or Dark Green and Light Green or Dark Green and Skyblue. Just as the best and most uniform Cobalts should come from the mating of Skyblue with Mauve, so should Dark Greens from Light Green and Olive. I prefer this to the mating of Light Green with Mauve, since the presence of blue in the plumage of the Dark Green is undesirable and it is more likely to be present where a colour recessive such as blue is present.

Olives are difficult.

In Olives we have very difficult birds; it is difficult to state how the best Olives may be bred; in my opinion, and this is purely a personal preference, the colour should be definitely warm, dark but mustard olive, and I used to breed this colour from the mating of Olive with Yellow Olive; it is the presence of the recessive yellow here which gives the warmer tone and I should certainly, if this be the colour which is correct, keep away from the recessive blue in any mating for Olives. As already stated this colour may not be the colour required by the Budgerigar Society, and, if it be that the desirable colour is more harsh or bluish, then the mating of Olive with Mauve would be productive of the required shade. I should certainly keep away from the mating of Olive with Cobalt or with Dark Green, as this tends to cause patchiness.

I have already dealt with colour in the Blue Class, but I think if one follows the principles laid down in the Green Class, using, for the production of birds in the light shade, light to light matings, for birds of the dark shade dark to dark, and for the middle shade, light to dark, one won't go far wrong. This can be applied to many of the other classes and, in the Yellow Class, there is no question as to the correct mating for production of Light Yellows; there is no mating other than light to light.

The main faults in Yellows are due to the presence of green in the body plumage; this is fatal and no Yellow should be used which carries even a trace of rump green. The body should be pure rich yellow of a deep lustrous shade.

In " The Cult of the Budgerigar " most breeders will have read the chapter dealing with the " Yellow and Buff " theory; in this I describe the two qualities of colour which we find not only in Yellows but in all varieties, and, although years have passed since I wrote the notes quoted in this chapter, I have become even more firmly convinced that, to attain the highest success, we must recognize that there *are* these two distinct colour qualities. The deep rich colour may be due to the presence of an intensity factor which is absent from the paler "buff." In addition there is some indefinite linkage between size, type and a few other features, and the presence of this intensity factor which I term the " yellow." I think the term " intensity factor " would be more suitable in the light of present-day knowledge. The Green which has the desirable polish and sparkle in its plumage has this intensity factor; the Green which is larger, rather dull in colour, lacks this factor, and, although, to maintain reasonable size, it may be necessary from time to time to use an occasional big, dull bird, the rule should be to mate together birds both of which carry this intensity factor as shown by the brilliance of their colour.

In the Light Yellow, we employ this theory of linkage between the intensity factor and high polish in the finished article to breed mainly birds which carry this, but we do not discard the occasional big, shapely bird which is too pale in colour, which lacks this intensity factor; it is useful for maintaining reasonable size but, like the outcross, when introduced, its influence should be eliminated as rapidly as possible, and one should get back to the quality of yellow which we require. I should certainly never show one of those big, pale Yellows as they are not show birds; at the moment of writing I do not possess one of those birds, and have not used one for years, so it is almost unnecessary when quality has been established to employ this undesirable colour shade in breeding Yellows. I tend now to regard it as a fault rather than as something which it is necessary to use occasionally. Provided we select carefully, size should not fall off with the repeated mating of birds of the deeper, richer shade, and we have not found this tendency here during the past four or five years, during which time no " buff " has been used.

This sparkle or presence of the intensity factor should be looked for in all varieties, Opalines, Greywings, even in Greys. Only in Cinnamons is it difficult to see how this factor may be used to advantage. In fact, in breeding Yellows I think the use of cinnamon has much the same effect as has the introduction of a buff, a big, pale bird into the stock. Instead of brightening the yellow it dulls it down.

In the wings of the marked varieties we should look for neat, narrow edging, uniformity of shape in adjoining feathers, and a general tidy arrangement; faults are mainly smokiness where black is necessary and irregularity in arrangement, coarse, wide edging of yellow or white. The inner area of green or blue in each feather of the wings gives a high polish to the wings and, although not recognized as a show point in the Standard, it is not regarded as a fault so far as I am aware. I think this could be bred into a whole stock of Greens or Blues.

In Yellow-wings and Whitewings, the main fault in body colour is lack of depth; I think the best body/wing contrast is provided in the Whitewing Cobalt and next in the Yellow-wing Light Green where the colour is really approaching normal in good specimens. I have seen only two in which the body colour was nearly normal, and in both those birds the wings were rich yellow and reasonably free from lacing; it is thus possible, by selective breeding, to produce a bird such as that depicted on the colour plate showing the Whitewing Cobalt.

Solid Colour in Greys.

In Greys, the main fault is patchiness and flecking with blue. There are many Greys which are faultless in colour, however, and there should be no difficulty in establishing the correct purity of colour. Grey to grey would appear to be the most suitable mating, and there should be no need to employ the recessive blue.

In Cinnamons the wing markings should be distinctly brown and not too dark; they should be uniform in pattern and in colour depth. Faults are lack of decision in colour so that, at a few feet, a bird resembles a Greywing, irregularity in depth of markings giving a patchy appearance.

Faults in Opalines are mainly in the distribution of the body colour. One particularly objectionable feature is patchy striation of the back, neck and head.

In Yellow-faces, i.e., in Yellow-faced Blues, Cobalts, Mauves, and the modifications of these such as Opaline Blue, the yellow colour of the mask tends to overflow into the wings and body plumage, creating a greenish colour on the shoulders and upper chest. This is particularly objectionable, and only specimens which have the yellow colour confined to the mask area are really desirable show birds; a breeder of this variety tells me that this yellow colour tends to spread with age, and that the bird which may be perfect at a year may, in two years, have much of the body plumage suffused with this yellow overlay, giving a greenish appearance where blue is the desirable colour.

Although condition cannot be included as a show point, much of the success of a bird depends on careful conditioning. A bird should be entered for show only when in complete plumage, with full complement of spots, in clean condition and with plumage tight and shining. Hens should be in breeding condition with ceres clean, distinct brown; cocks should have smooth shiny blue ceres.

Feet and legs should be clean and free from deformity such as twisted claws, missing toes or lumps.

I have not dealt exhaustively with faults in the budgerigar, but I have given sufficient to indicate the main points which detract from high quality. Most of the faults of shape are hereditary and should be guarded against in the main stock; faults of carriage are likewise, in many cases, handed down by parents, but much can be done by careful training to render less noticeable wing crossing and faulty stance. Spots are not directly handed down to the young, and I feel that the hen plays a big part in transmitting excellence in this show point.

I would ask the reader at this stage to study carefully the pictures which accompany this section of the book; they are not perfect as illustrations, but they are from photographs of actual birds in my stock, chosen specially to illustrate this book, trained for weeks to sit on a special perch in a special cage and under intense floodlights. I may say that the taking of these pictures proved the most difficult part of my whole task. I had to get birds of suitable type to illustrate the text; they had to be conditioned and trained, and they had to be persuaded to stand on a perch about 2-in. in length on top of an adjustable iron rod, this being the only perch available in the cage; I hope that these pictures serve their purpose as illustrations of statements made in the text.

CHAPTER V

GOOD HUSBANDRY PAYS

I SHOULD LIKE to conclude this section of the Exhibition Budgerigar with a few remarks on features which do not strictly speaking fall into the category of Show Points. I regard a show point as something inherent in the make-up of the individual, something capable of being handed down from parent to offspring.

In the section dealing with genetics I discuss show points and the manner in which they may be emphasized, fixed and established in a stock as well as in an individual; mention is made of the part played by husbandry in the attainment of perfection of show quality and, although show points are not permanently affected by external influences, condition plays such an important part in the successful exhibiting of budgerigars that I feel it suitable to deal with this problem, if not fully, in part at this stage.

No matter how good a bird may be, that is, how basically excellent, how much real quality it carries, unless the bird is shown when in condition, the judge who has, after all, the final say in the success or failure of the exhibit, cannot be expected to give an exhibit the justice it deserves when shown in condition, in full bloom and finish.

Husbandry is the first factor which influences visible quality to a considerable extent, and I shall deal with this first. By husbandry I mean the care taken over the bird during its developing period, during the period of its growth from babyhood to full attainment of adult plumage and skeletal growth. If deprived of suitable nourishment during this period it may never attain full stature; if deprived of certain substances it may not attain full health and vigour, and, during the war years, the necessity to use substitute feeding has done much to impair full development of certain stocks where mainly substitute feeding has been the rule. I have satisfied myself that we can breed better, bigger and more numerous budgerigars on canary and millet than we can on persicaria, buckwheat and screenings. Not only are the young better but the parents suffer less from rearing their young.

I have seen birds literally stuff themselves with persicaria, etc., and feed this directly to their young, time after time with scarcely a pause during the hours of daylight. Soaked oats provides some measure of relief from this arduous duty of feeding young, but these are not readily obtainable and so, in spite of all statements to the contrary, in spite of assertions that by supplying bread and milk in addition to persicaria and buckwheat we can satisfactorily rear young birds equal to those which are non-austerity fed, I say that statement is wrong, entirely misleading and just an example of making "facts" fit the situation. Just as the Ministry of Food used to tell us during the days of austerity that, as a nation, we were better fed than ever before; again this was nonsense and just an attempt to gloss over our shortages.

We can rear better budgerigars, bigger budgerigars and healthier birds on canary and millet than on anything else, and now that the seed position has improved I have reverted to pre-war feeding, and although I may provide persicaria in a small dish, I shall be surprised and disappointed if any of my birds touch this stuff. I have tried it with a few pairs and, so long as canary and millet are available, the other remains untouched, and I prefer to trust the birds to know what is best for them.

Not only does suitable, or perhaps more correctly palatable, feeding play a big part in growth, but it also, I feel sure, influences advantageously the final conditioning and fitness so necessary for the show bench. Birds which have to travel in small cages in closed boxes, frequently over many miles, and which have to spend two, and often three, days in close confinement with the attendant excitement of the show hall, must be physically fit, and as a necessity for the highest degree of fitness, at least several weeks of good quality feeding has to be provided. I had a letter recently from a fancier friend in Calgary, Alberta, and there it is frequently necessary for birds to travel several days to one of the big shows, to remain a day or two at a show, and then do the return journey in cramped quarters. Fortunately we do not have to contend with such conditions in this country.

I recommend that, for at least three or four weeks prior to the commencement of the show season, birds which show promise should be given liberal amounts of canary seed and, if obtainable, white millet in addition to any substitutes used; so much of the final fitness depends on this that I should keep my birds at home rather than have them put to the strain of shows under austerity feeding conditions. As I value my stock much more highly as breeders than as show birds I am more concerned with having them fit for the breeding season than for any other purpose. When I show I do not show birds more than once as a rule during the season; if a bird has been at a show for two or three days, I feed it liberally on its return, and, after allowing it exercise in a large cage or pen, turn it into the stock flight where it has ample opportunity to recover from the effects of confinement and travel. To use the same stock week after week right through the season, and then expect these show birds to breed healthy young and themselves remain fit, is asking too much of a bird whose natural state is so vastly different from that imposed on it by being caged.

Good Feeding and Cleanliness.

Feed the show stock liberally before the show season and right through the period of caging and, whenever possible, allow the birds flying space in a large aviary for some weeks before the breeding season begins. I know this is the practice of many, but it is not a general observance. Apart from feeding the birds well they should be kept clean; their cages or compartments should be kept clean; and this again is justification for dispensing with substitute feeding, which is anything but clean. If one sprays birds and returns them to cages which contain persicaria and other rubbish, there is every likelihood of the plumage being soiled. The only way to obviate this is either to use a drying cage which is electrically heated and which hastens the process, or place the bird in a clean cage without food for an hour before returning it to its substitute feeding.

This is particularly evident when one attempts to condition the light-coloured birds such as Yellows and Whites. I have had Yellows beautifully clean until I sprayed them and returned them to their cages; the following day I have seen them with soiled plumage, dirty heads through rubbing them on the dusty wire fronts, and all this due to using seed which is almost black in colour and which, even if free from dust when provided, is, during the course of shelling, productive of dust which settles on the wires.

Fortunately I live in a locality where the air is absolutely pure, free from smoke and dust, and there is no occasion even to spray the birds when they are taken from the flights. In industrial areas it is sometimes necessary to hand-wash the birds to keep them clean, and I certainly think I have much to be thankful for when I consider the lot of my fellow-fanciers who have such adverse conditions with which to contend. The fact that such fanciers can turn their birds out in spotless condition is worthy of the highest admiration and proof of the love and consideration which they have for their stock.

Even spraying should not be overdone, but it does play a small part in final conditioning; it tightens the plumage and, provided it is not overdone and stopped for a week before the show date, it helps the lie of the plumage and does not remove the natural sheen which overspraying may do. Nothing should be put in the clean, cold water (rain water for preference), and this should be administered as a fine spray and not as a jet.

Blotting paper may be used on the floor of the cage during the drying process, and, when available, is a safeguard against soiling of the wing-tips and tails of the light-coloured birds.

A difficulty experienced by most fanciers at some time or other is the habit which the birds have of climbing on the wire fronts; this may result in broken tail feathers or in ragged wing-tips. It may be difficult to overcome this, but one adaptation may be made which will discourage such climbers. Inside the wire front one may place a sheet of celluloid which reaches within an inch or so of the top of the front. This should be attached to the front with small loops of copper wire and is a certain cure for a persistent climber; one should remember that ventilation is necessary and therefore there must be a space at the top of the front and preferably also at the bottom, although I have not found this vitally necessary; a few falls on the cage floor will do the bird no harm and it will soon learn that it is better to stay on the perch. Two or three days will cure a climber of this bad habit, and it also saves the plumage from damage before being sent to a show. This procedure should not be adopted unless it is necessary, and its use should be limited to the few birds which show this habit and which are difficult to cure by normal training.

Some birds have an annoying habit of leaving the perch and crouching in a corner of the cage floor as soon as approached. It is useless to attempt to lever such a bird off the floor with the training stick and force it on to the perch. It will be noted that the top of the show cage slopes down from front to back, and it occurred to me on one occasion that I should make life as uncomfortable as possible for such a miscreant. I removed the seed and water dishes, turned the cage upside down and set it on the rack inverted. I stood back to study the effect.

The bird still left the perch when I approached the cage, but ultimately it decided that the sloping floor devoid of hiding places was less pleasant than the perch. This has now become standard practice, and it is a reliable cure for this form of misbehaviour.

Careful training and careful conditioning by suitable feeding and judicious spraying may make all the difference between a bird being well up in the cards and being out of the tickets; I feel it necessary to point out that although the basic necessity is the possession of show points, these can be enhanced by the fancier himself. There is an art in breeding show birds and a still greater art in conditioning. The combination of the two in a fancier makes him successful.

The purpose of this section of photographs is to show how deformities are handed down from parent to offspring. Above is a bird with bad head shape, a hump on its shoulder and faulty wing carriage, to say nothing of multiple spots. If bred from, a large proportion of its young would manifest the same ugly characteristics.

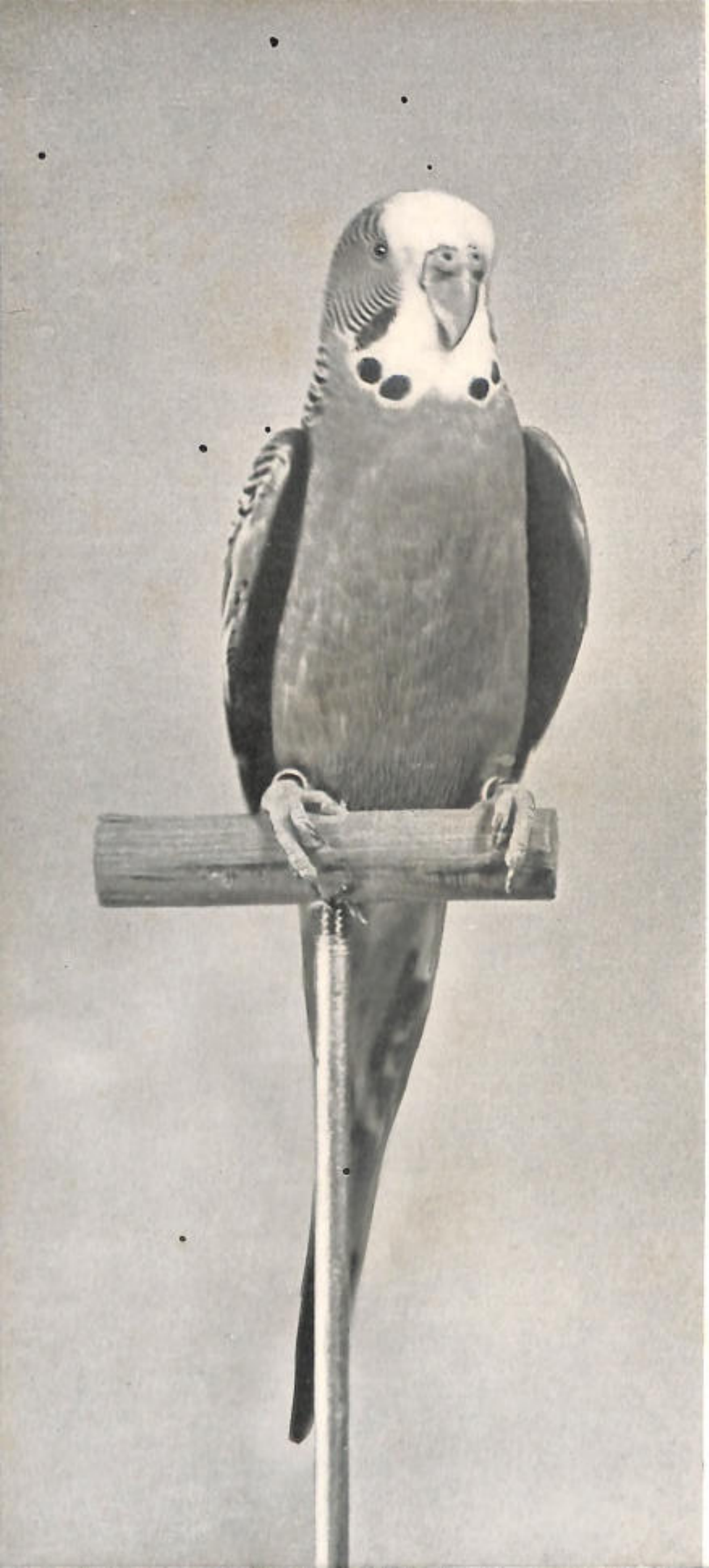
HEREDITABLE DEFORMITIES

Possessing two gross deformities—a raised rump and a badly dropped tail—this cock passed on his defects to his progeny, including two of his daughters, seen on the opposite page.

(Above). Daughter No. 1 whose outline is entirely spoilt by reason of the fact that she has a twisted rump which in turn has brought about ugly wing carriage.

(Top right). Daughter No. 2 with similar deformities which render her most displeasing to the eye. In this hen, wing carriage is exceedingly bad.

(Alongside). A granddaughter of the deformed cock shown on the opposite page. By careful selection her grandsire's defects have been eliminated and her back and wings are normal.



FEELING THE HEAT

An apparent deformity, the wings being carried in an abnormal fashion well away from the body. Actually, however, the best Budgerigars manœuvre their wings in this way when feeling the warmth of a show hall, or of flood-lights when being photographed—as in this particular case.

Part II

Chapter I

GULF BETWEEN BREEDER AND GENETICIST

I *INTEND*, in the following chapters, to make some attempt to bridge the gulf which separates the breeder from the geneticist. That such a gulf exists is indisputable, and no attempt has been made to overcome the scepticism which exists in the minds of practical breeders when the role of the geneticist is mentioned as having a part in the problem. Geneticists, I have found, are only too willing to assist, but generally speaking they use a language which is mainly incomprehensible to those who seek their advice; they talk of genes, heterozygosity, autosomes, etc., failing to appreciate that the ordinary breeder is interested only in his own peculiar problems and not in the subject of genetics. Until geneticists can lower themselves to talk the language of the practical breeder they cannot expect to be called on to assist; a Cobalt may be a Blue which is heterozygous for Dark, but it is, to the breeder, a Cobalt, and the geneticist must, if he is desirous of being helpful, refer to such a bird as a Cobalt.

I have frequently tried to explain occurrences on the basis of genetics and have completely failed even to interest the breeder; I have even been conscious of some resentment at my attempt to explain in other than simple, understandable terms. As it is my wish to be helpful to the breeder who is interested only in the production of exhibition budgerigars and who recoils from the study of genetics as something beyond his capacity to understand, I hope to deal with the subject simply, if not entirely to the satisfaction of the scientifically minded.

It is impossible wholly to divorce the subject of practical breeding from the study of genetics, so I shall deal with the theoretical side first, and then the breeder, provided he has *studied* the introductory chapters, can push them out of his way and consider the practical application of what he has studied. One difficulty which exists, and which makes the role of the geneticist less helpful, is the lack of practical experience of the problems which arise in the course of breeding for exhibition. Inheritance of colour factors has been worked out fairly satisfactorily and is still progressing, and thanks are due to the geneticist for having applied the principles of Mendel to the colour-breeding of budgerigars; we have tables of expectations which afford an accurate guide when arranging matings for production of colours; I have no intention of dealing with these other than by way of illustration of points which I wish to explain.

When we turn to the production of birds intended, not for particular colour classes, but for competition with their like within a class, the geneticist who lacks practical experience has little to offer in the way of advice; he cannot state that a cock which carries large spots, mated with a hen which carries small spots, will produce young which carry large spots because large is dominant to small in the way that green is dominant to blue. He cannot assert this because he has never proved such to be the case by deliberately mating together birds so that one member of a pair carries large spots and the other shows a deficiency. He cannot state that a good head in a cock will outweigh inferior head quality in a hen and that the young will all have good heads. He cannot state that a wild-type Green is dominant to a domesticated Green, and that the young from any such mating will be wild-type. I make no pretence to being able to give clear-cut guidance on such matters, but I hope I may be able to point the way whereby the practical breeder may solve *some* of the problems which confront him in his efforts to produce birds of exhibition quality year after year.

To attempt to do other than offer guidance, to make unreserved statements that certain matings will give certain results, would be not only presumptuous but harmful. I have no intention of filling the role of super-prophet or of saying " Do this and do that." I shall give advice which is based on my own practical experience, which is in turn based on careful observation over some thirty years of breeding for production of show birds, and I shall withhold nothing which I believe would be of assistance to the practical breeder.

If what he reads helps him to solve his problems; if it even gives him a fresh outlook and interest in his hobby, I shall be amply repaid.

If he disagrees with what I write, with the advice which I give, he is free to do so and free to disregard any suggestions which I make. I am merely trying to outline, in simple language, a system which should, I genuinely believe, be helpful in effecting improvement in stocks generally. There is an art in breeding budgerigars for the show bench, and I doubt if it can ever be brought down to an exact science; if it were possible to do this, much of the uncertainty and charm would be lost, and this is why I am no longer interested in colour-production; it has been all worked out and, provided the breeder knows the colour-capacity of his stock, his problems are few and easily solved; he can predict with great accuracy which colours will result from certain matings. Most of the adventure has been eliminated and romance has gone from this side of the hobby; it held me for only a brief period.

Transmission of character, comprising head quality, colour purity, size of markings, etc., is a "horse of a different colour" and, to me, a most intensely interesting line of research, exceedingly difficult but highly satisfying when one's predictions materialize, when one's expectations are fulfilled. I am not *primarily* interested in the production of birds for exhibition, but I am intensely interested in the transmission of exhibition features and in bridging the gulf which lies between the scientist and the practical breeder; the scientist has much to offer, and the breeder much to gain, by having the gulf bridged so that there is efficient intercommunication; we cannot hope to educate the ordinary breeder to the status of the geneticist; I would not have him other than he is; I would not have him refer to birds other than as Cobalts, Olives, Skyblues, etc., but, as the gulf exists, the geneticist must climb down from his pedestal and offer practical, easily understood advice to the breeder faced with the many problems which confront him year by year in his climb upwards towards a firm position on the show bench.

Hereditary Factors.

The science of genetics is the science of coming into being of the individual; it seeks to account for such matters as similarity between offspring and parent within the breed, of variation between members of a community within a breed, the transmission of certain features from one or both parents, the manner in which factors influencing shape, size, colour, etc., are handed down from one generation to the next and to successive generations.

The practical breeder who seeks fixation of desirable quality, continuance of individual features which mark out his stock as being unique and the product of his own skill, cannot afford to be wholly ignorant of how such characters are handed down, how such quality as he sees in one or more members of his stock can be spread so as to effect improvement in subsequent generations, and how such desirable quality may be fixed so that it will be the rule rather than the exception that his stock is productive of young of the highest quality.

It might be well at this point to regard two aspects of the problem and to consider whether the various factors may be paralleled, whether they run on similar lines or if factors which operate in one case need not necessarily operate in similar fashion in another. If we consider the breeding of stock for economic use, stock such as poultry, pigs, cows, goats, etc., we have to think first and foremost of what profit is possible, whether one flock of hens produces more numerous and larger eggs than another, and in addition whether one flock can be maintained and fed at less cost than another; the relationship between the money obtained for the eggs produced and the cost of feeding, replacement and housing of stock, is the important factor here. The poultry-keeper whose livelihood depends on this *must* make a profit, and this profit is the difference between income for eggs, day-old chicks, etc., and the expenditure necessary to maintain his stock; it isn't always the hens which lay the largest and most numerous eggs which are the most profitable to keep.

In cattle breeding the farmer with a dairy herd has to consider the milk production of his cows, not only the volume but the butter-fat content. Certain cows and certain herds give high milk yield, and, as producers of milk and consequently profit, are highly desirable; others may conform more closely to the accepted show standard but may yield less milk of poorer quality.

Heredity and Husbandry.

Matters such as these are dependent on factors inherited in the first case and on husbandry to a great extent. An excellent animal may be ruined through faulty feeding, bad housing and lack of care; another, fundamentally no better equipped for production of milk, may, through careful feeding and excellent management, become a much better producer. The groups of factors here are heredity and environment. Heredity decides the capacity, the " factorial constitution " of the individual; environment decides whether such capacity shall find full expression in high yield, in full bodily development, or whether it shall so influence the individual adversely that it becomes less desirable than it otherwise would, that it never attains its full inherited development.

Heredity hands down the genes or factors which decide the basic quality or capacity of the individual; environment permits, augments or inhibits the expression of such capacity, be it structural, as in the case of the animal bred mainly for show, or physiological in the case of the animal bred for utility. We cannot avoid using *a* term for these substances, be they chemical or any other, which so influence development of the individual that it ultimately becomes highly desirable as a show animal or as a producer, or which cause the individual to be of no exhibition or economic value to the breeder. The term we use for such substances is Genes or Factors. They are identical so far as heredity is concerned; factors such as good or bad environment influence *expression* of factors in the individual which have been handed down from parents to offspring but they do not pass on to the next generation as "improvements."

Qualities brought about by environment are not transmissible. Suppose we mate a pair of budgerigars of indifferent quality, birds which are fundamentally or factorially no better than average, and we breed from them three or four young and, by careful and special feeding and management, we provide the environment which augments the development of the young, we find such young are better than the parents. Let us suppose we do this and that such young are so much superior to their parents that we use them for breeding; should we expect to get still better young in the next generation? If we could step up automatically with each generation there is no limit to our attainments, but we probably will have no improvement in the next generation, and for two reasons: (a) the young, although better looking than the originals, are, genetically, no better; and (b) because the improvement effected by better husbandry is not handed down to the offspring; genes which decide the *basic* quality, so to speak, are handed down, but qualities dependent on environment are not, at least so closely as to affect any practical breeder, handed down from parent to offspring.

We thus have two sets of factors which affect quality: —

1. Hereditary factors which are transmitted from parents to offspring;
2. Environmental factors which are not transmissible but which affect only the individual as it exists.

It is with the hereditary factors that we are concerned, and, as already stated, we term such factors genes and the science of their transmission Genetics.

CHAPTER II

CELLS AND CHROMOSOMES

LET US TURN NOW to a simple study of the genes with which we have been dealing; although I may be accused of putting the "cart before the horse" in dealing with genes before I have described the structures on which, and within which, these are placed, my wish is to lead the reader into the subject rather than have him butt his head into something formidable at the beginning; had I commenced with a detailed description of the cell, its nucleus with its chromosomes, it would have had the effect of a cold douche right at the start. I have therefore encouraged him to dip his toe in, and now I must say "Come right in." I propose giving a description of the structure which carries those genes and hope that the reader will follow me step by step, appreciating that, without a knowledge of these structures, he will find it difficult to understand chapters which follow and that, if I avoid describing them, I shall find it almost impossible to bring out points which I consider highly important to breeders of budgerigars.

The budgerigar is composed of cells in groups specialized to suit the function of the parts which they form; there are feather cells forming the feathers, skin cells forming the skin, horny cells forming the beak, specialized cells forming the lining of the eyes so that the bird can see, cells lining the gullet and stomach, so that the bird can digest the food which it eats, muscle cells which move its wings, legs, beak, and so on. Apart from the food and food waste and water which it contains, it is formed of cells, so let us see what a cell looks like.

A cell is like a thin-skinned plum on a very tiny scale containing a jelly-like substance called the protoplasm. The skin of the plum is termed the cell membrane. In the middle of this jelly-like protoplasm we have a circular body like the stone in the plum, and this body we call the nucleus; this is the important part of the structure, the cell membrane being merely a containing membrane which is porous to allow nourishment to pass into the cell and allow waste to pass out; the protoplasm merely absorbs and retains the nutriment required. The NUCLEUS is important; let us open it and see what it contains.

Inside the nucleus we find small particles, curved or irregular in size and shape, and all grouped about the centre of the nucleus; these are the CHROMOSOMES and it is on, or in, these chromosomes that we have the GENES about which we talked. Let us run over this again. We have the cell membrane (the containing membrane), the protoplasm (the jelly-like substance inside the membrane which fills the cell just as a plum is filled), and, in the centre of the cell, we have the nucleus, like the stone in the plum; we open the stone and inside we find the curved particles which are the chromosomes; we can see all those things but we cannot see the genes; they may be chemical particles situated in orderly fashion within the chromosomes, or they may be outside attachments invisible to the eye even with high magnification.

They are there, nevertheless, and by accepting that *they* are the factors which influence the individual we explain the mechanism of heredity. After all, we cannot see electricity so why should we have to see the chromosomes to accept the fact that they are there. In each species there is a definite number of chromosomes within the nucleus, and every nucleus in every cell in the body carries this characteristic number of chromosomes. In the developing bird certain cells change their shape in accordance with the part which they will form; muscle cells become long and thin and are packed side by side to form muscle; bone cells develop in a different manner and harden to form bone.

Show Bird Breeding Difficult.

Feather cells take on a specialized structure so that the bird becomes green, blue or yellow; in the nucleus of every one of these cells we have the number of chromosomes characteristic of the budgerigar. Certain cells go to form the reproductive organs which manufacture the ova in the case of the female and the sperms in the case of the male; these again are cells and by their union under favourable conditions, by the entrance of a sperm from the male into the ovum produced by the female, we get a fertilized egg and ultimately a young budgerigar which has inherited genes from both parents.

The chromosomes in the nucleus of a sperm of the male "pair off" with chromosomes in the nucleus of the ovum of the female, and it depends on how the chromosomes pair off, and also on which genes the chromosomes carry, that the quality of the resultant individual depends. If there is a wide assortment of dissimilar genes on both sides it is a matter of chance how they assemble on the chromosomes of the new individual; we thus see that in such case the probability of two similar genes or rather two similar assemblies of genes meeting each other from each parent is somewhat remote and, when one considers the multitude of possibilities, one realizes why the breeding of exhibition budgerigars becomes so difficult; so many genes may be required from one, other or both parents, or they require to be placed in a certain order on the neighbour chromosomes that it would appear to be almost impossible to bring about the orderly assembly of genes necessary to make a budgerigar highly desirable as a show bird and as a producer of show birds.

Our problem is to get rid of the genes we do not want, which detract from quality, and to augment the assembly of genes which influence structure, development, colour and markings favourably. One might liken it to mixing two packs of cards, dealing them out in pairs and regarding the pairs in which face cards only formed the pairs as desirable combinations and all others as unfavourable combinations except that in the assembly of genes which decide structure and quality in the budgerigar, we should be dealing with a much greater number. The difficulties are apparent, but no problems are incapable of solution.

Let us use an illustration to fix this more clearly in the reader's mind. Let us think of the chromosomes as curved wires each with an assortment of coloured beads; let us look on beads coloured red, blue, and yellow as being, in combination, those which decide that a bird shall have large, even spots; only if such coloured beads are in an assembly of others which do not overrule them and suppress them do we get the visible expression of large spots, and only where two neighbour chromosomes each carry the red, blue, yellow assembly do we get fixation of this desirable quality. It must be obvious that the more we can cleanse the chromosomes of undesirable genes the better are the chances of two mutually supporting chromosomes meeting and giving us the "factor" in "double dose." If we rid our two packs of cards of all cards *except* face cards we should always deal desirable pairs. If we rid our individual birds of both sexes of undesirable genes we should be able to mate them in the knowledge that, no matter how we crossed them, we should still get high-quality young; that is our objective; let us see if it is attainable or even approachable.

Quality of Young Unpredictable.

It is not so long since the fact was realized that the individual is not the unit in inheritance; he or she is merely an assembly of factors, some good, some indifferent, and some detrimental, derived from ancestors. If the individual were the unit all we should require to do would be to search

Family of Light Yellows, the cock being of " yellow " feather quality and the hen a " buff " with paler colour and less wing lacing. After moulting, the two young birds of bleached " mealy " colour will be pure in plumage without any sign of lacing.

out a similar unit, put the two together and we should have certain foreseen results; like would breed like and all would be well and uninteresting; variation with its attendant benefits and ills would be difficult to arrange; we would be set in a groove and only departures from the fixed standard type would be esteemed; whereas we now strive to obtain uniformity, we should find it difficult to get rid of uniformity.

The individual being an assembly, genetically speaking, of genes handed down by ancestors, it must be obvious that we cannot, by looking at a bird, give a complete account of what it is, and still less can we state what it is capable of breeding. Neither need visible features, desirable or undesirable, be handed down and expressed in the progeny. The boxer with cauliflower ears does not breed young with cauliflower ears because his ear deformities are caused by external influences, environment if you like, and they are not hereditary. His big chest and part of his muscular development *may* be transmitted to his offspring, but it does not necessarily follow that every man with a big chest and muscles is a good boxer or that he must necessarily have his type and development repeated in his offspring. Nor need it be necessary that any of his ancestors had great physique; he may be a product of chance, of two mutually supporting assemblies of genes happening to come together and producing this "sport" or mutation.

Similar chance meetings of genes have in the past accounted for the unlooked-for new variety, and it would be rash to state that we have reached the limit of all possible combinations in the budgerigar.

The great charm of budgerigar breeding lies in the fact that we cannot, apart from colour, predict accurately the quality of the young from any mating; we may pair together two highly desirable birds and, although we may *expect* to get young which are up to show standard, this is all we can do; we can expect and hope but we cannot *predict with certainty* or reasonable confidence that the quality of the young will be above average; true, there is probably a greater chance of breeding good young from two unknown birds each of which is up to show standard than from two equally unknown birds each of which is a waster, but we cannot assume, provided we get such results, that like breeds like and that, except under certain circumstances with which I shall deal later, the "wasters" are incapable of breeding good-looking young.

Although not in themselves desirable show birds each of the inferior birds *may* carry a genetic assembly which, on meeting another equally advantageous one from the other member of the pair, may result in an arrangement of genes which stamps the individual bearing them as something of exceptionally high quality. This is the explanation of why like need not necessarily breed like, why desirable recessive meets desirable recessive and we get outstanding specimens from birds which look inferior. The inferior birds may be so because of bad husbandry, because perhaps each was the last hatched in a large clutch and badly fed; the bad feeding does not alter genetic composition, and it is a case of suppression of desirable features through unsuitable environment and bad husbandry; the genetic composition cannot be disarranged by environment, and it is possible to breed with birds which are highly desirable in themselves and by bad husbandry breed inferior-looking young which, given suitable environment and feeding, may in turn produce outstandingly good young.

The influence of environment cannot be disregarded, but environment cannot affect the *genetic* constitution of the individual; it may suppress the development of one or more desirable features, but it cannot disarrange the assembly of genes. Means have been employed to disturb the genetic arrangement and increase the incidence of mutation, and the time may yet come when we shall be able to produce male or female at will, but not in the budgerigar I think. Where artificial insemination is practised, as in horse and cattle breeding, it may be possible to disrupt the chromosome arrangement so that mainly males or mainly females are produced. The economic value of such procedure would be great, but this is outside our problem and is mentioned merely to anticipate a geneticist telling me I am inaccurate in my assertion that the genetic composition cannot be disturbed by outside influences.

Outstanding Individuals.

Another problem which arises when we attempt to adapt methods employed by breeders of animals of economic value to the breeding of budgerigars for exhibition is that, whereas the quality of the *herd* is important to the dairy farmer, the quality of the *individual* is of major importance to the breeder of budgerigars. The capacity of *all* his hens to lay well, and not of one individual hen to outshine all others, is important to the poultry breeder, whereas the breeder of exhibition budgerigars is overjoyed if he breeds one "Palace" winner in a hundred average young; he is not so concerned about the high quality of all his stock as is the breeder of animals or birds which are producers of milk or eggs which enable him to show a profit.

I have no fault to find with the breeder of the solitary outstanding bird provided he does not use this single occurrence, this "sport," to enhance the market value of the remainder of his stock whose breeding capacity may be no better than average. Even if he breeds a dozen such show birds, unless he breeds this number amongst a total of, say, two dozen he cannot claim to be a producer of exhibition budgerigars. If he employs thirty, forty or fifty pairs to produce his dozen show birds, he is an inefficient breeder; he has no skill and is not employing correct breeding procedure.

This is why I regard the existing pedigree system with suspicion, why I should not rely on pedigree as it exists at the present time. Only the desirable specimens are registered and no record is kept, officially, of all the inferior specimens which are bred from the parents producing the " valuable " dog, bird or bull. The prize-winning bird may be the only good one out of a dozen; the other eleven may be useless but we do not hear of those in the pedigree. Where the good-looker wins prizes his inferior brothers and sisters have their value enhanced by his success but they are no better than average.

That is why I contend that pedigree not containing a full account of the quality of *all* the individuals bred from a pair is of little or no value to the breeder of exhibition budgerigars who sets out with the ideal of improvement of his stock as opposed to the accidental production of an occasional show bird. He who makes claim through this chance production to being a breeder of high-class budgerigars is making a claim which is unjustified. Until the pedigree system is put on a more rational basis we must find some alternative means of assessing the breeding value of a bird whose looks may belie it and which may prove detrimental rather than beneficial to our stock.

How Cells Divide.

For a full realization of what happens prior to the fusion of the two germ cells or gametes into the fertilized ovum or " zygote " one must appreciate that, although, as already stated, each cell of the individual has a definite number of chromosomes characteristic of the species, there must be some change which takes place in the germ cells prior to fusion. Were the characteristic number of chromosomes present in the ovum and in the sperm that of the species from which they were derived, the new individual formed from the fusion of male with female would have *double* the number of chromosomes characteristic of the species; in the next generation the number would again be doubled, and it must be evident that this doubling of the number of chromosomes with each succeeding generation is an impossible state of affairs. Provision is made whereby the number of chromosomes which characterize the species is maintained in the new individual and in all subsequent generations.

It has been stated already that cells multiply and become specialized. Cells which go to form muscle, bone, skin, etc., multiply by preliminary division of *each* chromosome longitudinally; each half-chromosome moves with its neighbour half-chromosome to one or other pole of the nucleus. The chromosomes before division are situated at the equator; after division the halves move to opposite poles of the nucleus, one lot to the "north" and the other to the "south." *After* they have split and moved apart, the body of the cell divides so that each new cell contains a half-nucleus with the number of half-chromosomes characteristic of the species. Suppose the original number was twelve; on division of the chromosomes there would be twenty-four halves, they would congregate in two groups, one at each pole, and each group would comprise twelve half-chromosomes; when the cell has divided into two new cells the new cells develop and the half-chromosomes increase in stature until they in turn split into twice their number, group themselves at opposite poles and again each cell divides, and this is repeated again and again until the limit of growth of the part which they form is reached; the cell divides only *after* the chromosomes have divided and formed opposite groups; this is normal growth by multiplication of cells.

Matter of Chance.

When we look at the developing germ cell we find a different set of actions taking place. *Before the chromosomes have a chance to divide* the cell divides into two daughter cells each of which has only *half* the number of chromosomes characteristic of the species; it is a matter of chance which chromosomes are contained in each new cell and also a matter of chance which genes from the general assortment are contained in the new cell. This *reduction division* takes place in both male and female germ cells, and it is only by fusion of the two that the characteristic number of chromosomes is restored, half of the chromosomes being derived from the male and half from the female. It is again a matter of chance whether the genes in one germ cell meet others in the other germ cell which are similar or widely different, which are mutually beneficial or which neutralize one another; the genes in one germ cell which tend to make the new individual highly desirable may be suppressed by others, which are aberrant or harmful, derived from the other germ cell. The good may outweigh the evil or vice versa.

If good influences are derived from both sides the resultant individual should be highly desirable; when the chromosomes from the male germ cell meet those from the female germ cell they pair off and if a gene, say for blue, is present in both germ cells, the two chromosomes which carry this gene form a pair, and the individual which has derived the blue "factor" from both parents is said to have the blue gene in "double dose"; it would be visibly blue in colour; if the blue gene were present in one germ cell and not in the other the blue might, or might not, find visible expression. If the other germ cell contained the "green" gene the blue would be suppressed and the resultant individual would be green in colour but it would carry the blue gene as a recessive or hidden factor; it would be green/blue, i.e., visibly green but carrying the gene for blue tucked away out of sight.

From this brief account of the two ways in which cells divide according to their ultimate function it is hoped that the reader will be better able to appreciate how it is by chance that certain factor-bearing chromosomes enter certain germ cells and how again, purely by chance, they meet complementary or antagonistic factor-bearing chromosomes from the germ cell of the opposite sex. The possible arrangements are almost infinite, and the addict to football-coupon filling will appreciate how difficult it is to get his 1, 2 Xs in the correct sequence and correct proportions; the factors which influence colour and quality in the budgerigar are much more numerous and more complex than are the three with which the football pool enthusiast is concerned.

Our object is to arrange the genes in orderly manner on the chromosomes and to afford the best opportunity for like to meet like and so influence the structure and development of the new individual that he or she ultimately becomes a highly desirable exhibition budgerigar.

CHAPTER III

FAVOURABLE AND UNFAVOURABLE FACTORS

IF *WE ACCEPT* it that the ultimate quality, be it colour or structure, of the individual depends mainly on the genes which are located on its chromosomes we go far towards fully understanding the various happenings during an average breeding season; if we get an occasional Blue from a pair of reputedly pure Greens we know that the Greens are not " pure " but that each, although visibly Green, carries the " blue " gene tucked away out of sight, ready to pop up when it meets another of its kind; when Greens which are impure, i.e., when they are heterozygous for blue, when they carry the blue gene out of sight, meet others carrying a like recessive, a proportion of the young will be blue in colour, a proportion will be green in colour and homozygous for green, i.e., pure green, free from the recessive blue, and another proportion will be green in colour but carrying the hidden blue gene.

We describe the birds free from hidden colour factors as homozygous Greens or Blues; those which carry one or more hidden recessives as being heterozygous. Unfortunately the homozygous and the heterozygous, the pure and impure, individuals are frequently indistinguishable the one from the other and, unless we know the genetic constitution, the genetic " build-up," we cannot say with any certainty that one is pure and the other impure; the only way in which we can tell is by test-mating each with the recessive. To sort out pure Greens from Green/blues we should mate each Green with a Blue; if, given young in reasonable numbers, we get blue young from any green bird we know that bird to carry the recessive blue gene; if we get only Greens from another mating we assume with *almost* certainty that the green member of this pair is pure green, a homozygous Green, free from the recessive blue. It is the presence or absence of the blue gene which makes a green bird heterozygous for blue or homozygous for green, impure or pure. Here we are dealing with genes which decide colour; there are genes which influence size, shape, markings, head quality and many other features.

Not all factors exercise a beneficial influence on the individual; there are factors which are favourable, others which are unfavourable. If, as already suggested, we could " weed our garden," eliminate factors which have an adverse influence and leave only those which have a favourable influence, we should have no difficulty in breeding excellent budgerigars. This is our problem; let us deal with it and see if there are some means whereby we can eliminate the adverse and assemble the favourable factors so that our task may be easier. One difficulty we meet is the separation of factors which are inherited and those which are not. We cannot state emphatically that size is due entirely to an inherited factor; it may well be due mainly to good husbandry, good feeding by parents, supply of suitable food by the attendant, by allowing stock to breed in the most favourable environment, at the most suitable season of the year; all these external non-inherited factors may have a most important bearing on the ultimate size of the fully grown specimen.

Birds genetically of good size, and which carry the factor or factors for " bigness," may never fully develop due to unsuitable feeding and environment and, if stunted during their full period of growth, they will never attain the size which they would have attained had environment and feeding been highly favourable. Personally, I think size is *mainly* dependent on good environment and good husbandry but that, genetically, there are birds which are capable of breeding young of exceptional size under favourable circumstances because such birds have in their genetic make-up genes which are favourable to rapid growth and development. Husbandry plays such a big part, however, in the production of outsize birds that I consider that good feeding and favourable environment will cause birds, genetically of normal size, to become much larger, and indifferent feeding and out-of-season breeding (unfavourable environment) will tend to stunt the growth of birds which are genetically large.

Colour Unalterable.

No amount of any particular kind of food or any sort of external influence, such as suitable or unsuitable environment, will transform a Blue into a Green or into a Yellow; the bird is blue and will remain blue in spite of what we do because it was blue from the time it was a fertilized ovum, because the factor or factors which make the bird blue are definite inherited factors and not subject to outside influences. If it is neglected in the nest, in the aviaries, badly fed, exposed to sun, frost, wind or rain, right through its life, it will remain blue because it carries the genes which make it blue; and once decided by fusion of male and female germ cells, its factorial composition so far as colour goes is unalterable. Good feeding and suitable environment during the stage of growth will afford full development; suitable environment or, more accurately, adjustment of environment for a particular purpose, will cause a bird which crosses its wings to cease to do so and carry them in the desired position; prolonged caging will effect improvement in wing carriage in a bird exhibiting this fault, but it will not affect the capacity which this bird may have of passing on such defect to its offspring; to accurately assess the part which inherited and non-inherited factors play in size, carriage, etc., we should have to breed all our young at the same time, provide them with identical feeding and accommodation; we should have to rear the same number in each nest and, when we had done all this, we should still find variation due to feeding and environment, variation not all of which was due to inherited factors.

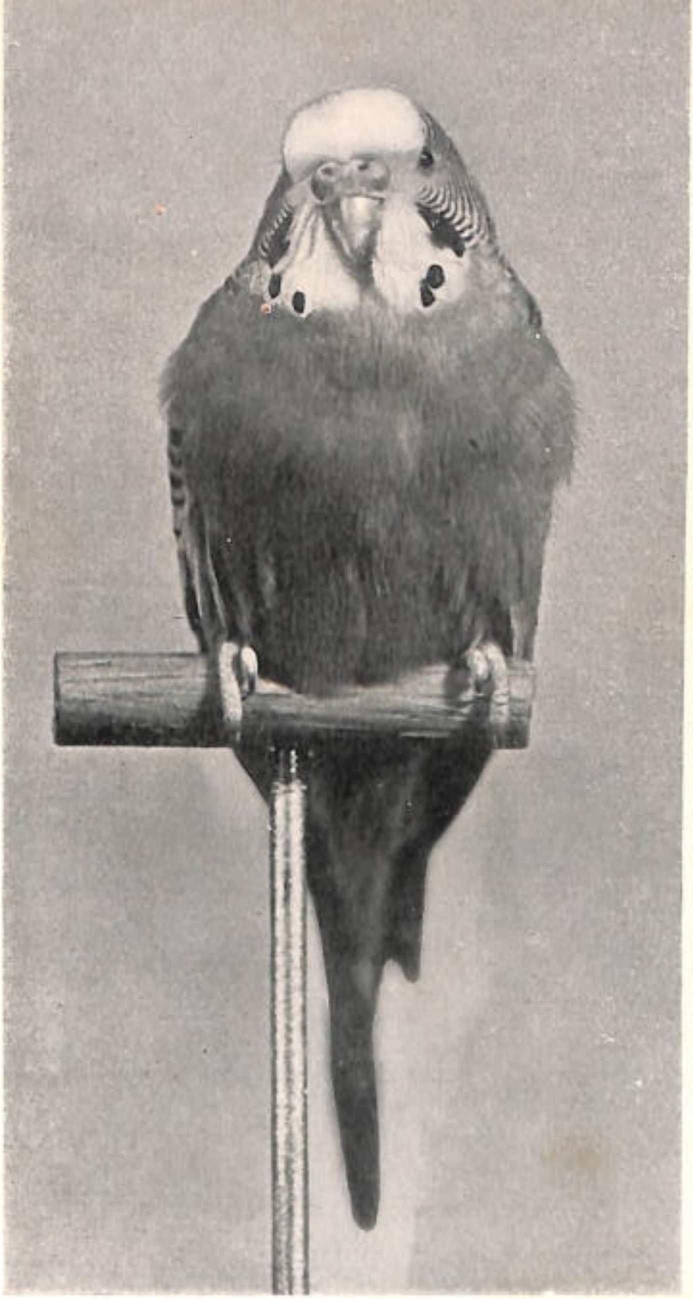
Only individuals are influenced by feeding and environment; the genetic composition remains unaltered, and the breeding capacity, the ability of the individual, when suitably mated and under suitable circumstances, to breed good, bad or indifferent young, remains unaltered. A pair of under-developed birds, where the stunting is due to unfavourable external influences, may breed young of the highest quality, and outstandingly good-looking birds may breed only indifferent young.

Only if they are genetically favourably matched, if each carries factors which are favourable, will the young from good-looking parents be themselves good; like need not necessarily breed like; size and development in each may be due mainly to good husbandry, and qualities which are due to external influences are not handed down from parent to offspring; it is because of this that we frequently find show specimens breeding nothing more than average young, of indifferent birds breeding winners. The genetic constitution decides the limit of full development; favourable environment provides the means whereby full development may be attained before the termination of the growing period.

Once growth has come to an end no amount of good husbandry will undo harm which has been done; the stunted bird can never attain full development and it remains stunted for all time, but it may be *capable* of breeding outstandingly good young. The last hatched in the clutch, the worst fed as a rule, may be capable of breeding better young than its well-fed, well-developed brothers or sisters. If we could eliminate environmental influences we should simplify our task to a great extent.

Passing on Visual Qualities.

We come now to the question of correlation or relationship which exists between visible quality and capacity to produce good, bad or

These two photographs are of a young Green hen bred from massive parents which were coarse in feather. As a result, her feathering is unduly coarse in texture, long and untidy, thus utterly spoiling her appearance.

The picture on the right is a rear view of the same hen. Note the excessive width of her back and the straggly feathering covering her rump.

FAULTY FEATHERING

Close-up of an ultra-large bird whose breast feathering is so coarse and long that it actually extends over the wing-butt, a serious defect.

Side view of the massive young hen (depicted on the first page) which carries excessive feather. Observe how her shape is completely ruined by the body feather dangling round her feet and vent.

(Right) *Contrast the shape of this bird with the one on the left, and note the regularity of the wing markings as compared with those of the other, much bulkier bird.*

PERFECTION IN FEATHERING

A young Light Yellow hen possessing plumage of a beautiful smooth, silky texture. The absence of throat spots in this colour variety will be noted.

The same Light Yellow hen in a different pose, with not a single body feather out of place.

indifferent young. We cannot dispute that there is some relationship between visible features and the ability of the individual to pass them on to his progeny; were there no relationship, selection would be devoid of any value and, when we realize that selection of the most desirable for future production is the basis of most breeding, we cannot be so dogmatic as to assert that there is *no* relationship between visible features and breeding capacity; there are, however, many fallacies, many beliefs which have no reliable foundation and which will not bear close scrutiny and which are little more than superstitions.

Breeding Blue Series Birds.

There is no scientific foundation for the statement that, in order to breed good Blues, one must use at least one green member in the pair and that to have both birds green/blue is productive of the best Blues. This is wholly inaccurate and could be almost described as a superstition; there is no genetic reason why, given two Blues, each of which has a favourable assortment of genes, we should not breed Blues of the highest quality; the presence of green is unnecessary and merely adds to the difficulties which attend selection of birds for future use. Equally good Cobalts may be bred from a suitable mating of Blue and Mauve as from Cobalt and Olive/Blue; if favourable genes come together as the result of the mating, Cobalts of the highest quality will result irrespective of whether the parents are blue and mauve, cobalt and mauve, cobalt and olive/blue, dark green/blue and mauve or cobalt to cobalt. If it be our wish to breed Cobalts for exhibition we are more likely to get what we require from the mating of Skyblue to Mauve than from any other, principally because this mating gives us twice as many Cobalts from which to choose, twice as many chances of favourable genes coming together.

Let us see if there is any justification for stating that the chances of breeding desirable Cobalts is greater from the mating of Blue with Mauve than from any other.

Both birds are homozygous for blue; each is homozygous for colour depth, the blue being homozygous for absence of D (the dark factor), and the mauve homozygous for the presence of D; in the former it is lacking and the latter has it in "double dose." The hybrid form is the Cobalt and it is a well-known fact that there is greater uniformity in the first-generation hybrid than there is in either of the pure varieties; there is thus justification for expecting greater colour uniformity in a number of Cobalts bred from blue to mauve than from any other. I am quite aware that the breeder of show animals and birds does not particularly desire uniformity; he may find wide variation helpful in his early stages since it provides him with widely diverse types from which to select; it still follows that, provided we use correct material, we are more likely to breed good Cobalts from blue to mauve than from any other. We breed 100 per cent. Cobalts and thus have plenty to choose from; the chance of a favourable assembly of genes from the Blue meeting a favourable assembly from the Mauve is greater. If we mate Cobalt with Olive/Blue (a favourite mating) the chance of a favourable assembly of genes from the Cobalt meeting a favourable assembly of genes from the Olive/Blue capable of producing a Cobalt are only 1 in 4. If our wish is to breed exhibition Cobalts, for every Cobalt we breed, we breed three which are not even the colour we desire; for every Cobalt produced we breed in addition a Dark Green/Blue, a Mauve and an Olive/Blue, none of which is of immediate use to us for exhibition. We have a limited number of Cobalts from which to choose, and the variability is greater amongst the Cobalts than it is amongst those produced by the mating of Blue with Mauve. I am quite prepared to admit that I favoured the mating of Cobalt with Olive/Blue to any other until I studied the matter critically; I can find no justification for such belief and it might serve to clarify the statement that we get greater uniformity in the hybrid from blue to mauve than we do from any other mating if I apply an illustration of what occurs.

As an Illustration.

As *Cobalts* both Blues and Mauves are undesirable; we require in the Cobalt a deep, even cobalt blue; the Skyblue is undesirably pale and the Mauve undesirably dark and dull; as Cobalts both are faulty. The illustration I have in mind is that in which we have a window which requires to be blacked-out; to do this we have only two old black-out frames, each of which has holes in it; we put up frame No. 1 and find that it is faulty because the light shines out through the holes; we put up frame No. 2 and find this, too, is faulty as it, too, allows light to shine through in parts. We put up both frames together, one over the other, and we find that the black-out is effective as the holes in one do not correspond with the holes in the other, and we get much more uniform black-out than we did with either alone; it is the same in the hybrid; the faults in one are overlapped by the good points in the other and we get great uniformity; from the mating of Blue with Mauve we should get Cobalts which are very uniform in colour; if they are faulty in colour, they will probably all be faulty, but if good they will all be good. It is a matter of choosing the quality of blue and the quality of mauve which will " overlap " in the proper manner to give the desirable colour depth. Now the problem of variation.

I have already mentioned that the breeder of exhibition animals or birds may welcome or deliberately breed for wide variation so that he can carry out selection, from widely diverse types, of specimens which most nearly approach his ideal. Variation has its uses, I admit, but it must be realized that there are two kinds of variation, one the abrupt variation which constitutes the difference between a Blue Budgerigar and a Yellow budgerigar, and continuous variation which accounts for all the gradations of colour between a Yellow-wing Light Green and the purest Buttercup Yellow; in abrupt variation there is clear-cut cleavage; in continuous variation, the variation which allows us to select specimens within a colour class which most nearly approach the ideal, there is no demarcation between one and another until we approach the extreme ends of the scale; there is a distinct visible difference between the Yellow-wing Light Green and the Buttercup Yellow, but each has been evolved by selecting, as breeding stock, birds which most nearly approached the ideal in each case; Yellow-wing Greens were bred by mating together year after year birds which carried the greatest depth of green body colour and which still retained the yellow wings; the Buttercup Yellow was evolved by mating together only birds which showed the minimum of green in their plumage; selection based on continuous variation was practised in each case.

No Yellow Gene in Blues.

No matter how long the breeder selects and mates together Blues, he cannot turn them into Greens; he cannot produce Greens by carrying out selection of Blues; there is sharp distinct cleavage between the two, and the one cannot merge into the other; the Blue lacks the yellow gene; because it lacks the yellow gene it *is* a Blue, and no amount of shuffling and selecting will restore the yellow gene until a bird is introduced which carries the yellow gene, either a Green or a Yellow for example.

Within a colour, e.g., Light Greens, we get continuous variation; we get birds with big spots, birds with indifferent spots, birds with small spots, but no clear-cut division into classes; nor can we state that birds with big spots are dominant to birds with small spots; continuous variation permits of selection and improvement for show purposes; abrupt variation permits of our deciding which colour varieties we shall breed. Continuous variation permits of improvement of quality such as colour purity in the Light Yellows, of head quality and spots in Greens and Blues, of size and even of fertility.

CHAPTER IV

AGE AND ENVIRONMENT CAUSE VARIATIONS

THERE IS, IN ADDITION to the types of variation already mentioned, one which can be placed in neither category; we recall that good or bad husbandry plays a part in effecting differences in development in animals and birds which are fundamentally, in their earliest stages, more similar than they appear to be at a later stage. Age is the next cause of variation; individuals develop as they grow older until they reach a peak beyond which there is a gradual decline towards the inevitable end. In human beings there is bodily development and bodily decline, intellectual development and decline, physiological development and decline. In budgerigars we have the same upward climb and, after a period of optimum development, an inevitable decline until a stage is reached at which the bird is no longer of use for breeding or for exhibition. The physiological decline commences before the structural signs of age show themselves, and this is why birds may continue to be exhibited successfully after they have ceased to be useful as breeders.

The decline in "physique," appearance and conduct of the bird, takes place after the sex glands atrophy and after the bird has ceased to be capable of reproducing its kind. Development is rapid during the first year, more gradual during the second, and there is little visible change during the third year; during the third, fourth and perhaps even the fifth year, the budgerigar looks his or her best; males wear better than females as a rule. The yearling looks smaller and slimmer than the three-year-old; the bird of six or seven summers becomes less shapely, more bulky, and so, with advancing age, we get variation due not to any inherited factors but common to all, not to any environmental factors but to normal development and decline, the development assisted, perhaps, and the decline delayed by, good husbandry, but the process is inevitable.

Development which is retarded by faulty feeding even in the first few days may be sufficient to prevent a genetically desirable youngster ever becoming an exhibition budgerigar. There has, during the war years, been widespread retardation of development due to inadequate and unsuitable feeding; this has no effect on the ability of such stock to pass on their full quality to their young which, when reared under favourable conditions, may become excellent show birds. My point here is that environment and feeding will influence the development, but it does not disturb the genetic assortment and therefore the capacity to hand down desirable qualities remains.

This offers hope for the breeder who has been forced to maintain his stock under unfavourable conditions, who has had to provide meagre fare for his young, fare which does not assist their full development; it offers hope, even assurance, that when suitable feeding becomes available, he will be able to breed just as good young as if their parents had been reared under ideal conditions. Variation due to inadequate or ample feeding accounts in great part for the difference in size and development of the bird reared on canary and millet and the bird which has been brought up on persicaria and what other inadequate fare the owner can provide. The important point, and one which should provide comfort to the owner of austerity-reared stock, is that the breeding capacity of his birds is just as good as if they had had a full supply of ordinary foods. I have proved to my own satisfaction by using identical pairs that the young reared on canary and millet with normal accessories such as green food, etc., are bigger and better looking than their brothers and sisters reared on persicaria and corn. Until I witnessed the difference I must admit that I held the view that substitute feeding provided adequate nourishment to permit of full development; now I know it does not. Whether the factor of palatability enters into this is debatable, but the fact does remain that parents rear young better and the young develop more rapidly and more fully on pre-war feeding than they do on substitutes.

Uniformity in Studs.

Where variation is due to the presence or absence of one or more genes we have an opportunity to practise selection of those which most closely resemble our ideal; the aim of the breeder should be to have a high percentage of his young approaching the standard laid down for the variety. I have already stated that uniformity is highly desirable in first-class breeding stock; the birds need not resemble each other as do peas in a pod, but there should be marked resemblances within each family. When I refer to a family I do not mean the whole breeding stud. A first-class stud should not consist of one single family of budgerigars all derived from two or three ancestors.

One should keep each family compact and closely related, but there should be independent groups within the breeding stud in which, although relationship between members of A group should be close, there should be more remote relationship, if any, between members of different groups. There should be a family A, another virtually unrelated family B, another C, and so on, dependent on the size of the breeding stud. I shall go into the reasons for this more fully when we put our theories into practice, when I suggest how families may be built up for special purposes within the breeding stud. One of the reasons for maintaining independent, possibly dissimilar families, is the fact that the Standard is not a fixed, final and unalterable Standard for all time. It is transient, subject to modification, and the governing body who decides the Standard makes adjustments from time to time.

Suppose we have a breeder who excels in breeding Light Greens; he regularly wins prizes with home-produced stock until someone else breeds equally good birds; differentiation becomes difficult until it is noticed that the second breeder produces birds with smaller, more close-fitting beaks; this is looked upon as a desirable feature and the Standard is adjusted accordingly.

If we appreciate that the Standard is flexible and not rigid, we can see how it may pay us better, in the long run, to have our stock equally flexible, to be able to produce variation at will instead of having to put up with it.

Suppose family A is bred mainly for head quality, we should not be satisfied until all members of family A have good heads and are capable of breeding young all of which have good heads. We concentrate, in family B, mainly on markings, and, while maintaining reasonable size and reasonable head quality, we arrange that every young bird produced within the B family will excel in markings. Suppose, at some future time, markings get a higher allocation of points than they do at present, we can immediately set about crossing members of our two families to produce the variation which will give us a few young which excel in markings but which still have head quality almost as good as in family A. I maintain that it is advisable to run independent lines for individual features, to fix the main feature in the line and, when we require to, we can virtually produce what is in demand on the show-bench for the time. It is just as if we blended blue and yellow pigment in order to get green; if we consider a yellowish green desirable, we add a little more and a little more yellow until we get the required shade. When we blend members of family A with members from family B we may have to return to one or other family for subsequent matings to emphasize certain highly prized exhibition features. We eventually get just what is required, and, should the Standard be modified, we can modify our stock accordingly.

There must be variation, but it must be orderly and prearranged variation, not the chance variation which we get when we put two differing unknowns together. We must know the breeding capacity of members of each family and, knowing them, we can move with the times instead of making the usual statement that "the birds aren't what they used to be."

There may be yet another cause of variation; I have already stated that the birds vary according to their ages, that there is a stage of ascent, a period of maximum development, and a stage of descent. There may be variation due to the ages at which we use breeding stock; if we use birds which are one year old we may breed young which differ from those bred from the same parents two or three years later. It is reasonable to assume, in spite of the fact that the genetic constitution does not alter with age, that environment *within* the parent, the provision of nutriment within the egg, may vary with the age of the parent bird; this development before the young bird hatches may be influenced by the ages of the parents, and environmental factors again play their part even at this early stage. The sperm and ovum produced by old birds, although carrying the same genetic assembly, may be less vigorous where the producers, the parents, are beyond a certain age. We should thus expect to get variation which is due to the youth or age of the parents.

We may have aberrant factors cropping up from elderly parents not observable in young bred from the same birds two or three years previously; there is an optimum breeding age, an age at which sperm and ovum are at their best, but this may vary with different birds, and it is difficult to say what is the optimum breeding age. I attach great importance to early development of breeding stock, to the age at which birds mature, and I believe that we get better, more vigorous young from birds which mature early than we do from those which have a delayed or protracted change from baby to adult plumage.

Early maturity may be influenced by environment and feeding, birds bred in September and October may not moult until the following spring. Birds reared and fed on substitute food grow more slowly and mature later than do young which are bred in March or April and which are beter fed.

Selection of Breeding Stock.

Since selection is the preliminary to advancement, on what basis should we select stock for production of birds which closely approximate to the Ideal? Selection plays a most important part in the early stages, but there are complications, the first of which is dominance. We may select a male which is fully up to exhibition standard and, as his mate, a hen which, although high in the points scale as regards size, shapeliness and head quality, may fail somewhat in throat markings or in tail or wing carriage. She may be the best all-round mate we possess for this excellent cock. We put the two together, hoping that the minor deficiency in the hen will be outweighed by the excellence of throat markings in the cock; the reverse may well be the case, and all the young from this mating may fail badly in throat markings and consequently be less desirable and less successful as show birds than we hoped for. Small spots in this case may be dominant to large spots, and so much depends on the manner in which each bird has been bred, on whether fixation of the desirable or of the undesirable feature has occurred during the production, that he would be a rash prophet who would state that the markings would be of any special size or uniformity.

If the cock is the product of in-breeding for spot size he may dominate the deficiency in the other unless fixation of small spots has occurred in the case of the hen. There may be wide variation from two such dissimilar degrees of markings if each is the product of chance. Visible quality in a bird, particularly size, may be due to excellent inherited make-up or due to environmental factors; to separate one from the other is difficult, but not impossible; I shall deal with this when we go on to the problem of test-mating; by test-mating we can decide whether a feature is inherited or due to external influences when it is not inherited.

When we come to individual show points, such as head quality, we find that many of these are little affected by external influences. Whereas there may be gross variation in size due to good or bad husbandry, head quality is not affected advantageously or adversely by good or bad feeding. If we select birds which excel in head quality and reject all which fail in this respect, we can very rapidly establish this quality in our stock, provided, of course, that the material is originally available; if, while we are establishing head quality, we disregard throat markings, we may well find ourselves with birds which excel in head quality, but which fail in markings or in which there is wide variation in this respect. Our journey is a long one if we progress step by step in this fashion, dealing with each feature individually, establishing one *before* going on to another; if we do this we run a grave risk of fixing not only desirable head quality, but also of fixing deficiency in respect of throat spots; we have two alternatives here; we may progress step by step dealing with "first things first," or we may work for *all-round* improvement with each succeeding season, in each successive generation.

There is a third method, and one which I think has much to commend it; if we establish breeding lines and operate each line for improvement and

A beautifully proportioned exhibition Light Green cock excelling in colour, quality of feather, wing carriage, throat spots and stance. The Light Green is still the most popular of all the many colour varieties.

fixation of *A* main feature, we should be in a position when the time comes, to blend the desirable features into one or more birds and so produce outstanding specimens, birds which, although no better than our best as regards head quality, perhaps not equal to our best in throat spots, not as big as our best in size, yet carry the highest aggregate of exhibition features; and so we produce our winning stock.

Chance Matings and In-breeding.

Head quality, size relative to body size, height and width, is due not to one single factor, but to an advantageous assembly of genes in the chromosomes of the individual; whether this genetic assembly is capable of being handed down directly from parent to offspring depends on the presence or absence of disadvantageous genes, genes which tend to narrow the head, to lower the skull or spoil proportions. If the stock carrying good heads is homozygous for this particular feature, i.e., if it is free from influences which detract from the quality we seek, the birds will breed young all of which have good heads; if the possessor of an excellent head is the product of a chance mating of parents neither of which carries the desired genetic assembly but which contain many adverse genes, this proud possessor of a good head may be incapable of passing on his quality to his offspring or only to a minority, and even then not in " pure " form. There is a vast difference as regards breeding capacity between the product of a chance mating and the product of in-breeding for fixation of desirable head quality. The former may never breed young which excel in head; the latter can be depended upon to breed a high proportion of young which excel in head, and a bird which fails in head from two parents each of which has been bred for fixation of head quality, will be an exception and evidence that, so far as this desirable feature is concerned, the stock is not yet free from disadvantageous recessives. The bad-headed young bird is the product of two disadvantageous genetic assemblies meeting by chance, and the chance of such meeting taking place has been greatly lessened by the purifying effect of in-breeding on the parents. They have been rendered almost, but not wholly, free from harmful recessives, and it is doubtful if absolute genetic purity is attainable in respect of head quality.

It is possible that, in our attempt to emphasize or exaggerate head quality, we may breed in some aberrant factor which will produce disturbance of balance such as vertigo; if we depart too far from the normal we may produce some physiological disturbance which may well ruin our plans.

In my writings I have frequently urged caution in departing too far from normal, in seeking to emphasize a feature which can almost be termed an abnormality, that I feel that in this striving for excessive head size we may well reap a whirlwind. There is a limit beyond which it is unsafe to go, beyond which it is inadvisable to proceed, and I so frequently found in the past, when breeding for over-development of head features, that I had a proportion of birds which suffered from "head twirling" and vertigo and even fits, that I hesitate to advise anyone to go all-out for head enlargement.

I have so frequently cautioned against the employment of birds which differ in sex but which are similar in head quality that I advocate using masculine cocks with feminine hens, cocks which have high heads with hens which have wide but lower heads; preservation of sexual differences, more noticeable in head shape than in any other feature, I regard as one of the most important problems which attend the breeding of healthy exhibition budgerigars. Here again we have selection playing its part; selection, or rather the standard which we should use for selection, should vary with the sexes, and I have found it even harmful to use hens which have the heads of cocks in a breeding team; they are, as a rule, neither good breeders nor are they productive of the best young. Selection should be carried out with due regard to sex.

CHAPTER V

SHOW FEATURES AND BREEDING CAPACITY

REFERENCE IS FREQUENTLY MADE to the correlation between exhibition features and the value or otherwise of the bird carrying these in its capacity to breed numerous or few, good or bad. Let us consider correlations which have some foundation on accurate observation as opposed to those which are nothing better than popular beliefs which will not bear analysis. I shall instance as a simple, varying correlation the cere colour in a bird as it comes into breeding condition; as the cere of the hen becomes brown we regard this as an indication that the time is appropriate for pairing her with a cock. There is relationship between the cere colour and the preparedness of the bird for reproduction. We judge its fitness by the colour of its cere, and we are correct to do so; this correlation is founded on observation that, together with this change, there is a desire on the part of the hen to go to nest. There is relationship between the age at which a maturing young bird develops this cere colour and her capacity to breed; young birds which change into adult plumage at an early age, and in which the cere colour turns brown, in the case of the hens, almost invariably become excellent parents and feeders; they need not necessarily breed young of any particular quality, but, as regards dependability, they are highly desirable.

Let us turn next to size and consider if there is any relationship between "bigness" and constitution; is the big bird sounder in constitution than the small bird? Although one could be excused for imagining this to be the rule, I believe there is no connection between great size and stamina. Personally, I have lost more outsize birds through sudden death for which no explanation was possible than I have medium-sized or small stock. When we enlarge beyond the average we do not increase vigour at the same time, and outsize birds are, in my opinion, more liable to heart failure; this is why we listen so frequently to the lament, "I lost the best bird I had." The "best" bird in such case is usually the biggest.

Let us now consider whether there is any relationship between head quality and breeding capacity, the instinct to reproduce. I think there is very definite correlation here in the form of hens which have cock-type heads being less dependable as breeders than feminine hens. The Standard, until recently, has applied to both sexes, and naturally, when selection has been practised for future breeding, one has tended to select as breeding hens those which most closely approached the Standard; hens with high domes have been chosen as breeding stock, and, although there are exceptions, I have consistently found that hens with high domes, hens which are almost indistinguishable from cocks except on close examination, are not dependable as breeders; they may go to nest and lay fertile eggs, but I have so often had such hens fail to rear their young that I always make it a rule that if such a hen *must* be used feeders are provided to take over her young, or even her eggs. I have always found hens which had wide heads when viewed from the front, and rather low domes when viewed from the side, made excellent parents, readily going to nest, laying large clutches of full eggs, sitting closely and rearing their young satisfactorily. As feeders (which I always use) I choose hens of this head quality, and I have scarcely ever been let down.

Defect in Hens.

When I use a hen which lacks depth in the region of the pelvis, just about where the legs join the body, I always keep a careful watch for egg-binding, as I have lost many hens which had this structural defect. Some hens lay very large eggs, and they, too, are more prone to egg-binding. There is here relationship between egg size and tendency to become egg-bound.

As we go over our nests we may be struck by the differences in feet and legs in babies; one nest may contain young which have very large well-developed feet and thick legs. We can state almost with certainty that such young birds will be very large when fully grown. In a nest of Yellows we may observe young which have rather greyish-blue feet and legs; in another nest we may find young whose feet and legs are pinkish and wholly free from the blue tinge. We can say quite definitely that the Yellows which, as babies, have pink feet are going to be of more pure colour than are those which have greyish legs and feet; even a few days after the young hatch we can sort out Yellows which are to be of good colour from those which will fail in colour purity. I am referring here to straight-bred Light Yellows and not to those which are influenced by cinnamon.

If we observe twenty or thirty green cocks we may see one or two which carry very bright body colour and which have a special inner band of greenish colour in the feathers of the wings. I call this "bloom," and greatly admire it in a Light Green. I have so frequently found that birds which carry this feature are " split " blue that I now feel reasonably confident in picking out such birds as being heterozygous for blue without knowing how they were bred. I know that, at the moment, in my aviaries, most of my Green/Blue cocks carry this wing colour, and I have experienced this year after year. I would not go so far as to state that, by putting together a Green and a Blue, we shall breed young all of which will carry this bright body colour and " bloom." There is a definite correlation between albinism and defective vision. The Lutino or Albino has defective vision, and this is easily proved. If we cage up in darkness for an hour a Lutino and a Green, and then return them to bright light, we find that we can grasp the Lutino or Albino with ease, whereas the Green rapidly adapts its vision to the illumination. If we turn Greens and Albinos or Lutinos from darkness into an open aviary, the Greens will find their perches much sooner and with greater accuracy than will the Lutinos and Albinos. There is no question about the correlation here, and we get exactly the same condition in human beings; human beings with albinism are described as being " Blind-fair."

Cinnamon Factor in Yellows.

The presence of certain factors influences colour; in Yellows we have the straight-bred Buttercup Yellow, and we also have the Cinnamon Yellow; the presence of the cinnamon factor in double dose tends to lighten the wing lacing and make the body colour less brilliant than it is in the straight-bred Yellow. By using cinnamon in yellow-breeding we lessen the wing lacing, but we also " brown-off " the body colour. The feather shafts are brownish in the Cinnamon, almost white in the pure Yellow. It may be difficult to appreciate this until one places the two birds side by side, and, in fluorescent " white-daylight," even a novice could tell one from the other. There is correlation here between the presence of cinnamon and a certain change in body colour.

Careful research is necessary before one can state accurately that definite correlations exist; what I have given, with the exception of the Lutino and Cinnamon, are rather to be classed as tendencies.

An important question crops up at this stage: Is the exhibition type the most desirable as a breeder; is there any correlation between show points and a bird's capacity to reproduce its kind? I think there is none. Birds which are valueless as exhibition birds, which are wholly undesirable in this respect, are usually most dependable as breeders and feeders. Provided the stock is robust and in breeding condition, I suggest that a breeder who selects as his feeders birds which lack show points will probably do better than he would were he to rely on his exhibition stock to rear their own young. In my opinion there is no correlation between show points and breeding ability.

The Matter of Pedigree.

Pedigree as it exists to-day is based on the belief that an individual hands its "quality" down to its young. Pedigree is of value so far as it proves that no cross-breeding has taken place in the recent past, but as a certificate that the individual to which it applies must inevitably breed better young than the non-pedigree individual, it is not reliable.

In most herd-books, stud-registers or kennel-registers only individuals which closely approach the exhibition standard are entered; we register the best dog in the litter, and no record is entered of the quality of *all* the young; we forget, very conveniently, about the wasters and regard the dog which carries the greatest number of show points as being sufficient; we put together two "pedigree" budgerigars, each from a separate source and, if we breed one which approaches the standard, we are satisfied; the fact that either or both has in its remote ancestry a winner of some renown is not a reliable guide to the breeding capacity. If both birds come from the same source there is greater likelihood of our being successful, since there is probably some relationship between the two or the same method has been used in the production.

The unwanted genes have been eliminated and possibly each carries a similar genetic assembly, and when two such favourable groups meet we get young of high quality. Where the birds are from different sources there is probably no relationship, and the exhibition points have been developed by different methods of breeding; one may be relatively free from unwanted recessives, whilst the other may be "teeming" with them.

I should never buy the nest-mate of a winner unless it carried the points I wanted to introduce; I should never lay down a large sum of money for an inferior-looking bird or even for an average bird merely because its brother or sister, its father or mother, or its grandparents won prizes. The capacity of an individual to hand down certain features is overrated, and it is only after certain conditions have been fulfilled that a bird becomes highly valuable as an improver of our stock; when it has withstood certain tests which I shall describe later; when it has produced a high proportion of desirable young and a minimum of undesirables it becomes something beyond gold and silver; it becomes invaluable; it becomes a master bird in the breeding team. It is worth ten times as much to the breeder as the untested, though pedigreed, bird. I am not referring here to pedigree which merely states that a green bird is the product of a green x blue mating; this is a certificate of cross-colour-breeding.

I refer to the certificate that a bird has a winner among its ancestors, and I regard this as much less valuable than it appears to be; the winners in past generations may have carried all sorts of undesirable recessives, and only the pedigree which states, not only the trophies won, but the relationship between each of the birds in each mating in the evolution, is of value. A certificate of in-breeding which carries the name of even one prominent winner is highly desirable, but how often do we get this. A certificate which carried details of the brothers and sisters of our pedigree holder would be invaluable, and we should be better able to guess the breeding capacity of the bird were we to know that it was a true representative of the clutch and not the only good one in half a dozen. If the other five are well below normal our newcomer is worse than useless; it is dangerous; it will, although it may look good, bring down our quality. There is one way, and one only, whereby we may judge the value of a newcomer; it must stand up to tests which will reveal its breeding capacity; the acceptance of pedigree is based on hope and guesswork.

Let us see how we may analyse our pedigreed bird before we dissipate his " quality " throughout our stock, before we use for breeding birds which he has bred, before we turn loose the undesirable recessives which he may, in spite of his excellent pedigree, carry tucked out of sight.

Analysis and Synthesis.

Let us fully appreciate the significance of the two terms, analysis and synthesis, and the part which they play in the stockbreeder's plans. Analysis is breaking down; synthesis is building up. The term synthetic (originally an adjective) has, by common usage, become a noun and should be familiar to all people. We describe a substance as being a " synthetic " when we mean that it is not a natural product, like rubber, but one which has been built up into a close resemblance of the natural product, and one which serves almost the same purpose and can be put to the same uses. We use the term adjectively when we speak of synthetic rubber; synthesis is the process of building bit by bit, fashioning as we proceed into something which we have in view. When we analyse something, we break it up to find out of what it is composed. We take it apart or subject it to various tests which will reveal its composition.

Analysis must precede synthesis. If there is a shortage of some commodity which is vital to our survival, a substance such as rubber during wartime, we must find a substitute, or, failing that, we must manufacture a substitute which will serve the purposes for which we require the natural product. We do not put together all kinds of available materials, boil them up and expect to get synthetic rubber. Before we make the substitute we analyse the natural product; we break it down and examine each element of which it is composed, study the proportions of each, and only then, with this knowledge, do we set out to duplicate the composition. This is applicable to the breeding of exhibition budgerigars; we must first analyse the unknown and, having gained knowledge of its composition, we can begin to build. The newcomer to our birdroom is an unknown quantity; we must analyse it before we use it for building what we have in view. Without this preliminary analysis we might introduce all sorts of rubbish, under the cloak of external show points, tucked away out of sight, but nevertheless there.

Upgrading a Stud.

In the course of my writings in *Cage Birds* I have frequently likened in-breeding to a process which " brings the dirt to the surface." In-breeding is an analytical process, a method of bringing to the light of day features which are hidden. This is the main method which we employ to reveal hidden factors which may be detrimental to our stock. By in-breeding we analyse our newcomer; we find out what he contains apart from what is visible.

It will be recalled that each germ cell contains only one-half the number of chromosomes characteristic of the species, and, as only one sperm fertilizes each ovum which in turn carries half the characteristic number of chromosomes, our male bird passes on his "quality" to only half of his progeny unless he is homozygous for the genes which bring about his high quality.

If he is free from recessives which detract from his excellence he will pass on his " quality " to each member of his family. Genetic purity is most unlikely, and we may therefore take it that approximately half of his progeny will carry the desirable genes; he is heterozygous and not homozygous. The hidden factors which we suspect may be present, may remain hidden in his young, but, when we mate brother and sister together, using several matings, somewhere recessives will come to light in the form of unexpectedly high quality, surpassing the original, or in the production of a proportion of grossly

Here is a specimen showing most of the faults it is possible for a Budgerigar to possess. A thoroughly bad example, it has a mean head with little height, no back-skull, a jutting-out upper mandible, multiple spots, faulty wing carriage, a dropped tail and separated tail feathers.

DEFECTS IN GENERAL MAKE-UP

The bird on the left (a hen) is far from being a good example. Not only is her forehead barred, but she possesses a mean, narrow face and multiple throat spots.

(Right) A Blue cock deficient in head properties. He lacks the required bold frontal, and there is insufficient height in the dome of the head. His wing carriage is faulty, also.


(Left) Serious defects in this specimen are its snaky neck, mean look and faulty wing carriage. Such a bird is useless for show purposes or for breeding exhibition stock.

(Right) An example of badly crossed wings. It must be pointed out, however, that even the best show birds often cross their wings temporarily when subjected to sudden fright.

The outstanding defect in this bird is its bifurcated mask which is in two distinct portions. This is due mainly to the great size of the specimen and its excessive width of face.

inferior young. In-breeding affords an opportunity for recessives to get together and, by so doing, of coming to light when present in an individual in double dose. It is an analytical process; we find out what is in a bird when we test his progeny in this way. We may employ the method of mating him with several of his daughters, and this, too, will eventually bring to light the hidden factors. Only if a first-class specimen can stand these tests should he be used for founding a strain or for grading up the stock generally. If aberrant factors come to light he should be rejected as a foundation bird or as one which can safely be used for general upgrading. If he passes the tests it is comparatively easy to transform the whole breeding stock into a much higher grade, as I shall discuss presently. Suppose our newcomer is an excellent green cock, a real show bird, and that he has stood the tests which we have carried out; "handsome is as handsome does," and in every way, as an exhibition bird and as a breeder, he is highly desirable. In two or three seasons we can transform our stock, which is only moderate, into a high-class exhibition stud. It is merely a matter of getting the correct master bird, of making sure he is as good as he looks, and then we can change the whole picture in two or three seasons. We term this process upgrading, and I shall go into this in some detail, as it is highly important that its principles be fully understood.

The Better Procedure.

When we upgrade by using this particular green cock we may mate him with one hen one season, another during the next year, and a third in the one after that; by that time his breeding life may be nearly over, and this is a slow method; in three years we have introduced his quality into only three breeding lines, and life is short. Why should we use only one hen in a season? The answer is because the budgerigar, unlike the farmyard rooster, is naturally monogamous; he is like the pigeon in this respect. So long as we allow him to remain monogamous our progress will be limited; we must force him out of this state no matter how desirable it may be; he becomes polygamous and he thereby introduces his quality into many more young than he otherwise would; we mate him with three, four, five or six hens in a season and breed from him as many young as possible during his first year. We may use him in like manner during the next year and, at the same time, we choose as his mates the best of his daughters from the previous year. The best of his sons we may mate with several hens each, and so, in two or three seasons, by breeding back on him and his best sons, we transform mediocre stock into something much more desirable; not only do we improve the stock generally, but we produce a measure of uniformity.

The process described is the widespread dissemination of high quality *which has stood the tests* throughout the whole stock. By breeding back and back we eliminate all the undesirable factors which kept our initial stock in a lower grade, and by the time we have upgraded to this extent we should have produced some outstanding show birds. The process is not automatically bound to succeed; much depends on selection of suitable birds during each year, but the method is sound. It is up to the breeder to use his judgment as to what is important in an exhibition budgerigar; he has been shown the way, but he must follow the pointing finger as best he can. The track is narrow and difficult, and there are yawning chasms on either side, but success is assured. If he even once injudiciously introduces a newcomer and uses him without testing him for harmful recessives, he is down into a pit from which there may be no return. If he loses his nerve and introduces an outcross without testing him he may bring in any number of harmful factors which will downgrade his whole stock more quickly than it was upgraded. I always think the natural tendency is towards degeneration in a high-class stock, and it takes a breeder all his ingenuity and care to avoid the pitfalls; we so frequently see birds which tempt us that I think a breeder would do well to make it a general rule to introduce nothing without most carefully testing it.

CHAPTER VI

SEX CHROMOSOMES

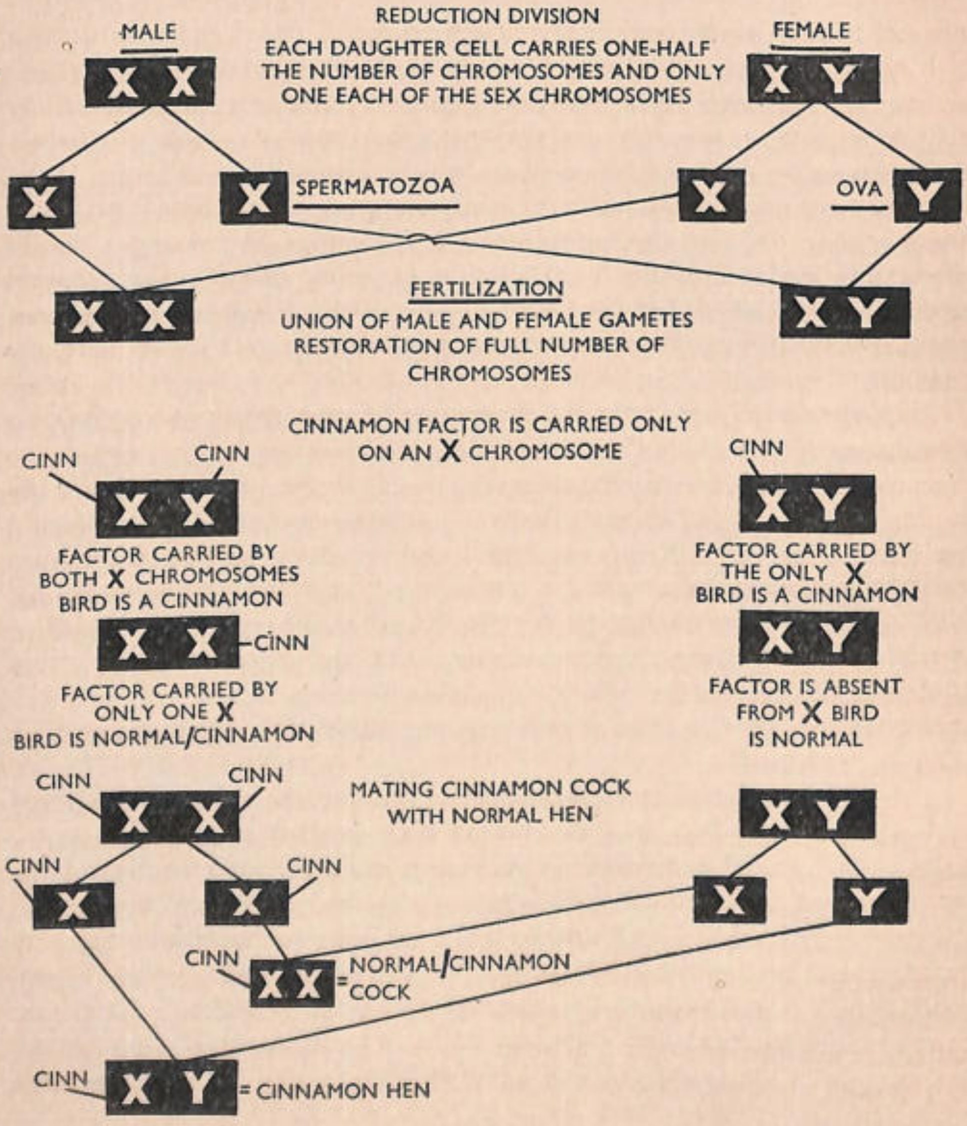
WE HAVE ALREADY CONSIDERED how a new individual originates from the fusion of male and female germ cells and how, with this union, genes are handed down from both parents and how such genes influence size, shape, colour, fertility, etc. In addition to the chromosomes which bear these determinants (genes which make a bird a Blue, a Green or a Yellow) and modifiers such as Greywing, we have chromosomes whose function is wholly different in that they carry genes which determine the sex of the individual. In addition to the *ordinary* factor-bearing chromosomes originally referred to and which we term the autosomes, there are two chromosomes which differ in size and shape from the others and, in the case of the female, they differ from each other.

In birds, the female is the sex determiner, as she carries two differing sex chromosomes; in the male the sex chromosomes resemble each other. The three chromosomes which look alike we call the X chromosomes, and of these the female has one and the male two. In addition to the X chromosome the hen has this odd sex chromosome which we term the Y chromosome. In the male the sex chromosomes are XX and in the female XY. In cattle the male is the sex determiner, the bull having one X and no other, and the cow having two XX; the bull is represented as having XO, and the cow as XX; there is no dissimilar chromosome like the Y chromosome in birds.

Let us see how these factors operate and so determine that the new individual is a male or a female.

It will be recalled that each member of the breeding pair produces germ cells which contain only half the characteristic number of chromosomes; the ripening germ cell has divided into two daughter cells, each having only half the number of chromosomes; with regard to the sex-determining chromosomes, the germ cells produced by the male will *each* have an X chromosome. The female produces two kinds of germ cells, one containing X and the other containing Y. Reference to the diagram will make this clear. Each sperm contains an X chromosome, but one-half of the ova contain X and the other half contain Y. It is a matter of chance which ovum is fertilized and, so far as the sex of the individual is concerned, it does not matter which sperm is the fertilizer. If an ovum containing an X chromosome is fertilized the new individual is a male, since X meets X. If the ovum is one containing Y, the new individual is a female with the sex formula XY. It is a matter of chance

SEX LINKAGE



which ovum is fertilized, but as the two types are produced in approximately equal numbers there should be approximately equal numbers of males and females in the progeny of the mating. In practice I have frequently found a preponderance of males in one nest and perhaps a preponderance of females in the next, but, taking results over a season or over large numbers of matings, we get about equal numbers of young cocks and hens.

Attempts have been made to control or influence the production of dissimilar germ cells; if one could inhibit the production of, or render sterile, ova which carry the X chromosome we should be able to breed mainly females, and the time may well come when the poultry breeder can produce mainly hens and maintain separately a normal compact breeding stock to produce the new necessary males. Certain genes which influence colour attach themselves to one of the sex chromosomes, while the other is free from them. The cinnamon factor in budgerigars, for example, is carried only by an X chromosome, and is absent from the Y. Using the diagram we can easily see why, where a male which is visibly cinnamon is mated with a cinnamon-free hen, we get young hens all of which are visibly cinnamon and cocks which carry the cinnamon as a recessive. In the male each X chromosome must bear a cinnamon gene before the bird is visibly cinnamon; if one chromosome only bears the cinnamon the bird is not visibly cinnamon, but carries the cinnamon gene as a recessive, since it is carried only on the one X chromosome and normality is dominant. As cinnamon is carried only on one chromosome its presence is masked by the other X chromosome which is cinnamon-free; the bird is normal in appearance, but " split " cinnamon. If cinnamon is present in the X chromosome in the female, there is no other X chromosome to mask it, and it is visibly cinnamon. A hen either visibly *has* cinnamon or it is free from it. A hen cannot be " split " cinnamon.

This is known as sex-linkage and is applicable to other varieties such as Lutino and Opaline.

In cattle the male produces two types of sperms, one of which is a large one containing the X chromosome, and the other smaller one, free from a sex chromosome. If one could separate the two types and by some means allow only one type to survive and fertilize the ova, we should be able to produce young all of one sex at will. By artificial insemination we could use only sperms which contain the sex chromosome, and so produce only female young. This would be of great economic value. If we could disturb the genetic constitution or chromosome assortment in the ovaries of the hen we might be able to produce birds of either sex at will. This time is not yet, and no reliable means have been employed of disturbing the chromosomes to this extent.

In budgerigars this would be of no economic value. In poultry breeding sex-linked inheritance is used, and chicks which show the colour of the male parent are pullets. Those which do not are cockerels and can be disposed of without wasting time and money in rearing them.

Theory and Practice.

Let us now put our knowledge to good account; let us see whether we can make practical use of our theories.

I take it that the aim of the breeder of exhibition budgerigars is to produce not that odd bird of chance which, although carrying a fair proportion of show points, may be of little value as an indication of the quality of the stock—a bird which is not representative. The aim should be to produce a high proportion of show birds each season. Since it is unlikely that his stock will ever attain genetic purity for all the desirable features there will probably be a number of inferior young each year, not necessarily defective, but of a lower grade than we desire for exhibition breeding. Most of such young will carry desirable features as recessives, and, while not what we ourselves may require, they are, by their relative genetic purity, attained through a system of breeding which cleanses the stock, very much more useful as outcrosses in the studs of other breeders than birds of unknown breeding. Although this portion of the book was intended primarily for the established breeder who desires some guidance in the matter of stock improvement, it would be useful, I think, if we took a simple illustration which could be adapted even by a beginner, although I am cautious about advising a complete novice to embark on a system of in-breeding; one can just as easily establish defects by in-breeding as one can highly desirable features and, until the breeder has educated his eye to appreciate the finer points in the show bird, I feel it is somewhat risky to suggest that in-breeding will give him what he will not get by some other system. In-breeding alone does not effect improvement; selection of stock which carries each a high aggregate of show points and rejection of stock which falls below a certain grade is not only a preliminary to in-breeding, but a procedure which must be consistently carried out in each generation, in each season. It is difficult for the novice to select accurately, and I should advise him either to serve his apprenticeship by out-breeding or obtain the help of an experienced breeder of exhibition birds, preferably one who is not averse to the mating of relations, as I feel sure some are even yet.

When I first advocated in-breeding for improvement, somewhere about 1932, I was met by stiff opposition; many condemned a thing of which they knew nothing. Others had had no success and based their views on the results obtained from perhaps three or four matings during a couple of seasons. This is not in-breeding as I see it.

Before one drafts a system of breeding which includes a measure of relationship between members of his breeding team there are two requirements:

(1) He must have an accurate mental image of what is required, and until he has such a picture of perfection he should refrain from in-breeding.

(2) He should see that his stock comes within reasonable reach of the standard, and so save himself years of trouble in effecting improvement; if his stock is low-grade he has a longer way to go and it will take him longer.

If a breeder has already a flock of budgerigars he should select the few which are definitely superior; there are all grades between the show bird and the rubbish, so he should set himself a standard and decide that he will not employ for in-breeding anything which fails to reach this standard; he should apply the Scale of Points issued by the Budgerigar Society for the variety he intends breeding, or he should use his own scale if he has ideas of his own; he must have a standard of some kind. Even if he has only one cock and two or three hens of good quality, he can establish a strain of exhibition birds in two or three seasons, certainly much more quickly and much more satisfactorily than he can by continuing his indiscriminate mating of birds on outward appearance alone. Selection plays a big part, as it gives *direction* to improvement; in-breeding supplies the *motive power*.

Let us take it that the breeder has one cock and three hens of reasonably good quality; he should mate the cock with each hen in his first season and use his ordinary stock as incubators and foster parents. At the end of his first season he will have young from his three matings each of which carries inherited factors from the cock. He will have reduced his variability by about one-sixth. The formula for reduction of variation is $\frac{1}{8M}$ plus $\frac{1}{8F}$ where M represents the number of males used and F the number of females. If we use only one male, then $\frac{1}{8M}$ becomes $\frac{1}{8}$ and if we use three females $\frac{1}{8F}$ becomes $\frac{1}{24}$; $\frac{1}{8}$ plus $\frac{1}{24}$ comes to $\frac{4}{24}$, or $\frac{1}{6}$, which is the reduction of variation by using one male and three females. Had we used three males with the three females, using the same formula, we should have obtained only $\frac{1}{24}$ plus $\frac{1}{24}$ or $\frac{1}{12}$. It follows from this that the fewer males we use in our breeding plan, or for that matter the fewer females as against the males, the greater the reduction of variation we effect. We now appreciate that each young bird we have produced owes half of his " make-up " to factors derived from his male parent and the other to whichever female is his dam. If the original cock be the best bird we originally had I should mate three or four of his best daughters with him in the second season, again using fosters. I should also mate half-brothers and half-sisters and, if any one of the three hens used carries desirable features, I should mate the best young cock with her in the second season.

Reduced Ancestry.

Breeding his daughters back on the original cock increases the number of factors in the F.2 young which are derived from the original cock, and we should find that a high proportion of these second generation young resemble him in many respects. By in-breeding in this way we halve the number of ancestors which any bird has; if we mate brother and sister the young from this mating have still only two grandparents, four great-grandparents, and so on; instead of the normal 4, 8, 16, 32 in the case of unrelated stock we have 2, 4, 8, 16. If we continue to mate brother and sister, or continue to breed back and back on to parents and grandparents, we still further reduce the relative number of ancestors; if we continue to mate brother and sister generation after generation we eventually have birds which have two parents, two grandparents, two great-grandparents. The " coefficient of in-breeding " is the relationship between the actual number of ancestors a bird or animal has and the total number it would have if in-breeding were not practised. Suppose we find the coefficient over four seasons. In mating unrelated stock each bird would have two parents, four grandparents, eight great-grandparents and sixteen great-great-grandparents; the total number of ancestors over four generations would be thirty. If we continue to mate brother and sister for four generations each bird has two parents, two grandparents, two great-grandparents and two great-great-grandparents, a total of eight as compared with thirty. The coefficient of in-breeding is 4/15 in this case.

As it is unlikely that a breeder will continue to mate brother and sister in each generation from an original pair of birds this coefficient of in-breeding need not concern him, and it is mentioned mainly to show the reduction in the number of ancestors where the closest form of in-breeding is practised.

An Opaline Green cock and an Opaline Cobalt hen of exhibition quality. The sexual difference in head contour will readily be noted.

CHAPTER VII

ESTABLISHING DESIRABLE FEATURES

IT IS SCARCELY REASONABLE to make the statement that in-breeding brings about genetical purity or simplification of the assortment of genes present in an in-bred individual as compared with the product of out-breeding and, having made such statement, to expect the reader to accept it; it is necessary to produce evidence of justification for expressing this as a fact. That in-breeding will effect genetic purity is incontestable, but I shall try to explain how such purity is brought about, how certain genes are virtually eliminated and how, when selection has pointed the way, in-breeding provides the motive power.

We refer again to the production of the germ cell which is ready to fertilize or be fertilized, and we recall that it contains only half the normal number of chromosomes; on these chromosomes are located the genes which influence, for good or ill, for one or other colour, for health or disease, the individual which will eventually develop. The aim of the stock breeder is to get rid of genes which delay or operate against improvement of his stock, and he therefore selects as his breeding members individuals which show the highest aggregate of show points, believing, or at least hoping, that the presence of show points indicates the presence in the make-up of desirable factors.

There is some justification for believing that the animal which carries the best aggregate of desirable features also carries genes which are favourable. Many may be present in double dose, i.e., on two adjoining chromosomes, each chromosome of that pair being derived from each of the parents. If a budgerigar is blue in colour, and was bred from two Greens or from a Green and a Blue, each parent must in the case of this individual have contributed a blue gene; the two chromosomes, each of which carries the blue gene, pair off side by side, and we have the blue in "double dose." The occurrence of a Blue in a Green × Green mating proves that each parent carries a blue gene as a recessive and that chance has brought together the two blue genes.

If we breed a young budgerigar which, when mature, has very large, even throat spots (a desirable feature) we can take it that this is either dominant to small spots or that it is present, perhaps as a recessive invisible factor in both parents. If neither parent excels in throat spots the genes which produce these large throat spots are present as recessives in each parent and, just as the Blue turned up from a pair of Greens, chance has brought together the one *or more* genes from each side which, together, produce the large, even spots.

If we mate our Blue produced from the pair of Greens with another unrelated Green, the factorial composition of which is unknown, we may produce young all of which are green; if we do, the unrelated Green lacks the factor which produces blue. Likewise, if we mate our young bird with large spots with another unrelated bird we may not breed young with this show point. If we mate it with a bird which is known to have the capacity to produce young with large spots (the parent of the opposite sex) we produce a proportion of young which have large spots. We are mating together two birds which we know carry the desirable genes. Had we mated the young Blue back on the suitable parent we should have produced both Blues and Greens. If we look on blue as a desirable feature we get a similar occurrence where we breed a young bird carrying a desirable show point back on its parent; we " wrap up " the assembly of favourable genes in each young bird which is the product of this in-breeding. Here, then, we have an illustration of in-breeding as opposed to out-breeding. The factorial constitution of each young bird, the product of in-breeding, is, within its own family, more uniform.

Features Emphasized and Fixed.

The same applies to fixation of any other desirable feature, and, in the mind of the breeder who thinks things out for himself and who has weighed one system against the other, there must be a strong influence in favour of in-breeding. I have no wish to involve the reader in a long discourse on the why and wherefore of in-breeding, and trust that the simple illustration may serve to show how in-breeding can be effective in establishing a desired feature in a proportion of the stock and how, with each successive phase of in-breeding, the feature can be emphasized through selection and fixed so that eventually a very high proportion, if not all, will carry the feature and, equally important, be capable of handing it on.

I have instanced throat spots as these are easily recognizable, measurable features; I might equally well have used head quality, but, for a beginner, this feature is more difficult to appreciate, and my choice of a simple, easily assessable feature does not in any way lessen the value of the illustration. The effect of selection followed by in-breeding is the same whatever show point (not colour variety) we breed for. In colour breeding one cannot by in-breeding produce Green budgerigars which are capable of breeding almost 100 per cent. Blues. There is no strict application of Mendelian principles which will assure us that good head quality is dominant to poor, or that large throat spots are dominant to small. There are all grades between excellent and poor, between large and small, but even this variation has its benefits; it allows us to choose, from what we have, certain individuals which carry desirable features and to reject those which lack them; the fact that there are no definite Mendelian proportions allows us to improve gradually, step by step, and ultimately to have stock capable of breeding young of uniformly good quality.

If Mendelian proportions were applicable to breeding of good and indifferent stock we should be tied to the apron strings of the 1, 2, 1 expectations. There is no art in colour breeding; we know what we shall get, as it has all been arranged for us. In stock improvement there is adventure at every stage, and it is because of this that I assert that the breeder of one variety who adopts a breeding plan for improvement gets more enjoyment out of his hobby than the breeder who mates all different varieties just to see what turns up. With few exceptions he could save his time by referring to tables.

"Plus" and "Minus" Genes.

Let us now consider the part which selection plays in stock improvement and, since I have practical experience of this in the breeding of Yellows, I consider that this may serve admirably as an illustration. The original Yellow, the Yellow "sport," as it cropped up in the first instance, was a greenish yellow, undesirable as a show bird on present standards. By selection, speeded up by in-breeding, the genes which caused the greenish suffusion were eliminated or virtually so, and, by choosing as breeding stock, year after year, those which showed least suffusion, and by fixation of the factors which were responsible for the rich yellow colour, the Buttercup Yellow was established as a true-breeding colour; Buttercup to Buttercup gives young all of which are buttercup yellow, relatively free from green suffusion.

The present exhibition Yellow has no trace of greenish suffusion on the body and only a trace in the wing lacing. The name of Mr. R. J. Watts, of Cambridge, will ever be coupled with the production of the Buttercup Yellow, as he did more than any other breeder to effect improvement and establish this as a definite exhibition variety. I have no doubt whatever that he would substantiate all I have written with regard to the evolution of the Buttercup Yellow. Those who have read that excellent book, "The Cult of the Budgerigar," will recollect that, many years ago, when Yellows which carried greenish body colour were regarded as of little value, I advocated selective breeding in the other direction, selective breeding to emphasize the green suffusion and provide colour contrast between wings and body.

There was a double object here; the wings would require to be kept as pure as possible while at the same time the body colour was being deepened with green suffusion. One might think that achievement in this would be more creditable than in breeding out suffusion from the entire plumage. I cannot say which is more deserving of praise, the breeder of the Buttercup or those who, by selective breeding on similar lines, deepened the body suffusion. I think it is easier to deepen the body colour, as there is a tendency ever present to revert to normal, i.e., to full colour depth, but there definitely is credit for the wing purity we see in the best "Yellow-wings" on the show bench to-day. The two extreme ends of the yellow scale show what can be effected by selective breeding, and when one realizes that the Buttercup and the Yellow-wing are basically identical as being in the yellow colour category we appreciate what can be done. There is no dominance of Buttercup over Yellow-wing or Yellow-wing over Buttercup. If we mate together the two ends of the scale we get Intermediates, Yellow-wings which are too light in body colour, or Buttercups which carry too much green. If we use a Buttercup for breeding Yellow-wings we lose depth of body colour, and no breeder of Buttercups would dream of using a Yellow-wing for production of Yellows.

Intermediate Yellows.

If we take the Intermediate Yellows, which have too much green to be Buttercups, and too little to be really good Yellow-wings, and breed one back to a Buttercup, we still further purify the yellow body colour; if we mate it with a Yellow-wing we deepen the green suffusion. There is no dominance one over the other, and where I have mated two Intermediates together the result was just an assortment of Intermediates, what we regard as bad Yellows or bad Yellow-wings. Mendelian inheritance is not involved in this selective breeding; had it been we should have had, from the mating of two Intermediates, Buttercups, Intermediates and Yellow-wings in the proportion 1, 2, 1 respectively. This is not the result we get; we get many gradations of purity and impurity, but none approaching either end of the scale.

If we mate one of the Intermediates with a bird of either end of the scale, particularly if we in-breed, we "swing the pendulum that way." If we have chosen, as a mate for the Buttercup, the Intermediate which carries the least green suffusion, we get young which are better in colour than we would had we merely taken an average specimen. If we use in-breeding in conjunction with this selection, we may even produce a few young which approach the Buttercup in colour purity.

Let us follow this line of thought and apply it to the production of birds with individual show points; let us take throat spots again. If we pair together a budgerigar with very big spots and one with very small spots, we may get young which have intermediate spots, but we get variation; some will have spots little better than the minimum, whilst at the other end of the scale there may be one or two with spots little smaller than the maximum carried by the parent. Naturally, and just as we chose the best-coloured young when we chose a partner for the Buttercup, we select the young bird which carries the best throat spots as a mate for the parent which carries the large spots.

Multiple Throat Spots.

To breed birds with large spots, we reject all the young which fail in this respect and employ only those which most closely approach the ideal. The reader may well ask at this stage why we should employ as a mate for a large-spotted bird one which fails badly, and why we should not choose another with large spots. It may well be that a bird which fails in throat spots may carry one or more desirable features which outweigh its deficiency in markings. Admittedly, if we can pair together two birds which have not only big spots but excellent heads, shapely bodies, and all the other desirable features, we should certainly do so except for one very remarkable thing which frequently occurs when we mate together two birds each of which has very big spots; we get multiple spots, more than the desired number, irregularity in size and shape, sometimes even two rows. I do not think we can say that one gene, and one only, is responsible for spot size, but it is possible that, where we get a double row of spots, the factor may be present in "double dose." If this is the case, we do not want it.

As already stated, I do not regard the presence of a desirable show point as being due to the presence of a single gene which can be described as the "big-spot" gene. The presence of a show point is probably due to a favourable *assembly* of genes each playing a part in the production of big spots; where a limited number of these favourable genes is present, or where there are also present unfavourable genes, we get a limitation of full-spot development; where the unfavourable outclass the favourable we get smallish spots; as I have said, there are many grades and the variability is due to the preponderance of favourable or unfavourable genes; I regard those genes which contribute to excellence as "plus" genes and indicate those which detract from excellence, which are in opposition, as "minus" genes indicated as $\pm$. This I apply to all show points, but not to colour as a variety. A green budgerigar does not have more + genes than a blue, but a bird with a good head has more + genes in respect of head quality than does a bird with a faulty head. The use of such terms simplifies the problem in my own mind; I think it is in accordance with correct breeding practice, and I hope that it will assist readers to follow my line of reasoning and to apply what I consider to be correct breeding procedure to their own problems.

Birds which are average in all respects probably have a balanced genetic assembly so far as quality is concerned, a balance between good and bad; we disturb this balance by eliminating the − genes and concentrating the + genes present in the stock, in respect of one or all of the show points. If we accept this theory we account for the way in which we sometimes breed very good birds from average stock. There are + genes present in both, but in the minority in each; chance brings together the + genes in one or more young and we get the superior offspring from indifferent parents; the reverse holds good.

Influence of Sex

There is fairly general recognition that the quality of young Budgerigars is determined by the quality of both parents, but it is perhaps less widely recognized that credit for any one feature of merit need not be equally apportioned. To my knowledge, no one has, as yet, attempted to establish the exact part played by each parent in the transmission of quality, and it would indeed be a long, painstaking procedure to do so. But there are certain occurrences which lead one to believe that male and female do not play equal parts in the production of young which excel, for example, mainly in head quality; neither can the transmission of throat markings be regarded as an equally shared capacity.

We have carried out over a period of many years careful recording of features which we know to be transmissible through parent to offspring and, when *our* findings are sorted out, there is justification for believing that the male has more than a fifty per cent. influence on certain desirable features, while the female is more deserving of credit in other cases. I shall confine my statements here to three features: head quality, throat markings, and size.

From our findings it is clear that the female plays a more important part in establishing head quality in her progeny than does the male. Certainly, if excellence in this feature is present in both partners, that is all to the good. But the point I wish to make is that it is much more important to have good head quality in the hen than it is in the cock. If the hen has an excellent head, we may be fortunate if she is mated with a cock which is somewhat indifferent in this respect but, and this is a big " but," you can't get away with it consistently the other way round. No matter how good the cock may be in head, unless he is mated with a hen which has all one could desire as regards head properties, the few good-headed young which may come from such a mating are not dependable as breeders of good-headed young. We have found it definitely advantageous to use the finest of hens where improvement of head is desired in mediocre stock.

In throat markings the opposite holds good and we have found that most of the credit for size, equality, and spacing, is due to the male ancestry. The cock must have well-developed throat markings before one can expect consistently to breed young which excel in this respect. For example, if we have a cock with large, well-spaced, even-sized spots and mate him with a hen whose spots are on the small side, we can still expect to breed young which carry good throat markings. If, however, we use a cock which has small spots and mate him with a hen with large, evenly spaced and distinctly defined spots, we do not expect to have anything but deterioration in quality of this feature.

But there is one important exception. If the hen we choose as a mate for this cock with small spots has herself an " overdose " of undesirably large and, particularly, multiple spots, we do very often get young from such a pairing which have large, even single spots. The spots might be said to be present in the hen in " double-dose." Again, if we use a cock which has an " overdose " of throat markings, we should deliberately choose as a mate a hen which has miniature, but evenly spaced spots. We " average out " in those two instances, and it is the only way I know whereby we can use an overspotted cock to advantage unless, of course, we resort to trimming the whiskers of our birds before we show them—a most reprehensible practice.

In the matter of body size we have to depend mainly on the female. The tendency here is even more striking, and if it be the wish of the breeder to increase size in his stock, he should acquire large hens. But it is most important that size be kept in its proper place, right at the bottom of the scale of show points. It is so easy to be attracted by a bulky bird that one may overlook undesirable features, and so build up trouble for the future.

CHAPTER VIII

PROGENY-TESTING

WHAT I HAVE SAID in the last chapter accounts for my views that the best-looking bird does not necessarily breed the best young. In a bird of average quality there may be a favourable genetic assembly which is suppressed by an unfavourable assembly—the + hidden by the –. It requires only another favourable assembly to bring this to light, and we should not be surprised when we breed a winner from a pair of average birds or a waster from a pair of show birds. In-breeding naturally increases the opportunities for two assemblies of + genes to get together, and consequently increases our chances of breeding show birds; it equally affords opportunity for unfavourable genes to come into association, and we get the wasters which crop up when we begin to in-breed with unknown stock; we bring the – genes to the light of day; we bring the dirt to the surface, and there is nothing but good in this process. It is a cleansing process and similar to the detective who unmasks the criminal, and nobody blames the detective. Why blame in-breeding? It has been said that a breeder, when asked if he in-breeds or line-breeds, should, if he is *successful* in breeding winners, state that he is line-breeding; if he is *unsuccessful* he should "blame" it on in-breeding. The difference between in-breeding and line-breeding is one of degree, but so fixed is the prejudice against in-breeding that one can always "blame" it for undesirable occurrences, whereas it is merely the process which brings the dirt to the surface; the dirt is there, and there is no use covering it up by out-breeding; clean up the stock by in-breeding and then we know where we stand. If our stock is full of – genes, bring them out where we can "see them." If mainly + genes are present, in-breeding will bring them out in full force.

Most in-breeders introduce an outcross to bring in a favourable show point which is lacking in their own strain, and, having brought this in, they employ in-breeding again to establish it. Some bring in an outsider merely because they have lost their nerve at the appearance of wasters amongst their young.

If nothing but wasters or a high proportion of these come from good-looking related stock, do not blame in-breeding; discard the stock and acquire something better in its place. The breeder who has built up his strain by in-breeding or by line-breeding, and is producing a high proportion of good young regularly each season, would be most unwise to introduce an outsider which may contain any number of – genes which detract from the breeding capacity of his stock, which may, in one or two seasons, cause his stock to produce an undesirably high proportion of faulty young unless his wish be to import some show point lacking in his stock, and it may be necessary to bring this in from an outside source because, although in-breeding is the motive force in improvement, it cannot *bring out* factors unless they are already present. When he takes in the newcomer there is a certain procedure which he should adopt before he introduces this apparently good, though doubtful, influence into his strain. He must subject the newcomer to certain tests as a preliminary; I shall deal with this procedure at length now, as it is vital to stock improvement, an essential precaution, a necessary preliminary.

In case any reader thinks that what I am about to describe is too involved, too exacting to be worth while, let me assure him that the easy way is the dangerous way and the strict observance of correct breeding procedure the only safe manner whereby we can effect improvement, whereby we can *import a gene* which is absent from our carefully bred strain. To clarify the situation I shall paint a picture.

Only Course Open.

A breeder of exhibition budgerigars has maintained himself in the forefront on the show bench for several seasons, but of late his birds are being beaten by those of another strain which carry a show point which has either jumped into favour, i.e., which has increased in importance or which is present in his opponent's stock to a more marked degree than in his own. He is being beaten by birds which are generally slightly inferior to his own, but which have one feature which is superior to the same feature in his own; this show point has gained extra prominence, and he has no alternative, if he is to maintain his position as a breeder of superlatively good budgerigars, but to import a bird which carries this point as an exaggerated feature.

I have already stated that the Standard is not a fixed, inflexible standard; it should be " one jump ahead " of what is generally winning at the moment and, as all-round improvement is effected and it becomes difficult to discriminate between many good birds, one feature, capable of improvement, is incorporated in the Standard. Let us take it that the feature is throat spots, size and equality. Our breeder has been winning with birds of excellent type, size and colour until he finds his birds taking second place to birds which carry very much larger spots. He has to do something about this, as he cannot accept defeat easily after his long run of success. What he must do is clear: he must maintain general quality and at the same time enlarge the throat markings. To do this he must import the genes which will give his birds large spots, and he must take precautions to ensure that, along with the outsize spots he does not import genes which will lower his general standard.

It is doubtful if any bird is pure for all the genes which make it good, and it is doubtful if our breeder would be able to purchase such an outstanding specimen. He stands a much better chance of getting a bird which excels in the wanted show point if he is prepared to accept one which is slightly lacking in some other respect; he may acquire a bird of good type with outsize spots but which is on the small side; this is exactly what he should take in if it is obtainable. As an outcross I should certainly prefer a smallish bird of good type with prominent throat spots to a big bird which failed even slightly in head. Size can be increased without much difficulty and is not really a show point in a true sense. Failure in head quality is a serious fault and one which should not be introduced. It is much easier to breed size *into* a stock than to breed *out* faulty head shape. The ideal outcross would be the big bird of good type and with outstandingly good throat spots, but as this is not obtainable he accepts the smallish bird of good type with outsize throat spots. What is his next step?

Bringing Hidden Factors to Light.

The visible quality is irreproachable apart from lack of size, which is not important. There may, however, be hidden factors which will detract from the high quality of his stock; he must bring these to light if they are present; he sets about unearthing – genes and he puts his "detective" (in-breeding) on the job. He mates this outcross, usually a cock, with three or more of his best hens and carefully puts aside all young bred from them. Next season he mates these young together, brother to sister and half-brother with half-sister and a daughter back on her father, the outcross. Out of this batch of matings there should come to light the – genes, the undesirable recessives; if none appear he can not only use his outcross with the best of his hens, three, four, five, six or any number of them, but he can also safely use all young which he originally bred from him; probably his brother/sister or other in-bred matings will have brought to light birds which carry good type and good throat spots and are of good size; he has his improved show birds without delay, but he has also *proved his outcross*. Should a number of wasters appear from his in-bred matings, the dirt has come to the surface and he has had a lucky escape from a general deterioration of his whole stock.

This process of analysis of his unknown is termed progency-testing, and if the reader will turn back a few pages and consider how these - genes are afforded an opportunity to get together by in-breeding, we see how important this progeny-testing becomes.

Establishing a Strain.

I have no doubt the ordinary reader will be wearied of theory by this time, but I trust that he who has, as his ultimate aim, the breeding of exhibition budgerigars will not give in too easily and that he will read and re-read what has gone before; it is the preparation for what is to come and, although largely devoted to scientific matters, I trust it has provided food for thought; that it is essential to put the breeding of budgerigars on a scientific basis I am convinced. I promised that, when fully grasped and understood, that section could be pushed aside and we could then get down to the practical application. The time has arrived for this, and I intend to outline a SYSTEM whereby one can breed budgerigars a large proportion of which should approach the Standard. The only requirement in a breeder which I cannot provide is the "fancier's eye," the ability to select stock. This is a vital necessity, but this he will have to cultivate as best he can; that it can be cultivated is beyond doubt; few are unable, after one or two seasons in budgerigars, to tell the good from the bad, and that is all that is necessary. I know there are people who can appreciate show points in almost anything once these have been pointed out, but they are the fortunate few; they have the natural inborn aptitude; I imagine they would become capable artists because they have inherited a natural appreciation of beauty.

This "fancier's eye" can be cultivated by careful observation, by tuition carried out by capable fanciers of whom there are many only too willing to help the beginner. I have many visitors to my bird-room, and to every single one I listen with care when he discusses points in my birds; never disregard observations made, even by a novice or one who knows nothing about budgerigars; every comment made, every criticism, especially adverse criticism, is worthy of consideration, and I should commend this education to every fancier, experienced or inexperienced.

Prior to the Second World War I bred Buttercup Yellows with some success and, although I have heard and read to the contrary, I have yet to be convinced that we have regained in this colour the quality of stock we previously had. I have paid particular attention to the Yellows at several big shows, and have yet to see one which compares favourably with those in evidence before the war. This applies to exhibition Yellows, but, from personal observation, I feel that the Yellows are not alone in this respect.

Several friends have remarked that it was a pity I could not have kept some birds during the war years, that it is because I dropped out and so lost contact with developments that I am critical of the post-war birds; this was a rational assertion, and so, before arriving at definite conclusions, I decided to study post-war developments; I delayed passing judgment on the post-war products in the budgie world until I had time to adjust my outlook; this is what I thought would be the proper course to adopt. I have had little cause to change my views that it is not only in Yellows that we are witnessing changes which are not for the better of the budgerigar as a show bird.

I have been asked *why* I stopped keeping budgerigars for several years, and my reply is always that I had something better to do, and that is an accurate statement of fact. Shortly after the war began we had difficulty in getting suitable feeding for the birds; I lost several of my best birds, and, although I succeeded in providing substitute feeding, the keeping of birds during those years seemed to be somewhat frivolous, and so one day I took a large box, scooped up the entire stock and sent them to a dealer. My aviary attendant had taken on evening work in addition to his day job and so had no leisure. I was put in command of the local company of Home Guards in a combatant capacity; this entailed parades, training, drafting of training programmes, and so every moment of my spare time was devoted to this.

I admit I had found another hobby, perhaps more arduous but more satisfying under war conditions. Were I faced with the same situation again I should do exactly as I did years ago and give up the birds. All credit to those who had the opportunity to carry on their hobby; to them we are indebted for stocks available after the years of war. There were probably many who maintained small studs of budgerigars during these years, and there is no doubt they had much with which to contend. Seed became scarce and costly; the market for surplus stock narrowed down and still more fanciers dropped out. The end of the danger period witnessed a revival of interest in former hobbies, and amongst these was the keeping of budgerigars.

I had closed the door on my hobby and I now decided to reopen. I put my aviaries in order and purchased stock here and there as best I could and as best I could afford. Possibly I was specially unfortunate, but when I look back on the rubbish I acquired at that time, and the rubbish which I bred from this stock, I wonder if my experience was a general one, if the returning fancier had to accept the stock which I had provided for my return. It is understandable that the scope for improvement of stock was limited during the years of war, but I feel that, as the danger passed, and there was a prospect of resumption of the hobby, many breeders who had maintained their stocks indulged in mass production to capture the post-war market, and that much stock offered was far below desirable quality. However that may be, we must forget, if not forgive.

I might almost describe the years since as "The Road Back." It is very interesting to cover ground which has been covered before, to retrace one's steps and recognize landmarks which were known in years past. It is easier to come back the second time; there is no doubt that experience counts for much; the pitfalls are known; the danger signs are recognizable; the difficulties are more easily overcome.

Birds Much Larger.

One might ask, "What are the main changes which the war years have wrought on the budgerigar?" The main change is an increased valuation of size, an over-emphasis on bulk as opposed to grace. I was shocked when I visited a big post-war show to witness the change in character of birds being benched. Whereas the budgerigar had been streamlined, alert, active, a bird of grace and beauty of form, those which confronted me were big, ungainly specimens, most of them down on the spar, with big, cumbersome bodies and with heads to match, spots which obliterated the intervals and, to my disused "fancier's eye," anything but desirable. As I have said, I delayed judgment until such time as I might possibly adjust myself to this change; I have found it quite impossible to reconcile myself to this over-valuation of size. The increase has not been coupled with a maintenance of beauty of form, with attractive deportment and so, although the post-war budgerigars are larger, they are less attractive, less comely than they were.

At several big shows which I visited I observed those very big birds occupying the leading places, big birds with big heads, big spots left after the unwanted had been trimmed from the mask. This I decided was not going to tempt me off my course on my road back. That a certain amount of skill is required to enlarge anything cannot be disputed, but when enlargement much beyond the normal detracts from natural charm it behoves us to condemn it, and I definitely condemn this tendency at present to regard a budgerigar as good mainly because it is big. I should caution every inexperienced fancier against this delusion and snare which awaits him.

When I observed the adverse effect which size had on the budgerigar I cleared every big bird I had from my stock and settled down to look for show points and some means of establishing them in a small stock which might improve. This was the beginning of the road back, and it may be of value to some who are in the doldrums to consider the steps taken to establish a breeding team with a view to producing exhibition budgerigars once more.

It was quite obvious from the stock which I had offered to me that no help from outside was possible. I had to breed with what I had and hope for a " break "—one spark to set me off; the " sparks " were loth to appear, but, by in-breeding, amongst the " dirt " there came one good, green cock, a bird of medium size, with good head, good carriage and good, even spots. From then on it was merely a matter of employing this bird to the best advantage, and the natural course to take was to mate him with two or three of the best hens I could provide; this I did, and from two hens I bred reasonably good young which gave me some stock from which to select. Selection followed by intensification and fixation is the road back.

Selection of the best each season, enhancing of show points by judicious mating and fixation by in-breeding or line-breeding, whichever one cares to term it. This is the road back for every fancier who has to start afresh. Selection is of prime importance, but it is not everything; one can choose the best each season, mate them together and breed good young; unless there is direction towards a goal, unless one adopts a *system* of breeding, the way back is long and tortuous. Given the direction and the motive power, we are on the road to success if we keep our sense of proportion, if we refuse to be diverted, if we refuse to leave the track and look at the tempting things by the wayside, the mirages which tempt every breeder sooner or later, the attraction of big spots, of great size, or some other solitary feature; if this tempts us from our straight course we may find our way back only with difficulty. I would advise a breeder of exhibition budgerigars to withstand all such temptations, keep on his course and breed, to establish, enhance and fix show points, show points which are of value—the real thing and not the mirage, the substance instead of the shadow.

There is a right way and a wrong way of doing everything, and the right way to breed exhibition budgerigars is to line-breed. I have already stated that selection provides the direction and in-breeding the motive power; there is little object in knowing the way if the means of progression is lacking. How, then, should one set about establishing a STRAIN? No breeder can have a strain of budgerigars unless he in-breeds for enhancing and fixing what quality he has in his stock, and so the breeder whose desire is to turn out show birds for his own use, or for the use of fellow-fanciers, must adopt some system of in-breeding or mating near or distant relations. He should firstly carry out selection of the best he has and, in case readers imagine I am merely covering ground already covered, let me assure them that I am merely leading up gently to a system which should assist them in breeding not the one or two good birds per season, but to which there is no limit, which will bring up their entire stock, which will give them assurance that their stock will, even in other hands, breed true and so be of value to others seeking improvement.

How often we hear of show birds failing to breed quality! The explanation of such occurrences is that no effort is made to fix the quality, to establish a show point as a transmissible factor before the bird is disposed of. We hope to show how this state of affairs may be remedied. Which bring us to FORMULA BREEDING, an adaptation of a Dutch system of up-grading livestock, or producing stock which can be depended upon to breed true to type.

Let me state right at the start that I have no intention of providing a ready-made formula for breeding budgerigars for exhibition. I use a formula, it is true, but it is based on a mass of recording, of careful observation of the parts played by male and female in the transmission of certain characteristics to their young; that male and female do not play equal parts in handing down all show points is obvious, and the formula is based on the part played by each, the percentage almost of the finished product which is due to the male and the female. If one understands this, one can put together two birds and accurately predict the peculiar features of the young; one can state that the young males from a certain mating will, when their turn comes, throw young of which the hens will all be outstanding in head quality.

I have no intention of providing this recipe, but I will outline the "method of manufacture." The ingredients are the birds in the breeder's possession or, more correctly, the show points carried by the birds. The "method of manufacture" is the system whereby the show points can be brought out in the stock so that, if it be the breeder's wish, he can turn them out as alike as "peas in a pod" after two or three seasons. The ingredients he has, and the production method I shall now outline. The formula I shall keep.

CHAPTER IX

FORMULA BREEDING

THE PRELIMINARY TO THIS SYSTEM of up-grading of stock is TEST-MATING, the testing of the most useful-looking birds in the possession of the breeder; unless one is prepared to carry out test-mating for a season, he might as well miss this chapter in his reading. Without test-mating the system is, in my opinion, useless, and may even be harmful.

Test-mating:—This involves testing of stock which visibly carry show points to ascertain if they are capable of transmitting them to their young. Most people are inclined to regard this as too much trouble, a waste of time, beyond a hobby; I think otherwise; if a thing is worth doing it is worth doing well, and nothing should be too much trouble. To carry out test-mating one has to sacrifice a season; one has to mate up his very good birds with inferior birds; he must be prepared to eschew success, to remain in the background for a time. I know there are few who are prepared to do this, but that is their responsibility, not mine.

The breeder chooses his very best birds of both sexes and, instead of mating the best cock with the best hen, as he usually does, he selects healthy, but definitely inferior mates, i.e., birds which carry faults instead of show points. I admit it takes a good deal of conviction to do this, and that it was much easier in my case than in many, as I am primarily interested not in the winning of prizes, but in the method of inheritance of characteristics in the budgerigar; I might just as well have studied how bad features were handed down, but this would have resulted in my breeding a lot of unsightly rubbish, and I still like to see good budgerigars, and, the object of most breeders being to produce good birds, I felt what I embarked on would perhaps be useful as well as instructive. I may state now that there is a tendency to revert to the wild type, that what we regard as faults, small heads, hoopy carriage, etc., are more easily passed down than are desirable features; against this I can say that where a good bird is mated with an inferior bird, and can still produce good young, that bird is worth its weight in gold.

The object of test-mating, then, is to find which birds produce good young under adverse circumstances, when mated with faulty partners, to test

Perfection in a Whitewing Cobalt hen. The highly attractive cock portrayed, a laced Yellow, is a possible bird of the future. Its production should be well within the capacity of a skilful breeder.

for dominance of good over bad, to analyse the stock and pick out the good from the seemingly good. I mentioned earlier that analysis must precede synthesis, that we must break down before we can build; the chemist carries out analysis of an unknown substance to find what it is composed of, what its properties are before he uses any of the elements for building or synthesis; before he can manufacture anything he has to test the ingredients of which he intends that it should be composed; it is the same with test-mating. If we mate together two unknown birds we are working in the dark. If we mate good with bad, and bad appears, it has been present in the good-looker, though not in evidence. The good-looker has not been able to transmit his quality under adverse circumstances and he is useless for our purpose; no matter how good he looks he is no use for formula breeding which is intended to cleanse the stock of all adverse elements and leave only the good, to get rid of the dross and leave the gold.

Detailed Records Essential.

Accurate recording of every young bird produced from each pair is essential; it is not sufficient to record that a mating produced two good-quality young only; if there are six young, the four bad ones must be noted, too, and the producer of the four bad young is no use to us. Only the one or two birds which produce *all* reasonably good young must be kept; the young need not all be up to show standard, but they must be uniformly good and definitely better than the inferior parent. Perhaps from twenty matings we may have only three pairs which produce the quality and uniformity of young which form the test; we segregate the better bird from each of those pairs and regard each one as a foundation bird; where we have the opportunity we should test those birds with other opposite numbers to confirm their capacity. Once this has been established we are on the high road to success; a season has not been wasted; many seasons have been won.

If we are fortunate we may have two pairs of high-capacity stock, and with these we form a nucleus of stock which will serve to improve the remainder. The object of this nucleus is to produce true-breeding birds which will be of high quality, capable of transmitting their quality to their young; instead of dissipating their quality throughout the stock before it has been fixed we in-breed within the nucleus to effect this fixation.

Young produced should be of high quality, and those which are intended for use should be test-mated. Almost invariably they are proved dependable if correct mating is used within the nucleus. Any young bird which is superior to any other within the nucleus, and which has been proved, becomes the master bird, and we then set about up-grading first the nucleus and then also the general stock. As this system entails rendering polygamous a bird which is by nature monogamous, which naturally chooses one mate for a season, if not for life, and in this respect differs from the rooster, we choose as our "improvers" only males from the nucleus. We select only the best young cocks which have been proved and mate them with a succession of the best stock hens which we possess, knowing that the quality of those young cocks will be reproduced in the young no matter how mated; from certain hens outstanding young may be produced, and from others young which are less excellent, but they will all be of good quality, even the worst of them invaluable as "improvers" of the stocks of other breeders. This is where this system is of value; foundation stock is proved and then suitably mated, and the young from those foundation cocks can be depended on to effect improvement. One may ask, "Where do the cocks come from which form the foundation?"

Each season the finest hens produced from one of the foundation cocks is brought into the nucleus solely for the production of young cocks for further up-grading; it will be noted that with this system only the males are important, and this is so merely because it is possible to mate a cock with three or four or five hens in one season (polygamy), whereas this is difficult in the case of a foundation hen. In the main stock breeding is carried on normally; birds from one line are mated with birds from another, and it will be noted that in the main stock line-breeding is carried on in normal fashion; it is from one of those outside lines that the top-grade hens are taken for use in the nucleus, but with this addition, that any cock produced from one of the outside lines which is superior to the master bird is test-mated with an inferior and, if satisfactorily proved, he takes the place of the master bird.

This sounds involved, but is perfectly straightforward; the only thing which makes this difficult is the need for several pairs of foster parents for the birds which are being used for up-grading; as it is necessary to mate a foundation cock with a succession of hens to get the full benefit from him, the eggs from each hen have to be removed and placed under foster parents whose eggs are discarded.

This is not the system for a novice, or even for a fancier who is not sufficiently discriminating, or who is not prepared to cast out unreliable good-lookers; it is for the breeder whose object is to produce birds which can be depended upon to up-grade the stock of other fanciers. The reward of the breeder who sets about fixation of quality and establishes its capacity to reproduce its like will lie in the demand for his stock as "improvers" or "up-graders." For the commercial producer of high-class budgerigars this is the system and, although there are not many openly engaged in the commercial production of high-grade stock, this system provides an opportunity for anyone with the time and equipment to make a name for himself as a producer of fine stock. If he is interested in producing show birds for his own use he can, by formula breeding, produce them at will and, from his nucleus, he can consistently turn out winning stock which, if he is a shrewd business man, he will retain.

The "Formula" Breeder.

Let us take a practical illustration of this: Suppose a breeder requires a bird or birds which will improve head quality in some of his stock; he approaches the "Formula Breeder" (let us call him), because he knows that, when he had stock from him before he got the results he wanted; he asks for a bird which will improve head quality in his stock; the Formula Breeder can put his hand right on the bird which will effect the necessary improvement and provide this with the knowledge that there will be no complaints from his customer; the bird will not, naturally, come from the nucleus, but from one of the outside lines, each of which should be devoted to fixation of one or a limited number of show points, one line being developed mainly for head, another for spots, and so on. This was mentioned in the development of breeding lines normally, but in this system it is the motive force of the nucleus which gives the added impulse; instead of dissipating this force it is concentrated and held in reserve so that any line requiring "boosting" can have it in full force. The breeding formula mentioned at the beginning is used only within the nucleus since the object is to produce for up-grading only males of the highest quality; there is a formula for breeding top-grade males and another for females; since it is easier to use a male for up-grading, only the male formula is used in the nucleus.

The author does not claim any originality for this system of breeding; it is merely an adaptation to budgerigars of a system used on the Continent for up-grading livestock of economic value. In place of milk production, egg production or bacon production I have substituted show points in the budgerigar; anyone who searches through animal breeding systems can find a similar system, but he will not find the formula which is the life-blood of the nucleus. I shall only go so far as to state that, as I stated early in this chapter, it is based on knowledge of the part played by male and female in the transmission of characteristics which are regarded as desirable in the budgerigar.

The formula in the hands of those who have top-grade stock at present would put them in a position where no one else would have a chance; it would kill the sport of exhibiting, and this I have no intention of doing.

Without the formula the general system of up-grading can do only good in the general advancement of the quality of the budgerigar. I have often stated that the combination of geneticist and showman would be the ideal; I doubt if it would be for the benefit of the Fancy, as the geneticist could put in the hands of an unscrupulous breeder a means of exploiting the Fancy. That it should remain a sport with a big element of uncertainty is the hope of the writer.

Part III

CHAPTER I

IN THE WILD STATE

THE PURPOSE OF THIS BOOK being to provide a readable treatise on the budgerigar as an exhibition variety, it would be out of place to dwell at too great length on the bird in the wild state. Since, however, several lessons are to be learned from a study of its behaviour at liberty some elaboration of what has already been written may not be valueless.

Comparing the wild type and domesticated type in the green variety, some differences are evident; the wild type is smaller generally when compared with a standard domesticated bird; here we have evidence of the effect of selective breeding as practised by fanciers over a number of years; most of this increase in size is directly attributable to selection, not natural selection or survival of the fittest as in the wild state, but to selection by breeders and the mating together of two specimens for the production of something still better. In the wild state only the fortunate and the fit survive; in captivity many of the unfit survive and propagate their kind so that, on general fitness, I rather think that the wild type is the more robust, more vigorous, if not so desirable from the breeding and exhibition point of view. The wild type is more alert, more timid, more "wild"; this is the only word which can describe the manner in which the wild bird, when disturbed, dashes itself against the cage or aviary front in an attempt to regain its freedom. Instead of the leisurely flight of the aviary-bred budgerigar, the wild type will almost dash its brains out with the speed of its flight and impact on an obstruction.

The wild budgerigar is generally duller in colour, although this is not an invariable rule. I have seen a few wild birds of bright colour, but again through selective breeding, breeders have improved on the original. It is this capacity for improvement which makes the budgerigar so attractive. The bird is so prolific that there is abundant material from which to select, and hence improvement is more rapidly effected than in the case of a species which rear only one or two in the season.

In its natural state the budgerigar lives mainly on grass seeds, although it appears to enjoy roots of small plants, small edible leaves, bark from twigs, and it does, contrary to the belief of some, drink water. The mere fact that a budgerigar will survive being deprived of water for a longer period than almost any other bird does not mean that it does not require water.

The wild budgerigar rolls in wet grass, runs wet stalks through its beak, and doubtless gets sufficient water for its needs in this manner; in the evenings flocks visit the water holes if only for a brief period. In captivity the diet is adapted to suit the breeder more than the bird; we cannot say that the diet is better. In many cases birds are wrongly fed, fed at the wrong time of day, deprived of natural food when such is available and treated in a manner which shows lack of thought and understanding. To feed budgerigars on canary seed, millet and a few groats with an infrequently renewed supply of water, and to give nothing in addition, is not productive of the best in the bird or its progeny. In addition to those dried seeds already mentioned the budgerigar in captivity must have a reasonable supply of green food, of seeding grasses to strip when in season, and wet grass in which to roll and play, earth in which to scrape, lime to peck at, sand and water frequently renewed.

Tree-hole Nesting Sites.

The bird in the wild state does not eat dried canary and millet, nor does it eat only seed; thus, from consideration of the habits and feeding of the bird in its natural state we learn the lesson that the ordinary staple diet of dried seed should be supplemented by a supply of live grass seeds, green food, lime and earth. Now, with regard to the nesting and breeding in the two states there are lessons to be learned here, too; in the wild state budgerigars nest in holes in trees and tree trunks, usually rotting stumps which are more easily excavated and shaped to suit the fancy of the prospective parents. These holes could better be described as burrows, since, as a rule, the entrance hole is not exactly opposite the part of the nest in which the eggs are to be deposited and hatched. There are at least two evident reasons for this: first, the parents require room to stand aside and feed the young within the nest, and the nest is more easily defended against a marauding neighbour if the entrance hole is situated to one side of the nursery.

Here we have a lesson which may be important when we breed these birds in captivity; we must conform to nature within reason, and we can do so to some extent by providing nesting receptacles which have the entrance holes set to one side instead of directly over, or opposite, the nest in which the eggs will lie and in which the young will be fed, at least in the early stages.

We shall see later, when we come to deal with the breeding of budgerigars in aviaries and cages, how provision is made for meeting these requirements.

In the wild state the brood varies from three to twelve, or even more, according to accounts of naturalists who have studied the budgerigar in its homeland. Many of the young must fall prey to predatory animals and birds while still in the nests, and still more while just emerging and before spreading their wings. The young budgerigars first look out of the entrance, or exit rather in their case, just a peep now and again to see what is outside their little house; having gained some experience, and still more courage, they pop their heads out, have a look round, withdraw and reflect on the situation.

Then comes the time when they grow even bolder; out comes the little body, too, and with the characteristic head-bobbing and inquiring glances the young bird gets a still wider outlook, again withdraws to the shelter of his home only to practise this exit and entry business until he becomes an expert. Instead of his clumsy scramble on the approach of danger he is into safety in a flash; thus is it that young budgerigars, so vulnerable when first they leave their nests, later acquire a dexterity which enables them to elude the enemy. In captivity the same holds good, but to a lesser extent; the risk is present only in communal breeding, where more than one pair is present in the pen, and is absent entirely in the single-pen system of breeding to which I shall allude at length later. From this we learn the lesson that, when breeding in communities the nests should not have too easy perching facilities just outside the entrance hole; thus the young are not tempted to leave the nests before their time. In single-pen breeding this matter is less important and, under such a system, the perch near the entrance hole may be an advantage in that the cock can more easily assist in feeding the young without having to enter the nest and occupy space which, with a large family, may be somewhat cramped.

These are all matters which we cannot afford to disregard although the birds are being bred under unnatural conditions. If more attention were paid to at least some of these the paths of many fanciers might be a good deal smoother.

CHAPTER II

ORIGINAL BREEDING ARRANGEMENTS OF PENS

I HAVE ALREADY STATED that, for the production of pedigree birds, strict control is necessary. Unless the budgerigar breeder is completely devoid of moral scruple he cannot dispose of his surplus as pedigreed stock unless he has made provision for assuring himself that the parentage of his birds is beyond doubt. One pair, and one pair only, in each pen or cage must be the rule if he is to have any certainty regarding the immediate ancestry. This does not apply so strictly to breeding for production of varieties as opposed to show quality. If, for example, all the cocks in an aviary are of one colour, say blue, the hens may be of different colours, but we still have the assurance, almost, if not quite absolute, that the young birds in any nest are the product of the hen occupying that particular nest and *a* blue cock, not this, that or the other special blue cock, but any blue cock in the aviary.

Provided the blue cocks are pure blue, and no cock carries a recessive, the colour-pedigree may be provided with a fair degree of certainty. If the young in the nest of a white hen are all blue, we can say that these young are all blue/white; if they are blue and cobalt, we can still say they are blue/white and cobalt/white, dependent on the suffusion of the hen occupying the nest. If, however, we have a green hen occupying a nest, we cannot say that all the young in the nest are green/blue. Unless the hen is a pure green, some of the young might possibly be "split" white, "split" greywing, etc.

Only where the hen is a white can we say that the young are "split" white, and even then cinnamon matings in the ancestry may have complicated matters. These examples are merely to indicate that there is apt to be confusion in colour-breeding even when all the cocks are of similar colour. When it is realized that, in a colony, any cock in the aviary may be the father of the whole flock, the question of pedigree-breeding for exhibition is hopeless. Suppose we took six green cocks and put them in an aviary with six green hens, we have still no guarantee that any particular cock is the father of any young in any nest-box. If the Greens are all pure green and carry no recessives, all the young will be pure Greens, but that does not imply that they will be of any use for breeding exhibition Greens. Since there can be no indication as to which cock is the legitimate father of any brood, no pedigree is possible, no evidence is available as to what latent characteristics any bird may carry, and no indication of relationship between birds in different nests is possible. They may well be all half-brothers and sisters. Even if the pairs are put up in small cages for a fortnight before turning them loose in the breeding aviary there is no guarantee that the attachments will remain. A dominant cock may father all the young or he may fertilize the eggs in his own nest and render all other eggs clear by interrupting every mating which takes place.

I have had these dominating birds, and they are splendid stock birds, usually big, vigorous specimens; they do not, however, have a place in the colony aviary. One such bird among six breeding pairs may cause all eggs but his rightful own to be infertile. He is not usually vicious and does not, as a rule, attack birds until they attempt to mate, and then he usually goes "bald-headed" for the prospective father, continues to cause these interruptions until no mating is possible and until all the hens but one are incubating clutches of infertile eggs.

No Colony Breeding.

It will be realized from what I have written that the colony system (although possible for the production of birds which depend entirely for their merit on colour) for the production of high-class exhibition birds is to be condemned; it is to be ruled out absolutely without any reservation. Let the breeder who has ideas of improving his stock, of stamping desirable qualities in his strain, of producing winners, forget all thoughts of colony breeding.

I consider it necessary to state this very emphatically and, as I have said, "without reservation." I used to consider that it was legitimate practice to select two brothers, pair them up each to a different hen and allow the two pairs to occupy a compartment. I even used to select the cocks which were equally developed and of equal quality realizing, of course, that, even if there were cross-mating or one cock fathered all the young, these young would all have the same grandparents on the sire's side, since the sires were brothers, but there could be no certainty regarding the male parent, and I have now given up this compromise and so I include the words "without reservation" in my statement that one pair per pen, and one pair only, must be the rule of the breeder of exhibition budgerigars. It is possible, of course, to turn loose, say, six green cocks and six green hens all of good quality and expect to get good young among the progeny; you may even breed winners in this fashion, but *only for one season.* Birds bred in this way carry no guarantee of parentage, and the breeder who is anxious to improve his stock will never succeed if he practises his art in this haphazard manner. He may sell his birds with the statement that they are pure green, but he cannot state that they are pure in-bred or even line-bred Greens; he cannot give the ring numbers of *both* parents; he cannot state what exhibition successes the sire has had, so, from the point of view of the breeder of exhibition birds, the assurance that the birds offered are "pure green" is valueless. To the geneticist who is interested in transmission of colour factors such birds are very useful, but only because they carry no recessive "colour" factors. They may carry all sorts of recessive or latent quality factors which may disintegrate the whole stock of a careful breeder before he realizes what is happening. "Quality factor" does not mean a factor for good quality; quality may be good, bad or indifferent. One "waster" may, in two seasons, work havoc in a carefully in-bred stock which it has taken years to build into uniformity in which the quality is good.

I feel that this matter cannot be overstressed and, until such time as breeders are compelled to furnish pedigrees, and genuine pedigrees, with their birds we shall not be able to effect the general improvement which is possible in the budgerigar. Concentration on one or two colours should be the aim of exhibition breeders; Mr. A. will breed Greens, Mr. B. Blues, Mr. C. Yellows, and so on. If this were carried out, two or three seasons would effect very great improvement.

What I have said may be regarded as introductory to what I have to say regarding breeding budgerigars for exhibition from a practical viewpoint. I have much to write about on this subject, and I wanted to get the question of single-pair pen breeding settled, as it is the foundation of the system which I am about to describe.

I know the old plaint that breeding birds in a colony is much easier than having to provide an aviary for each pair; it is easier to fill one seed dish and one water fount than it is to fill six of each; I know it is easier; it is also not the best. The easy way is seldom the best way, and in breeding exhibition budgerigars the way is hard and long, but there is a right way and a wrong way; the single-pair per pen system is the right and the other the wrong. The next objection is that it takes a lot of time to look after six separate pairs, to clean out six compartments, to open six doors and shut them, to twist and turn from one compartment to another; I admit it takes longer, much longer; it is still the right way. Next let us deal with the objection that it is more costly to erect six aviaries than it is to erect one. It most decidedly is, almost six times as costly, but is is wholly unnecessary to erect six separate aviaries and put one pair in each. The whole thing can be carried out in one aviary; I can put six pairs up to breed in one aviary and guarantee the pedigree of every young bird in every nest in the aviary. Let me tell you how it is done. Many will already have carried out this method; it is not the best possible method, but it will serve as an introduction to a method which is a better one. Let us take it that we have a space of ground about 15-ft. by 15-ft. On this space we erect an aviary with a shelter space of 15-ft. by 8-ft. and a flight space of 15-ft. by 7-ft. These are approximate sizes, but they will serve the purpose. For simplicity let us suppose that the shelter is open-fronted and communicates directly with the flight.

One Pair per Compartment.

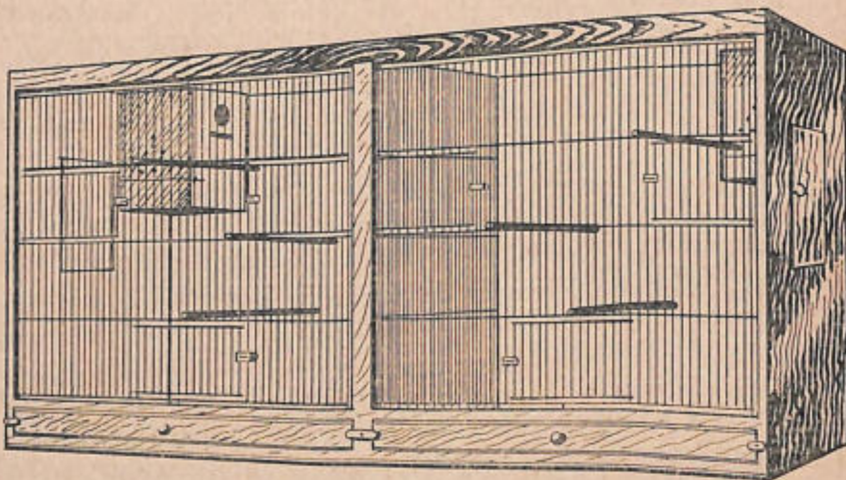
Into this aviary we intend putting six pairs of budgerigars paired up so that we can produce young with a guarantee of parentage in each nest. It is obviously impossible to turn the six pairs loose, hang up twelve nest-boxes and leave it to the birds. I need not go over that ground again. If we are to have any guarantee of parentage we must shut off each pair by itself until all the eggs have been laid and are being incubated. On the rear wall of our shelter we fix two shelves about 2-ft. apart, and divide this length into six approximately equal compartments, putting a next-box in each compartment.

The division may be of plywood or a wire netting-covered frame. For the front of each compartment so formed we require a wooden frame covered with wire netting and with a door for access to the nest and for feeding and watering the inmates. Small hooks serve to keep the fronts in position, so we fix on all our compartment fronts and put a couple of perches in each.

Finally, we put a pair of birds in each compartment and leave them to it. Each compartment is approximately 2½-ft. long by 2-ft. high, and it may be 12-in. to 15-in. from front to back. This is sufficient space for a pair of birds. "Ah!" I can hear my readers say, "that's cage-breeding." It is cage-breeding in so far as guarantee of parentage is concerned, but it is aviary-breeding in so far as general management goes. A watch is kept on the birds; when the hens are sitting on a clutch of eggs the fronts are removed and the birds are allowed the full space in which to exercise; it is unlikely that all pairs will be released at one time, but, as each hen settles on her clutch, the front of her compartment is removed. We are now on the colony system, but the eggs have been fertilized as we intended they should be, and by the birds which we have chosen, not by any bird who might literally "rule the roost."

The fronts are not returned until the first young are about ten days old, i.e., ten days out of the shell; then, the front having been put back, the cock belonging to the compartment is caught up and placed in captivity once more. He assists in feeding the young as before, and, when the young are a week out of the nest and feeding for themselves, they are removed from the parents and allowed to fly in the large space.

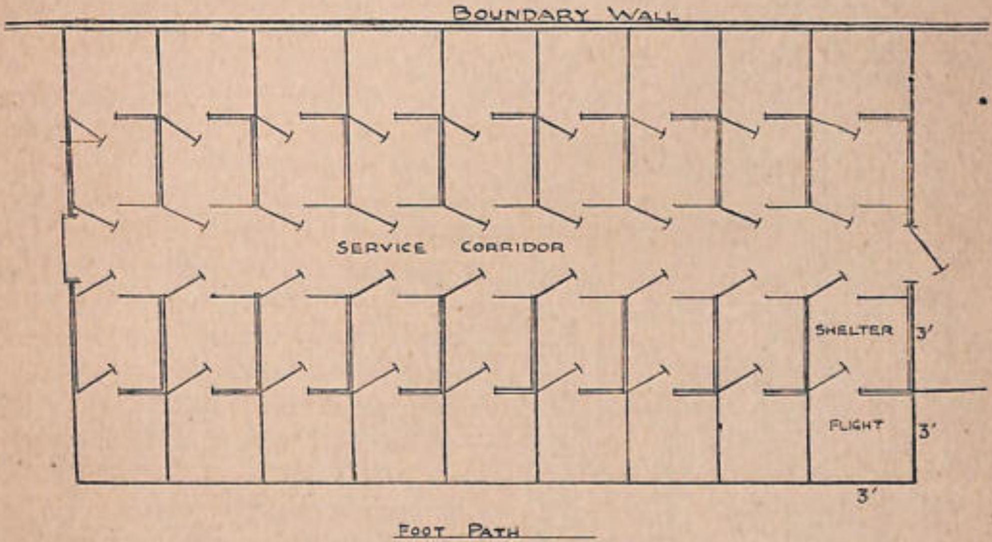
One objection which was raised to this was to the effect that the young being confined to the smallish compartment would interrupt the mating of



Budgerigar double breeding cage with nest-boxes in position.

the second round, and the result would be clear eggs. My reply is that it has been tried and found satisfactory over more than one season; with cocks of different colours I have never had evidence of cross-mating, and it provides the breeder of limited means with a solution to his problem of breeding several pairs in one house under control. There are, of course, little difficulties now and again with squabbling hens, but less than on the colony system without control; the nest-boxes being partitioned off from each other lessens the fighting, and the simplicity of the arrangement may commend it to those whose space is limited but who want to breed birds with certainty of pedigree and also allow full flying space for the young in the same aviary.

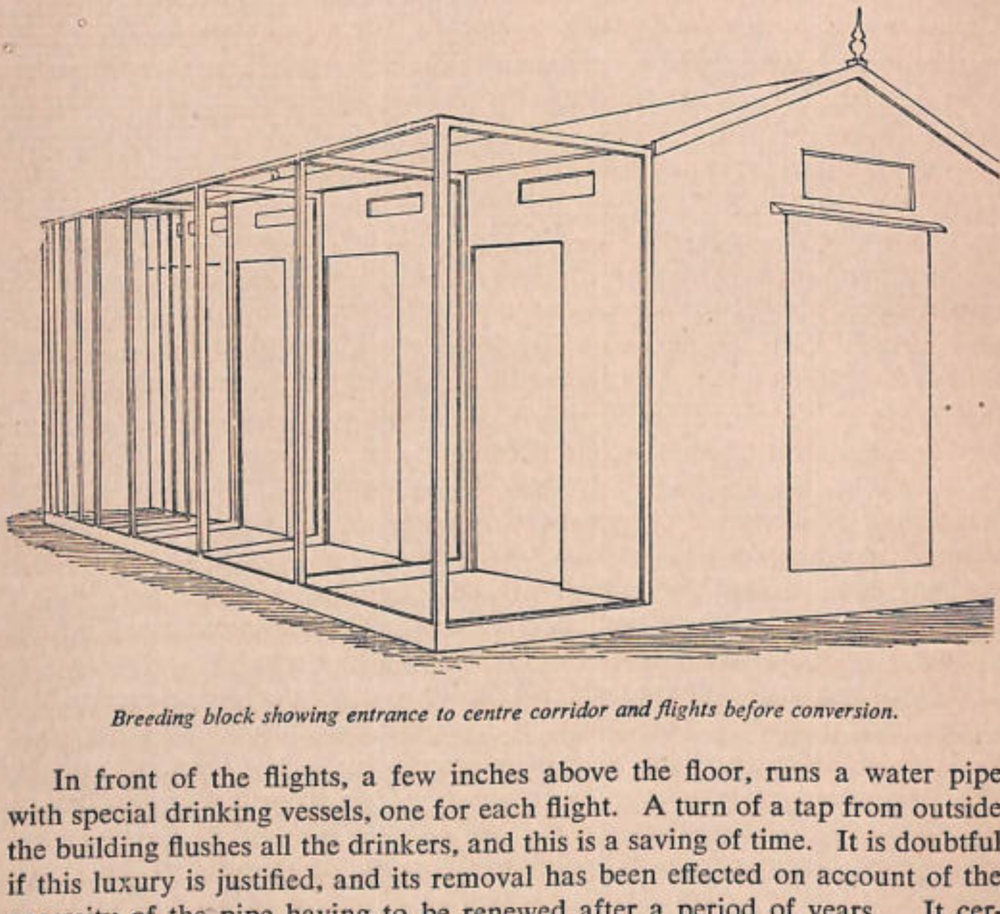
The next method is the single-cage-cum-flight method in which each pair is provided with a cage which communicates with an outdoor flight through a bob hole which can be opened and closed from inside the shelter. This is excellent and fulfils all requirements, and I think the birds bred in cages are less wild than those bred in flights where there is too much flying space. My only objections, not serious ones, to this are that the cage space is usually too restricted and that cocks are inclined to neglect their hens. This is a personal opinion, and I know it is stated that breeding birds do not require



Ground plan of breeding block.

much space provided they have access to flights now and again. I feel, however, that the indoor pen, rather than the cage, which communicates directly through a big door with the flight, affords more flying space than does the cage and flight principle. The preference is a minor one and, as I have said, entirely personal. With the wide door between the pen and the flight the birds can get plenty of flying exercise, and they use this constantly The disadvantage is that a separate birdroom is required, whereas with the cage-cum-flight arrangement the indoor portion serves both purposes; it is a breeding place during the breeding season and a birdroom during the show season. A full description of an aviary of this type is given in Mr. Watmough's book, "The Cult of the Budgerigar," so I shall proceed to describe the pen-cum-flight arrangement which I use. The accompanying drawings serve best to show the structure.

Looking at the ground plan first, it will be noted that the building referred to covers a ground space of approximately 27-ft. by 15-ft. It consists of a house 27-ft. long by 9-ft. wide which has a central corridor of 3-ft. flanked on each side by a row of nine breeding pens, each 3-ft. by 3-ft. Each indoor pen communicates through an 18-in.-wide door with an outdoor flight which is 3-ft. by 3-ft. The corridor is therefore 3-ft. wide and each pen and each outdoor flight is 3-ft. by 3-ft. When the doors are open, therefore, the flying space is 3-ft. by 6-ft., which is sufficient for a pair of breeding budgerigars.



Breeding block showing entrance to centre corridor and flights before conversion.

In front of the flights, a few inches above the floor, runs a water pipe with special drinking vessels, one for each flight. A turn of a tap from outside the building flushes all the drinkers, and this is a saving of time. It is doubtful if this luxury is justified, and its removal has been effected on account of the necessity of the pipe having to be renewed after a period of years. It certainly is a time-saver, and it is also useful for assisting in scrubbing out the concrete floors of the flights. The flooring throughout is concrete, the floors of the flights running down towards the front so that water cannot collect, but drains away through small apertures into the surrounding soil. The wooden framework of the flights is of 1-in. by 2-in., and is covered with ½-in.-mesh netting. The height of the flights is 6-ft. 3-in. The house is 6-ft. 9-in. at the sides and 8-ft. at the ridge, and is roofed with very heavy quality felt on ¾-in. pine boards. The sides and ends of the house are of ¾-in. weatherboarding on 2-in. by 2-in. framing with corner posts of 2-in. by 3-in.

In erecting this structure, holes were made in the concrete and bolts embedded so that the lower rails of house and flights are securely bolted down and the whole structure built on this firm foundation. Each communicating door is 4-ft. high and capable of being closed and opened from the corridor, by means of a cord. The doors which open into the indoor pens from the corridor are of 1-in. by 1-in. framing and covered with netting, as is the whole side of the pen which forms the corridor "wall."

Handy Feeding Flaps.

The corridor is flanked on each side by a row of nine breeding pens, the full interior of each of which we can see, as it is separated from the corridor by netting on 1-in. by 1-in. framing with the door already mentioned. In each door there is a feeding flap with a shelf for the food dishes, so there is no need to enter the pen to replenish the seed supply. The flap is weighted and so kept closed securely, while on the front edge of the shelf which carries the seed dishes a small fillet of wood is attached to prevent the dishes falling off when the door is opened and closed. As the interior of the pen is visible from the corridor the condition of the occupants of each pen can be noted in walking along on the twice-daily inspection. It is necessary to enter the pens to clean the floors once a week and to attend to the young in the nest. The perches in the pens are hinged to lift up, so it is unnecessary to crawl underneath the perches, a most unpleasant practice in my opinion.

At one time I had the nests accessible from the corridor, but I changed things round so that the nests are inside and I have to enter the pens to inspect the nests. I think the original method was better. The nest doors opened into the corridor, so, when the nest was to be inspected, the door was opened slightly, a piece of celluloid was slipped under the partially open door, and then the door could be opened wide without risk of the birds popping into the corridor instead of into the pen. When the birds had been "shooed" off the nest into the pen, a piece of paper was stuffed into the entrance hole to keep them from returning unexpectedly, and then the celluloid was removed and the young could be lifted out and placed in an old felt hat which was hung on the wire just below the nest door; in this way the young could be ringed and have their feet and beaks cleaned, and the nest could be scraped without having to enter the pen; the dirt fell in the corridor where it could be easily swept up and the procedure was ideal.

When I used the Version type of nest, described elsewhere, the removal of eggs and placing of these in the cardboard box was easy, while the turning of the box did not entail entering the pen, but was the work of a moment. The eighteen nests could be inspected and cleaned in about fifteen to twenty minutes, whereas when one has to enter each pen it takes much longer. Experiments with different sizes and shapes of nest-boxes caused me to abandon the nest-opening into the corridor. For anyone who is content to stick to one type of nest the type which has a door opening into the central corridor is the ideal. I am frequently told that I " mess about too much," but I get a great deal of fun out of it. There are several ways of doing most things, and it is interesting to try out ideas, even if they prove unsatisfactory under test.

Finally, with reference to the partitions between adjoining pens, these are of ½-in. T. and G. boarding, while the divisions between the flights are of ½-in. netting. The upper 3-ft. of the division between the flights is on a frame which is removable, so that the length of flights can be turned into one flight on each side of 27-ft. by 3-ft. for exercise during the non-breeding season, cocks being kept on one side of the house and hens on the other.

Chapter III

CONVERSION OF PENS TO PROVIDE EXTRA ACCOMMODATION

WHEN I DECIDED TO APPLY A SYSTEM which entailed test-mating and progeny-testing to the breeding of budgerigars it was immediately apparent that much greater accommodation would be required, or, rather, conditions would have to be changed so that more pairs could be put up without sacrificing the security of control-breeding. My indoor pens would have to be converted to accommodate four, five or six times as many breeding pairs. I still had to have absolute guarantee of pedigree, and to do so I should have to employ a system which I had condemned as being undesirable; I should have to cage-breed budgerigars. I still maintain that, where any alternative is possible, cage-breeding is far from ideal for such active birds, but needs must, and, if I were to carry out the plans which I had in mind, I had no alternative but to provide, in place of individual pens, individual cages. I can assure my readers it took me some time to reach this decision, but, as ground space was not available for expansion and materials were limited, the erection of another range of pens was out of the question.

I had two rolls of ½-in. mesh netting from pre-war days, a considerable amount of second-hand timber obtained through dismantling an aeroplane hangar which I had erected under happier circumstances, and so I decided to subdivide each breeding pen into six compartments. In case it is of use to those faced with a similar problem, I shall describe in detail how the conversion was effected. I may say now that, were I a cage-breeder at heart, and had to erect a building equipped with cages, I should, from the start, employ the plan I have used for the conversion. It is economical as regards space, provides the breeding pairs with as much space as the average breeding cage, and probably greater length in each cage (3-ft.) than is usually allowed. Length being more important than the other dimensions, it is provided for in this system. Although I regret having to dispense with half my indoor pens, I find the subdivision and provision for easy management and time-saving perfectly satisfactory.

This range of indoor pens was provided with an outdoor flight each, and, as these were no longer to be used, I dismantled all framing and wire, leaving only the concrete floors which now form a slightly sloping path in front of the building.

I next had to remove the doors, strip all the weatherboarding up to the height of the door tops and replace this with the weatherboarding which I had in lengths of 10-ft. to 15-ft. With the help of a local tradesman this was effected in one day; the doors were there in the morning and, by the time darkness put a stop to our activities, the new weatherboarding was in place; it had to be completed, as in the pens on the other side of the central corridor were the breeding stock, about a dozen in each pen. The work was carried out in mid-December, and it would have been undesirable to have the whole front left open at this time of year with wind at times approaching gale force and temperatures very low. Little change was apparent in the building at this stage, and it was not until we cut the window spaces which were to provide light for the occupants of these compartments that it took on a somewhat strange appearance. As will be seen from the photographs, there are three rows of small windows, each of which provides light for two adjacent compartments. The windows are fixed, and the glass heavy Arctic type, i.e., with moulded surface which admits light but is not fully transparent. This is strong and the birds do not fly against it so readily when frightened. Having completed the exterior, the wood was given a coat of red oxide and finished in light stone colour to match the remaining parts. The problem so far had been very simple. Now for the interior.

As will be seen from illustrations of the original structure, each indoor compartment had a door with feeding flap and the remainder of the inner "wall" of the compartment formed of wire on battens. The doors were removed and the wire and battens stripped, leaving each breeding pen with an outer wall with three windows in a vertical row, two sides formed of ½-in. wood partitions and only a bottom and top rail where previously the wire netting and door had been. As it would be difficult to catch budgerigars in the upper compartments unless we fitted a ceiling, we fixed fillets of wood, 1-in. by 1½-in., around the interior at the level of the top rail on the corridor aspect, and to this we attached a sheet of "Wallboard," a very tough, durable compressed sheet. Before fixing this in permanently we erected a vertical rail, front and rear, midway between the two side walls so that, when netting was fixed to this, it would vertically divide the pen into two compartments, each 18-in. wide and 3-ft. from front to back, while the height was the height from the floor to the ceiling fillets. Having fitted in the rails, by nailing and screwing, we cut out the ceiling to allow for these vertical rails, fixed a front to rear rail on a level with the ceiling fillets and with the front attached to the front vertical and the rear attached to the rear vertical. We now placed the ceiling board in place under the fillets and central rail and screwed it in place. We next fitted a front to rear central rail below the ceiling, attaching it again to the front and rear verticals. This provided a rail to which we would fix the netting. We next put a front to rear rail between the feet of the front and rear verticals to carry the lower end of the netting, and we cut the netting to a suitable size and, with wood strips, fixed it to the central framework.

We next fixed fillets of wood on the side walls, inside the front wall, between the front to rear verticals 18-in. below the ceiling. On the opposite side of the netting from this next front to rear rail we fixed a similar rail and screwed the two together through the netting and also fixed them firmly front and rear. This was the framework for the floor of the upper compartments which also formed the ceiling of the next flat. To complete the framework for this floor a horizontal rail was run across the rear vertical from side to side of the pen, as shown, and on the upper side of this framework we placed the wallboard in two halves; we now had the two upper compartments completed apart from the rear walls.

Three-tier Arrangement.

We did the next and third floors the same, and so provided six compartments in each pen, each compartment measuring 3-ft. by 18-in. by 18-in., and all looking very trim. Before we put in the floors we had decided on the height of each cage, and, anticipating difficulty in catching birds if the perches were fixed, we decided to hinge hardwood blocks on to the side walls at suitable positions, each block having a hole to take the end of a $\frac{1}{2}$-in. dowel which would be used as perching. The perches, instead of folding upwards, as in the larger pens, were to fold back against the wall, one folding backwards and the other forwards so as to leave an unobstructed space in which to catch the birds when necessary. The length of each perch was arranged so that it just passed through a mesh of the netting when in position, and it was quite simple to press the netting aside to free the tip of the perch when it had to be folded against the wall. It will be noted that the front vertical divided each window into two smaller panes, one in each compartment, and ample light was provided in this way. The ceiling in each compartment was painted with flat zinc white paint, over which distemper could be put if necessary. The reverse surface of this type of wallboard has a canvas surface and took the paint very well. Before the floors had been fixed in position, the interior of the pen had been freshly distempered, and so, with the floors in place, and the pen symmetrically subdivided, it did indeed look a tidy arrangement. There was still a space below the lowest floor, but this was left for the time and no window was provided for this space, but instead ventilators were set in the outer wall at intervals.

We now had to complete the compartment by fixing a horizontal cross-rail in each to carry the cleaning and feeding flap shown in the photograph. We completed the whole by making the wire-covered doors of 1-in. by 1-in. verticals and horizontals of $\frac{1}{2}$-in. by $1\frac{1}{2}$-in. and $\frac{1}{2}$-in. by $2\frac{1}{2}$-in. top and bottom respectively. This makes a very sturdy light door, and it is decidedly better than using 1-in. by 1-in throughout, i.e., for verticals and horizontals.

Only the nest-box space was left, and this we completed by fitting removable pieces of plywood until such time as we made the special nest-boxes required. We could have left the plywood in position and used existing nest-boxes, but this entailed opening the wire doors to get at the nests; these would require to be lifted out and set down somewhere for inspection and cleaning, and, as we were putting up many more pairs than we usually had, my attendant might have raised some objection to the additional work.

I calculated that, by providing nests which could be inspected from the corridor without having to be moved, by providing flaps for feeding *and* cleaning, and by having uniformity in the whole structure, and provision, when seed became available, for seed hoppers which could be filled and emptied from the corridor without removal, we should be able to manage the forty-eight pairs which would occupy these compartments; we decided to leave the pens on the opposite side of the corridor, each with its outside flight and communicating door, for the housing of young as they were removed from their parents; they would form nurseries for the young, compartments where they could get a reasonable amount of exercise and yet be under observation before being turned into the larger stock aviaries.

We thus provided the three requirements, accommodation for larger numbers, nursery aviaries for young stock, and we had two larger aviaries for moulting stock and birds nearing maturity. The method was progressive, from the breeding compartments into the nursery, from nursery to aviary, and, in deserving cases, from aviary into the birdroom training cages.

To obviate having to catch up young birds in the nursery, cage and carry them to the aviaries, we provided a means of moving them along from the distant nursery pens towards the aviaries so that, when ready to go into the aviaries, a section of the end partition was dropped and the young birds flew into the larger flights. As the nursery pens were as originally designed, with doors with feeding flaps, management was orderly and the minimum of work entailed in feeding and cleaning.

As already stated, were I to design a new structure I should copy exactly this conversion. To my way of thinking it provides ideal breeding accommodation, allows of standardization, absolute control, good lighting, good ventilation, easy inspection of nests and young, interchangeability of nest-boxes, and, in appearance, a neat, workmanlike arrangement.

When completed, we painted the doors and hinged flaps with aluminium paint, and on each nest-box door we fixed a card frame in which we could insert a card with the ring numbers of the occupants and the ring numbers of the birds bred from them, not necessarily the young occupying the compartment; elsewhere I mentioned the use of feeders, and, as no note is kept of the rings of the feeder pairs, the card bearing the ring numbers of the main stock pairs is inserted in the frame of the compartment to which the eggs are transferred, and, as each card bears the pair number of the stock pair to which it applies, there is no need to ring birds in one compartment and put their ring numbers on a card attached to the compartment occupied by the true parents. There is thus little risk of error, and, as the main stock pairs form a central row with feeder pairs above and below, the distribution of eggs is easy and error almost eliminated. The nests can be cleaned and the bottoms replaced from the corridor, and, as only one spring clip holds each nest bottom in place, and badly damaged or badly fouled concave can be replaced in a moment. This is important when the young are tiny and the weather cold.

Fresh Air Always.

During warm weather the doors of the nursery pens are open and fresh air enters the whole building. During cold weather, with the ventilators below the lowest floors, draughts are avoided yet sufficient air enters to keep the building fresh and airy. As regular weekly spraying with a disinfectant is carried out, disease is unlikely to occur, and, although we expect to have losses each season, we feel we have provided against losses due to bad ventilation and mismanagement. I hope that readers may be able to find something of benefit from this description of how we provided additional accommodation without extending the ground space, and without structurally altering the existing building.

Chapter IV

MANAGEMENT OF STOCK UNDER FEEDER SYSTEM

WITH REGARD TO THE OPERATION of this breeding plan, an example will be found on an adjoining page of the sheets used for providing a day-to-day picture of happenings in the breeding compartments. To keep written records of each pair of stock birds and of each pair of feeders, with details of transference of eggs, etc., would entail much writing and would, in my opinion, be open to error. It is quite impossible to maintain a day-to-day picture in the mind of the happenings, and I regard the "Distribution of Stock Sheet" as being a vital requirement where so much distribution of eggs and changing of hens in the stock pairs requires to be recorded. Just as I had to do when faced with the problem of accommodating more breeding pairs, I sat down with pencil and paper and made an "appreciation" on the basis of Object, Factors, Courses and Plan.

The object is accurate recording; factors are needed for compact system, minimum of error, and a day-to-day picture of events. Courses open were (*a*) to keep a card for each stock pair and for each pair of feeders and, after the young reared by the feeders were ringed, the ring numbers should be entered, not on the card of the feeders, but on the appropriate stock card. This was open to error and clumsy; (*b*) to use only a stock card and one for each mating and, when eggs were transferred, to transfer the card with the eggs and, on that card, to enter the ring numbers of the young. There should be no occasion to enter the numbers on the wrong card in such case, as the ring numbers are the ring numbers of the young occupying that particular pen, irrespective of which pair is rearing them. The plan which evolved from consideration of such matters is illustrated by the distribution sheet and by the notes which follow.

It will be observed that the central row of breeding compartments contains only stock pairs, i.e., birds which have been specially chosen and specially mated for production of some particular feature or for study of expectations based on certain theories held, but not proved, by practical test.

Compartments above and below are occupied by pairs of feeders which must be healthy, but need be of no special merit; it may be necessary to mention in passing that the preparation of the feeder birds should be just as meticulously carried out as is done in the case of the main stock; it is asking for trouble to nurse and care for the stock pairs and to use as feeders any old thing which happens to be handy. The feeders must be mated in small cages before being put in the compartments just as is done with the stock pairs; the feeders must be just as well fed and equally cared for throughout. Just as the stock pairs are not put up until they are in condition, the hens brown in cere and both fit and active, this applies equally to the feeder pairs.

Stock pairs should be held back until feeders are in condition, even if this seems to be a waste of time; it is unnecessary to wait until all the pairs can be put up and, indeed, it is inadvisable to put the whole number up at one time as, with the possibility of young hatching all about the same time, the work of ringing and nest attention becomes formidable. When pairs are put up at intervals, there is continuous hatching and ringing, but there is never the pressure of work at certain periods which we may experience if the whole stock is put up at one time; fortunately the birds usually decide these things, and I have never yet had a season when I could look over my stock and say, "Now is the time to start off the lot."

Spaces Left Blank.

In the distribution sheet it will be noted that, at the top of the top row of feeders, and at the bottom of the lowest row, are spaces which are left blank. As eggs are transferred to feeders the stock pair number is entered in this space and the date of hatching of the first young. This allows us to see when young require to be ringed, and, the distribution sheet being larger than is shown, the number of young and the ring numbers can be entered. These can be copied from the stock card attached to the feeder compartment, and, by looking at the whole layout on a reduced scale such as this, we simplify management.

When the young are removed from the feeders the stock card is removed and the necessary details entered in the Young Bird Register, the layout of which is illustrated on page 114. For the exhibition breeder a Register of this nature is essential, for it enables him to keep an accurate check on the merits of the young birds reared throughout the season.

At the end of the season, or after each round has been completed, and as the young are removed from the parents, particulars of colour and sex are entered in the appropriate columns. As a young bird is caught up, its ring number is recorded, together with any details of appearance ascertainable

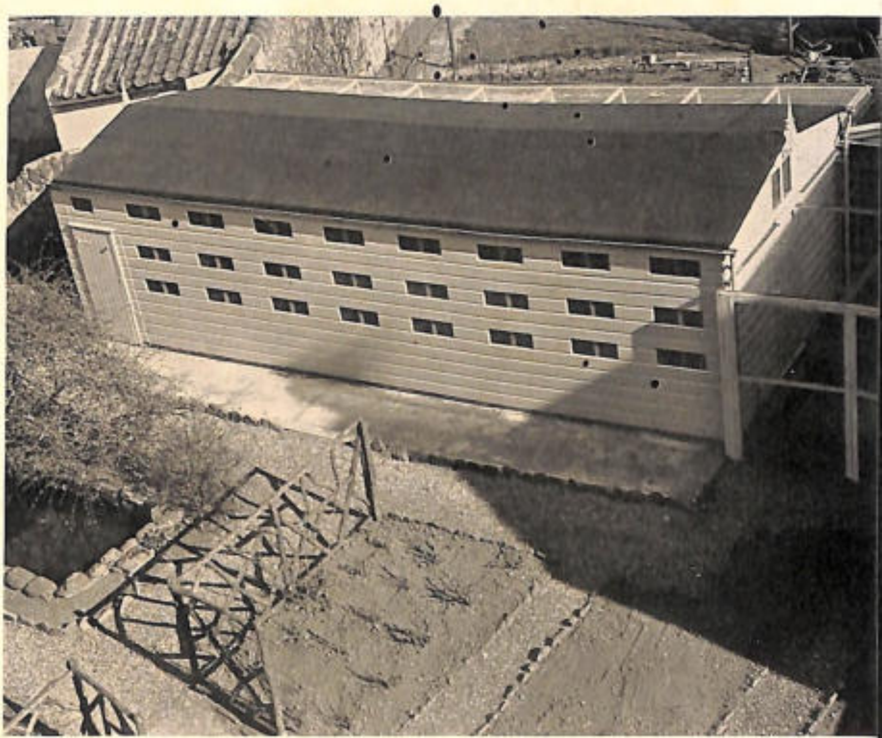
The Breeding Register Card carried on the outside of each breeding compartment, as described on page 109, and (below) the Distribution Sheet referred to on page 111.

Pair No.................	
Cock	Hen
Mated	
1st Egg ....(date)	No................
1st Young........................(date)	No................
Rings	
2nd Round	
1st Egg ....(date)	No................
1st Young........................(date)	No................
Rings	
Notes :	

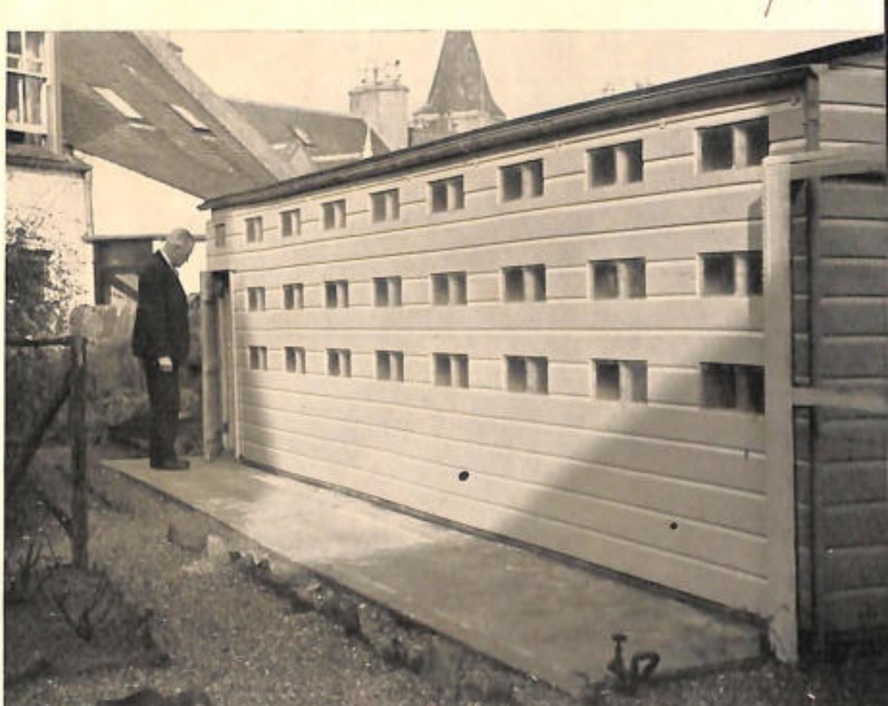
DISTRIBUTION SHEET

	1	2	3	4	5	6	7	Up to 16
Feeders—A								
Stock—B								
Feeders—C								

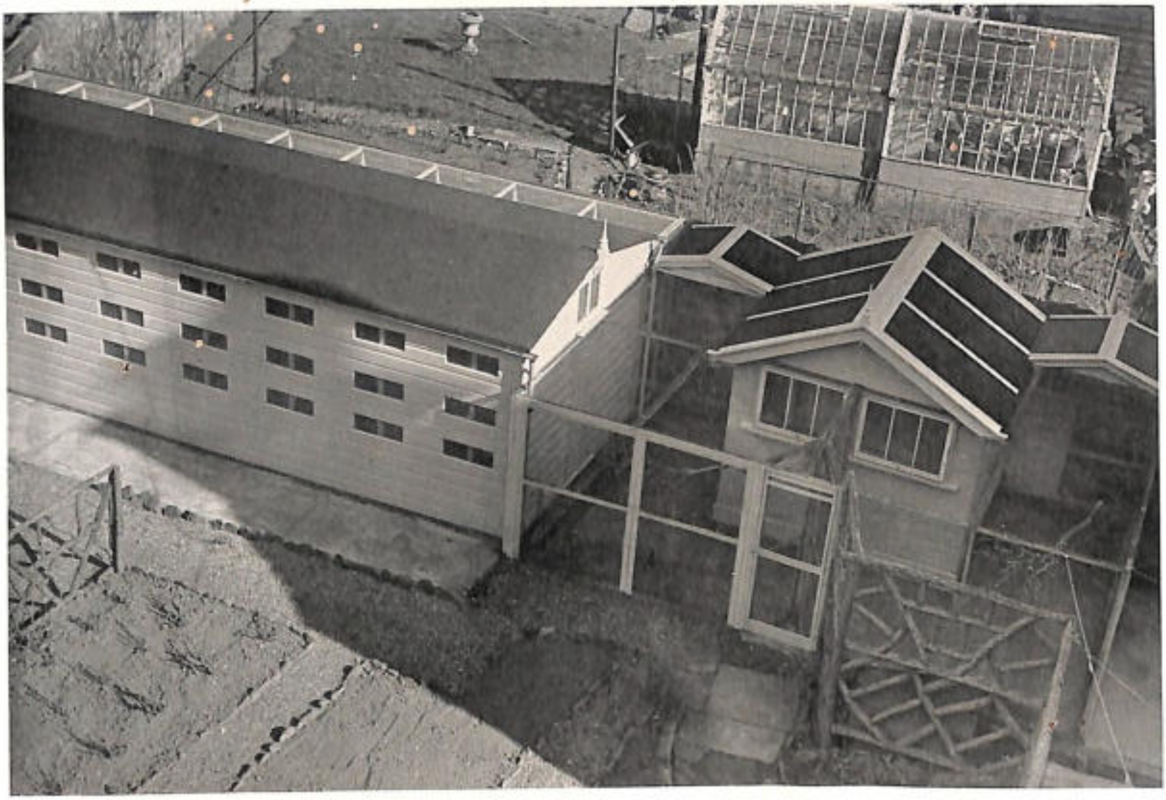
Cards from Stock Row B accompany young which are transferred to Row A or C.



Dr. Armour's main breeding room, the overall dimensions of which are approximately 27-ft. long by 15-ft. deep. Height 6-ft. 9-in., rising to 8-ft. at the ridge. Seen at the back are the nine outside flights, each 6-ft. 3-in. by 3-ft. wide. The roof is covered with thick felt and guttering on either side carries rainwater down below ground level. There are 48 breeding compartments each being illuminated by the three tiers of small windows which are of heavy moulded glass.



Another and closer view of the same building showing clearly the small entrance door on the left which is the only means of access. The dividing partition hard up against each window separates one breeding compartment from the next, and the lighting provided is completely adequate. The floor of the structure is of concrete and extends well out to provide a narrow sloping pathway. The timber used is ¾-in. weatherboarding on 2-in. by 2-in. framing.



(Above) A general view of the author's up-to-date Budgerigar breeding establishment showing the large breeding room on the left and the two stock aviaries on the right.

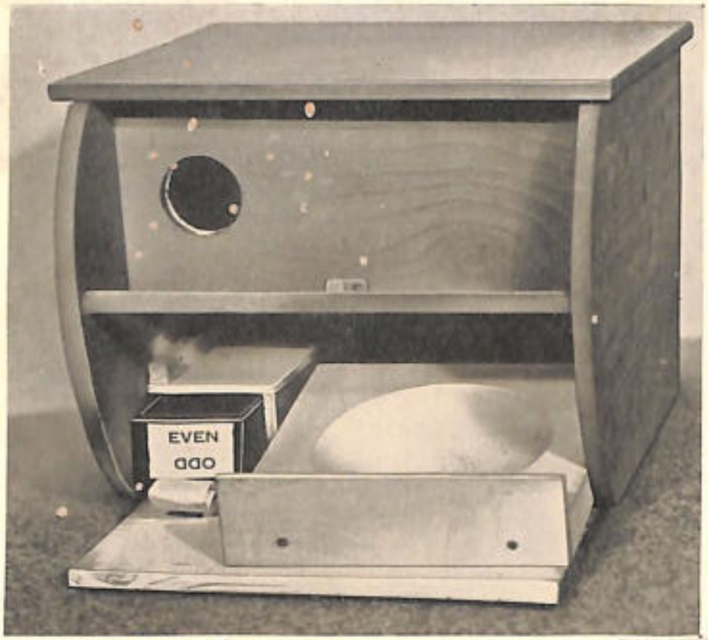
In the illustration alongside part of the stock aviaries is shown; also the triangular porch entrance serving both flights. Each door is spring loaded to ensure against birds escaping. The flights attached to these two stock aviaries are double wired with half-inch mesh netting.

The corridor that extends along the entire length of the breeding room and separates the young stock pens on the left from the triple line of breeding compartments on the right. The door at the end gives access to the stock aviaries. Cleaning of the concrete floor is done with hose and brush.

The small, wire-covered door giving access to a breeding compartment. There is no vertical rail between this door and the nest-box.

(Below) The feeding flap in one of the breeding compartments, the floors of which consist of wallboard with the shiny side uppermost. No sand trays are used. (Right) This illustration shows the ease with which nests can be inspected. The loose bottom has to be lifted upwards before it can be withdrawn. Each nest door is fitted with a brass card holder, the card being used to record breeding details. White and red discs indicate the presence in the nest of eggs and young respectively.

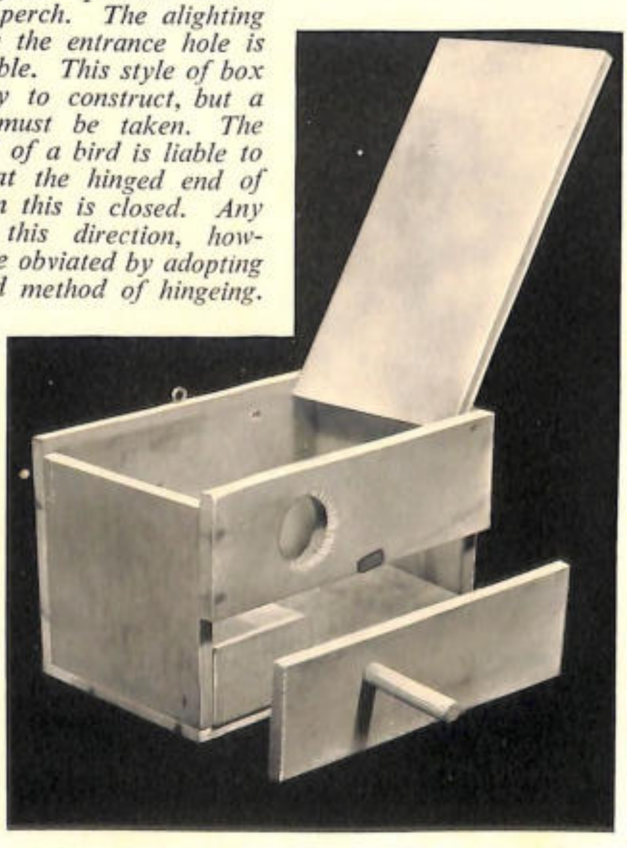
Picture on left shows the feeding flap partially lifted and the excellent arrangement of the food and water vessels on the broad shelf with which every young bird pen is equipped.

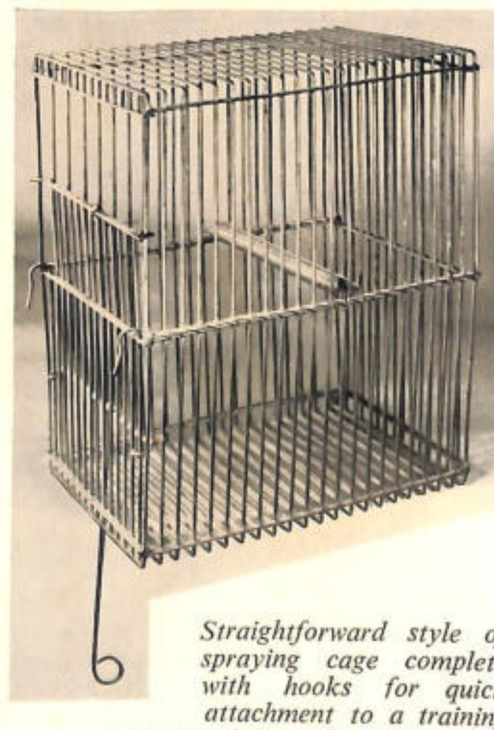


Special nest-box of the author's own patented design, but not now on the market. A feature of this box is the inclusion of a cardboard container in which carefully wrapped eggs, removed as laid, can be kept and turned daily, the idea being to ensure that the chicks hatch out at one time and not at intervals of two days. There are distinct advantages in having chicks hatch out more or less together. Ringing is simplified and there is little risk of a baby being crushed.

Close-up of the cardboard container showing three eggs resting on a layer of soft " gamgee " with another layer to go on top before the lid is put on, thus preventing breakages.

A simple type of nest-box with the concave bottom attached to the removable front portion which carries the perch. The alighting block below the entrance hole is also removable. This style of box is very easy to construct, but a precaution must be taken. The head or tail of a bird is liable to be nipped at the hinged end of the lid when this is closed. Any danger in this direction, however, may be obviated by adopting an improved method of hingeing.





Straightforward style of spraying cage complete with hooks for quick attachment to a training cage containing a bird being prepared for exhibition. It is of all-wire construction.

at the time. Usually it is necessary to examine all youngsters at a later date, caging them separately and assessing their various show points. Personally, I wait until the birds have moulted out before filling in the Register. The Pair Number from which each young bird has been bred is entered in the final column, and when all particulars have been completed we have a comprehensive record of each individual, together with a note of its parentage. Frequent reference should be made to this sheet.

When the eggs have been removed from a stock pair and placed under feeders, we have a choice of allowing the same pair to continue to lay another clutch, and in turn transfer them or, what is our usual practice, to remove the hen occupying this stock compartment and introduce a new hen. I think it advisable to remove both birds and, in the small training cages, mate the cock with his new partner, the original hen going into the stock aviaries where she is out of sight and sound of her late partner; she may require to be used in a later stage with a different cock, and it is wise to wholly divorce her from her husband. As my stock aviaries adjoin the breeding block a cock deprived of his original mate may take no interest in his new hen while still within sound, if not within sight, of his original hen. It is because of this that I suggest that both birds be removed from the stock pen and a fresh mating be effected at a distance, the stock compartment in the meantime being left unoccupied and being thoroughly disinfected and cleaned. When we observe that the cock has taken to his new mate, the birds are returned to his compartment, a fresh card with the ring numbers placed in the card frame and observation kept on the pair so that the date of the first egg can be recorded and, on this, a suitable pair of feeders, birds at approximately the same incubating stage, selected as feeders.

Hens Not Over-worked.

After this hen has laid, her eggs are put under feeders, and she is either allowed to carry on or removed and a fresh partner chosen for a third round off the cock. It will be noted that the hens, with this system, have not been abused, have not even been put to the strain of feeding, but I think that it is advisable occasionally to allow stock hens to feed a few young, and so, in the case of hens from which young have been obtained under feeders, and which are not to be further used as stock, they should be given a round as feeders.

There are advantages which are not readily apparent in this system. By removing eggs and putting in a fresh hen we get a bigger number of young

REGISTER OF YOUNG, 19

Ring No.	Sex.	Type.	Head.	Size.	Spots.	Colour.	Other features.	Aggregate.	Pair No.

GREEN COCKS — STUD REGISTER, 19

Ring No.	Type.	Head S.	W.	H.	Colour.	Size.	Spots.	Wing Mkgs.	Breeding record.	Other notes.	Aggregate.
Scale	30	10	5	10	10	15	10	10			100

GREEN HENS — STUD REGISTER, 19

Ring No.	Type.	Head S.	W.	H.	Colour.	Size.	Spots.	Wing Mkgs.	Breeding record.	Other notes.	Aggregate.
Scale	30	10	10	5	10	15	10	10			100

YELLOW COCKS — STUD REGISTER, 19

Ring No.	Type.	Head S.	W.	H.	Colour.	Size.	Wing Mkgs.	Breeding record.	Other notes.	Aggregate.
Scale	30	10	5	10	20	15	10			100

YELLOW HENS — STUD REGISTER, 19

Ring No.	Type.	Head S.	W.	H.	Colour.	Size.	Wing Mkgs.	Breeding record.	Other notes.	Aggregate.
Scale	30	10	10	5	20	15	10			100

from the best-quality birds, and there is less disparity in the ages of the first- and second-round young than there is in straight laying, hatching and rearing as usually practised. The system is not as simple as the orthodox system where a pair of birds hatch and rear their own young, perhaps the same pair doing so throughout the season; by this system, the hens are not taxed by feeding many young and, of course, the great benefit to be derived from this system is the introduction of the factors from the males into more than one line of young in a single season. This system is not one for the novice to adopt; it takes experience in the selection of suitable stock birds, in stock management, and it takes the necessary stability of temperament to withstand the shocks which may be experienced when a pair of feeders throw out valuable eggs or when stock pairs refuse to go to nest again after their eggs have been removed. It is the system for the experienced breeder/exhibitor, and in keeping with the most modern principles of stock-breeding; a naturally monogamous bird is made polygamous, and by doing so his excellence is introduced into more than one line in a season and, in the subsequent season, it may be wrapped up, concentrated and fixed or introduced into still other lines.

I have no wish to go into every detail connected with the management of stock under this system, but there are one or two which cannot be omitted; I must not be expected to cover all unforeseen occurrences, yet there is one provision which must be made, and I shall describe how we overcome a difficulty which may arise in transferring eggs from valuable pairs. Let me describe the problem first and then provide the solution.

It is known that the budgerigar hen lays an egg approximately every second day and that incubation commences, as a rule, in the first round, with the second egg. (In subsequent rounds, if the hen lays while young still occupy the nest, incubation may commence with the first egg.) This being so, we have young hatching at intervals of two days; in a clutch of six the first two young may be ten days old when the last egg hatches, and frequently the last youngster is smothered, badly fed, and fails to survive or develop.

The best bird under suitable feeding and environment may become the waster, not because genetically it is inferior, but because it does not get a chance. Budgerigar hens frequently, especially in late rounds, lay large clutches of fertile eggs, and one clutch of six fertile eggs is better than two clutches in each of which only three eggs are fertile. Now six eggs are too many to place under a feeder, and it does not give the last hatched the best possible chance of developing; it is also literally putting all one's eggs in one "basket," and it would be better to divide the six fertile eggs into two lots of three, and to place three eggs under one pair of feeders and three under another. The clutch might well be eight or ten fertiles, and such clutches are by no means exceptional in high-conditioned breeding pairs. The difficulty experienced in "splitting the clutch," as we refer to it here, is that, when all the eggs are laid, one cannot tell the first laid from the last, or one cannot with accuracy divide them into two satisfactory hatching groups.

When "splitting the clutch" we may well put the first laid with the last laid, and, if we do, we run a risk of having an age disparity of eight to ten days, and, as already stated, this is not satisfactory for the last hatched. The problem is to have the eggs in the nest in the correct sequence so that there is the optimum chance of all hatching and surviving and developing as they should.

"Sequence Stamping" of Eggs.

The solution is what we refer to as "sequence-stamping," not date-stamping as is done in poultry breeding. Only the first three, or possibly four, eggs are stamped as laid, 1, 2, 3, 4, and the others, if any, are left unstamped, as further stamping is unnecessary. When the hen has laid her full clutch we can tell the eggs which have been laid 1, 2, 3, 4, and transfer those eggs to a suitable pair of feeders who have laid their own eggs about the same dates.

It is easy to calculate laying dates of the fifth, sixth, seventh and eighth eggs, as, when one knows the date of the first egg in the full clutch, one has only to count on two, four, six, eight days to get the date of laying of the fifth egg, the first of the second half of the split clutch. We look around for feeders which will fit in with those dates, and so we may have a half-clutch under one pair of feeders and a half-clutch under another pair; in which case a duplicate card is inserted in the card-frame of the second pair of feeders. Frankly, I prefer to "split the clutch" unless it is too small to split with safety; I should not split a clutch under four, and if I *had* to put two eggs in a nest and discard all the feeders' eggs from that nest, in case of uncertainty, I should put in a couple of clear eggs which are not to be scorned at such a time.

Putting all eggs in one basket, or nest-box, is risky. The likelihood of two hens discarding the introduced eggs is less than if all the eggs were put in one nest. The "sequence-stamping" is done with an ordinary rubber date stamp and is very simple: the first egg is stamped 1 and the rubber band turned to 2 for the next one, and so on. Each egg is stamped in several places.

This is regularly practised here, and we have never had any trouble through the interference with the eggs and nest, and hatching in correct sequence has been the rule. There is certainly less likelihood of trouble through stamping than there is through removing eggs, storing them and returning them to get the young all hatching about the same time, as I did with the Version nest-box.

There is another advantage in sequence-stamping when feeders are being used; in the case of a large clutch two pairs of feeders may not be at suitable stages to take over the two half-clutches; in such case one has a choice of which half-clutch can be more suitably disposed of, as it doubles the chance of a pair of feeders being at a suitable stage, and the other, preferably the original half, may be left under the stock hen if no suitable feeder pair is available for this half. If a suitable pair of feeders is available for the first half, the latter half may be left with the stock hen, although she may, when no young are forthcoming at the proper hatching date, discard the eggs, but those are normal risks, and this is not a frequent occurrence. I have had hens take over eggs which were well behind the hatching date of their own and rear the young satisfactorily; I think there is more risk in advancing the date and putting eggs under a pair of feeders and have young hatching a week before expected; frequently a hen treated in this cavalier manner will throw out each young as it hatches, realizing that she has been fooled; it is unnecessary to stamp eggs 1, 2, 3, 4. One could put an asterisk on each of the first four, but, as there is no difficulty in putting the correct figure on the egg, I invariably use the sequence of numbers.

One other matter of importance when transferring eggs to feeders is to waste as little time as possible in effecting the transfer. In cold weather this is particularly important, as I have had hens discard introduced eggs through their being allowed to cool during the transfer. The bottom from the feeders' box should be removed and the eggs discarded; to this the stock eggs should be transferred and the bottom replaced without delay.

To obviate the risk of the feeder hen returning to the nest which lacks the bottom and escaping into the corridor I stuff a piece of paper in the entrance hole from inside the box and remove this after the bottom has been replaced. The removal of the obstruction is most important.

To prevent escape of the sitting hen into the corridor, during inspection of the nest instead of through the hole into the compartment, I carry a small sheet of celluloid and, as I open the lid of the box I slip this underneath. These are small, but none the less important, details in management which might possibly not occur to everyone.

CHAPTER V

NEST-BOXES

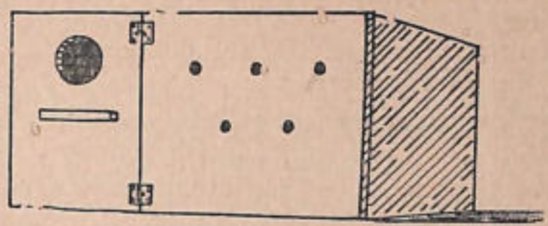
IT IS DOUBTFUL if nowadays any breeder uses cocoanut husks for the breeding of budgerigars. In the old days these were used as being the nearest approach to the natural nest; fortunately budgerigars are adaptable, and the cocoanut husk, an insanitary and inaccessible appliance, has fallen into disuse. Present-day breeders almost invariably use a wooden nesting box.

Although design of the box varies, there are several basic features which are incorporated in all box-nests. These are: (1) The entrance hole, (2) the hollow bottom, and (3) an inspection door for access to the young for purposes of ringing and to permit of the nest being cleaned occasionally. I have shown three main types of box-nests, and in all three there is provision for the bird entering and leaving, for laying and incubating her eggs in a hollow so that they do not become scattered and overlooked, and, finally, there is provision by means of a hinged door for the nest being inspected. Provided these three essentials are included in the design, it matters very little indeed whether the box is oblong or upright, circular or square. The box must have the three features mentioned, and, provided these are present, there is no difficulty in getting hens to nest and rear young in satisfactory numbers.

In addition to the above, certain unessential, but very useful, matters require attention. Budgerigars do not take so readily to a nest which has the entrance hole opposite the hollow bottom; the hen likes more privacy, so the entrance hole should be situated a few inches to one side or a few inches above the bottom part on which the eggs will be laid and incubated. This instinct has been retained in the bird in captivity, and dates from their breeding in the wild state when, as I have stated elsewhere, they easily become the prey of animals and birds. The entrance hole being out of the line of the nesting-hollow makes for security, and it is recommended that this be provided in the nest-box. It matters little whether the box is oblong or upright.

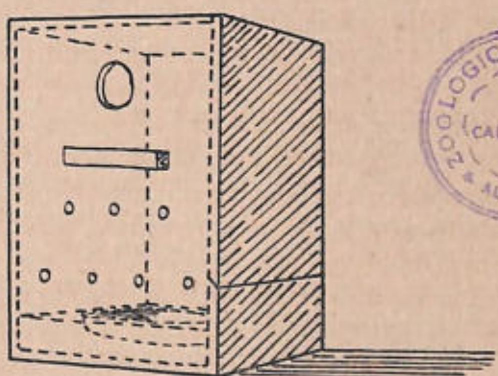
In the illustration of the oblong box it will be seen that the entrance hole is to the left of the nesting-hollow so that the bird, on entering, turns to the right. Just below the entrance-hole there is a solid block of wood cut to fit the space, as shown in the second diagram. The block is not fixed in the box, but is loose and easily removed for cleaning or renewal. This acts as the doorstep for the birds, and it also saves the nest-box; budgerigars are wretches for chewing the inside of their boxes, and by providing something which they can attack with ease they tend to leave the body of the box more or less undamaged. That is part of the idea, but budgies also have ideas and occasionally they prefer the box itself. Alongside the block of wood inside the box is shown the hollowed portion which serves as the nest proper. There is a door on the front of the box (it might equally well be on the end away from the entrance hole), and this is hinged so that the door swings to the left when opened. (It can equally well be hinged to open upwards.) In order to lessen the risk of a young bird being pushed aside by the hen and falling out of the nest when the door is opened, a strip of wood, usually plywood, is nailed along the front of the removable hollow bottom; this piece of wood is about 1-in. deeper than the wood of the removable hollow bottom so that it projects 1-in. above the bottom. This helps greatly to stop the young falling out when the door is opened; a drop of about 6-ft. is hard on young birds.

It will be noticed, lastly, that

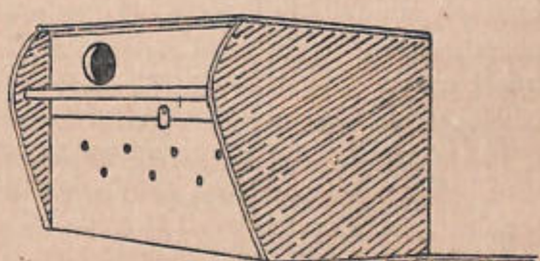


Horizontal Type

Horizontal Type Interior



Vertical Type



Version Pattern

there is a slat of wood nailed across the outside of the box just below the entrance hole. This is to allow the cock to hang on and feed the hen at the entrance hole. The door is fastened by any simple form of hook-and-eye fastener placed preferably on the underside of the box where the birds are less likely to reach it and open the door. It may seem unnecessary to point out these small details, but budgies are mischievous little devils and will undo any fastener which they can reach. It is a pity to have novices find these things out by bitter experience.

The other oblong box shown, with the horizontal perch held by the extended sides, is virtually the same as the one described. The only additional features are the drop door in front which facilitates entry for ringing the young, and the whole top is hinged so that the box is easily cleaned. There is less likelihood of the young falling out unexpectedly when the door is hinged at the bottom, but otherwise there is no advantage in this design.

We now come to No. 3, a type which I like in preference to the oblong type. This is the vertical nest. I shall point out some disadvantages first and dispose of these. First, the hollow bottom is directly under the entrance hole, and a bird jumping down on the eggs might break them. To lessen this risk a "stairway" of wooden slats is fixed across the inside of the box from the entrance hole down to the next level. I have had boxes about 2-ft. deep of this type with cross-pieces inside, and the birds have nested very nicely in them. The bird has to climb up and down inside the nest, and I have had no broken eggs through the bird jumping from the hole on to the nest bottom. The next feature in this nest is that the door is to one side and hinged to lift up. This door forms the greater part of one wall of the box, the other part, the lower portion, being formed by the wooden part which makes up the remainder of the wall, being nailed on to the hollow bottom and being removable along with this; there is no fear of a bird falling out on the door being opened, and the box is very easily taken to pieces for cleaning. Note that the hollow bottom has the lower portion of one wall of the nest-box attached to it, and that this slips out and in like a drawer. To lessen the damage to the box I usually fix a thick piece of wood inside the box, to one of the walls, and allow the birds to tear that to pieces in preference to the box.

As will be noted elsewhere, budgerigars lay an egg every second day, and usually commence to incubate the eggs with the laying of the second egg; this being so, the first two young usually hatch together and the remainder at intervals of two days.

As a consequence of this we frequently find in a nest birds which are about ten days old along with birds which are recently out of the shell; there must be provision for this in nature, but I had an idea, not wholly abandoned, that it might be more desirable to have the young all of the same age in the nest, that the young should all hatch together and develop together; if this could be arranged it would simplify closed ringing, as the whole clutch could be done at one time; the food which the hen fed to the young would suit all equally well. I had noted that frequently the last-hatched succumbed or failed to develop as did the early chicks. I therefore designed a nest-box which allowed me to remove the eggs as they were laid, store them, and after, say, three or four had been laid, return them to the nest for hatching.

This nest-box, not on the market now, was known as the Version nest, since there was provision for the eggs being turned daily without having to handle each egg, and there was an easy means of checking up that the eggs *had* been turned on any particular day. Where the solid block of wood is shown in the diagram of the oblong box I made a compartment, approximately the same size, but hollow, and with the front open. Inside this hollow space was kept a cardboard box containing two sheets of surgical fabric known as gamgee, similar to a layer of cotton-wool with thin gauze on each side. On the end of the cardboard box was attached a label bearing the words " Odd " and " Even," these being printed so that on a day such as the 2nd, 4th, 6th, and so on, the word " Even " was upright and on the odd days of the month the word "Odd" was upright. As each egg was laid it was placed on the gamgee in the cardboard box, and then the other layer of gamgee was placed over it and the lid placed on the box. If it was an even day, the box was put in the compartment with the word " Even " upright. Next day, while looking in the nests, the boxes were withdrawn and turned without opening them; next day again another egg was put in where necessary and the box again turned to correspond with the odd or even day.

This system of removing the eggs and storing them aroused a good deal of controversy, but I still think it is worth a try out. I used to get four or five young hatching at one time and, as this was all I wanted in a nest, I did not mind if some of the eggs failed to hatch.

It stands to reason that, when we are feeding our birds on unnatural food, and we see the solid, undigested seed shining through the crops of the young, and these youngsters then swell up and die, there is something wrong with the feeding of these young; the food provided by the hen, and also by the cock, for a bird which is two weeks old is unsuitable for a chick of two days.

Although older chicks can digest this food, very young babies cannot;

this is the reason for the last birds leaving the nest being below the standard of those which leave first. I was accused of tampering with the provisions of Nature; we tampered with these when we caught up the birds in their wild surroundings, transported them to this country, and fed them on unnatural seeds. We interfered with Nature by feeding them on other than their natural food, so it is nonsense to say that we are tampering with Nature by removing eggs and replacing them so as to get the young to hatch all at one time. We are tampering and trying to upset these laws, but we have been doing so in an attempt to counteract the ill-effects of unsuitable feeding. This type of nest should be regarded as purely experimental, and I do not recommend that any breeder should use this type to the exclusion of more standard models; there is no harm in trying one here and there with his less valuable stock until he has decided whether it is a good or bad thing to remove eggs and replace them.

I have no hard-and-fast rules regarding the best type of nest-boxes. Provided the nest has the essentials, namely, entrance hole away from the nesting-place, hollow, removable nest bottom, and inspection door which minimizes the risk of the young falling out when opened, budgerigars will nest and rear young without difficulty.

CHAPTER VI

THE BREEDING SEASON

AS A PRELIMINARY to the commencement of breeding it is advisable to carry out a thorough inspection of breeding pens and flights. Flaws may develop in the structure, and the loss of a few good birds is to be deplored at this season. Wire netting in particular should be gone over carefully to see that it is firmly attached to the supporting standards and that it has not rusted to such an extent as to make the flight insecure. In aviaries situated near the sea, netting deteriorates fairly rapidly and it becomes brittle after two or three years although it may appear to be fairly sound. Especially should the foundations of the pens and flights be inspected for holes through which mice may gain access. If the netting used is of ½-in. mesh, small mice will get through occasionally but ⅜-in. netting will keep out any vermin. Bottom rails of wood in pens and flights should be given a dose of wood preservative some weeks before the birds are put in and the wood tested with a knife blade for rot. Any which have become badly decayed should be replaced. If the woodwork generally has been creosoted it may require another coat, so this should be attended to as early in the year as possible, certainly not the day before the birds are being put in for breeding. Personally, I dislike creosote and prefer paint, which looks much nicer. Paint should be non-poisonous and made up with white zinc in place of white lead.

Light stone colour, in the country where the air is clean, looks well and stands weather better than most colours. Creosote is much easier to apply and probably keeps the wood even better than paint, but, after a few treatments it looks rather tarry, and the coloured wood preservatives, although nicer in appearance than creosote, are probably not much better than paint for keeping the wood and certainly do not look so well. If the aviaries are in a town where the atmosphere is smoky, creosote will probably be most suitable, but, in the open country, light paint adds greatly to the appearance of the structure.

The nest-boxes, after cleaning, should be inspected for flaws, fitted into the pens to see that they are securely suspended, and then removed once more. Perches should be examined to see that they, too, are firmly fixed, and the floors should be given a final thorough scrubbing with sand and swept clean. I know some people lime-wash the floors of pens and flights, and I think this is satisfactory. Chloride of lime will remove any green slime which may have collected on concrete flight floors; the concrete should be wet and the chloride of lime sprinkled evenly over it and left for a day or two and then thoroughly washed off.

Having attended to all these matters, having seen that all doors are secure, all bars and locks working satisfactorily, the floors of the pens should be sanded, using rather coarse sea sand, and the birds should then be installed, one pair in each pen. It is advisable, for about ten days or longer, to confine the pairs to the pens and not allow them to use the flights. If allowed to use the flights from the first birds are apt to roost out of doors at night and are more liable to be disturbed by prowling cats than if shut in until they have become accustomed to their new quarters. In these small breeding pens, where the windows are below the level of the flight roofs, it is unnecessary to have wire netting over the glass to prevent accidental escape. The space inside the pen is limited and birds cannot injure themselves by flying against the glass in this short distance. If the window is outside the flight it should be covered with wire netting, for otherwise a broken window might result in the loss of the birds, and one cannot keep little boys from throwing stones.

I mention these matters because I consider they are important; the inexperienced breeder often overlooks minor points and then complains that he has had bad luck, a flaw in his netting, a broken window, loose perches resulting in clear eggs, insecurely fixed nests resulting in accidents to the inmates, weakened springs on safety-door allowing birds to escape. Most of the bad luck is due to thoughtlessness, and although I am quite aware that one cannot foresee everything, attention to the above will help.

Having put the pairs in their respective pens, leave them alone; one must, of course, feed them night and morning, but, although it is necessary to observe, it is rarely necessary to interfere.

The birds should be watched for a few days to see that they are feeding, that the change of quarters has not made them go "soft," that all can fly strongly and that they are agreeing as prospective parents should. Hens should be watched for signs of egg-binding. Note should be kept of mating which is observed so that a check may be kept on fertility. When it is seen that the birds have settled down, that no changes require to be made, that the pairs are satisfactorily mated, the breeding-register cards should be fixed on the outside of each pen. They will have been written up with the necessary details, Pair No., Cock No., Hen No., and the colour-capacity of each bird. For example, a pair may consist of a Cock A45/2/47, Cobalt/White and Hen A45/4/48, White Blue (deep suffusion). In the Remarks column I enter the previous breeding results of either, or both, notes regarding relationship, if any, and anything of interest during the present season such as " hen egg-bound with second egg," replaced by Hen No. A45/5/48 White Blue (light suffusion). I sometimes allocate a " stick " of rings, usually five for each round, to each pair, and place these rings on a circular piece of cage wire the ends of which hook together. I also allocate a set of coloured celluloid rings for each pair, and both these sets I hang on a small hook outside the pen and adjoining the breeding-register card. Even if a few closed rings are wasted by this method, the birds in any nest being ringed in sequence is an advantage. It is better than having No. 1 a Cobalt and No. 2 a Light Yellow and No. 3 a Green, and so on. This may lead to confusion, and there is at least more chance of error. In my pens I use seed trays of large capacity, home-made affairs with three compartments so that I can give three different kinds of seed and leave the selection to the birds; I find this is less wasteful than when the seed is mixed and fed in a singledish. The trays are of wood and measure 11-in. by 4-in. by 1-in. deep, the tray being divided into two equal compartments, one of which is again subdivided into two equal spaces.

Protected against Rot.

We thus have a tray with compartments one half capacity and two compartments each one quarter. In the large compartment is put the usual stock seed, e.g., canary and millet, and in the others pin-head oats in one and in the other small one sprouted oats or greenfood. These wooden trays are finished by coating them with shellac varnish, which is harmless to the birds and which prevents moisture from rotting the wood. The trays are also easily cleaned if varnished, and can be washed out now and again and recoated. The varnish dries in a few minutes in a warm atmosphere.

I use glass pots for water and renew this daily; I have provision for automatic drinkers which flush and refill themselves, but the arrangement requires a good deal of attention and is not entirely fool-proof. With a good-sized kettle and a bucket one can wash and refill the drinkers in a few minutes, and the exercise is good for one.

About 7.30 a.m. I go round the pens and see that the birds are in good condition; that is my first concern. I next remove all the seed trays, blow off the husks and replenish them and wash and refill the drinkers. Any greenfood which is available is given at this time, and it is necessary to see that this is not frosted; it is best gathered the day before and kept in the kitchen with the roots in water overnight. If the greenfood is not given in trays, as suggested, it can be placed in glass or earthenware pots or placed in small wire holders which can be bought very cheaply and which hook on to the wire netting or wall of the pen; they are called salad racks.

Having fed the birds, I sweep up the inevitable mess of husks and, finally, inspect nests and ring the young. About an hour before dusk I again go round the seed dishes, remove any greenfood left, blow off husks and replenish the trays, this time leaving the mess until the next morning visit. It is unnecessary to poke in the nests again, and, in fact, it is inadvisable to disturb a sitting hen in the evening, as she may fail to return to the nest if put off towards nightfall. Do not put off this evening visit until it is almost dark. Birds are easily frightened then and may injure themselves. If the aviary windows face a main street it is advisable to have "black-out" frames to cover the windows. Motor-car headlights flashing through unprotected windows may upset the birds, and even put the hens off their eggs. I do not allow my breeding birds to roost out at night, but if allowed to do so the flights should be double wired.

After the breeding pairs have been in the pens for ten to fourteen days, I open the communicating doors in the mornings and allow the birds to have the use of the flights during the daytime. These doors are opened after the general clean up in the morning and are closed on the evening visit before the seed trays are filled.

This, in general, comprises the management during the breeding season. There is, of course, the ringing of young, cleaning of nests and a few other relatively unimportant matters to attend to; it must not be forgotten that budgerigars, if given a suitable nest-box and suitable food, will hatch and rear healthy young without any assistance from the owner. Where breeding is begun in February, or even earlier, egg-binding must be guarded against. The addition of cod liver oil to the seed ration is, in my opinion, a reliable preventive, and I have had none of this trouble since I have used the oil-treated seed. I regard egg-binding as being due to a vitamin deficiency, and this will be dealt with in the chapter on diseases and ailments.

Finally, I keep a small book in a pocket of the old jacket which I wear in the aviary; in this little book I jot down any interesting facts and observations; it is a great aid, and I recommend the practice to all breeders.

CHAPTER VII

CONSTRUCTING TRAINING CAGES

MOST EXHIBITORS during the process of conditioning and training birds for show use portable training cages. Admirable though these may be, there is no disputing the fact that they are somewhat unwieldy, require cleaning in the same manner as show cages have to be cleaned, and, when not used for training birds, occupy space in the birdroom. After several years spent in wrestling with training cages, literally wrestling in a small birdroom, I decided that something would have to be done about this business of preparing birds for shows. The endless dismantling and cleaning of training cages occupied too much of my spare time, whilst the feeding of large numbers of exhibition birds, each in its own cage, became what one must describe as a "labour of love," but nevertheless a labour. There should be no need to have portable, individual cages for show budgerigars; individual cages there must be, but why portable? Show cages must be portable, since the birds have to be assembled in a hall away from their normal surroundings.

While in their own quarters they need not be caged in separate movable cages; standardization, too, was considered necessary so that every part of the training equipment should be interchangeable. No matter how much we admire the show cage, in most cases the fronts are not interchangeable, and, when one is washing up after a show much time is lost in refitting the fronts unless one is methodical, which I am not. Again, feeding dishes and drinking vessels are awkward at times; doors stick, cages are dropped occasionally and frequently bumped into birdroom furnishings with detrimental results to the occupant and the cage, not to mention the temper of the owner. Having considered such matters carefully, it was felt that the solution lay in having the cages built in a block, fixed in position so that they could not be moved, simple in construction, easy to clean and facilitating training without too much trouble.

Without wishing to appear in any way smug, I consider that the system of construction and management which I am about to describe is unequalled for cleanliness, convenience and all-round attractiveness.

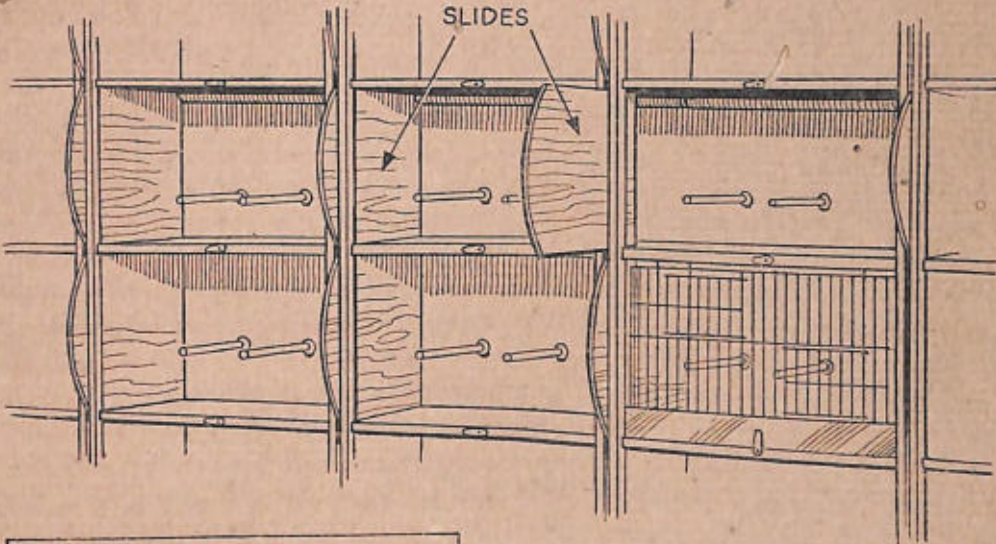
To construct a "battery" of cages after this fashion one must have, or one must arrange, first of all, a substantial wooden wall on which to build the structure; this should, if at all possible, be covered with plywood carefully fitted and the whole smoothed down to give a good surface. The principle of cage construction will be evident from the illustration, but some description is necessary; the text should be read as the picture is studied.

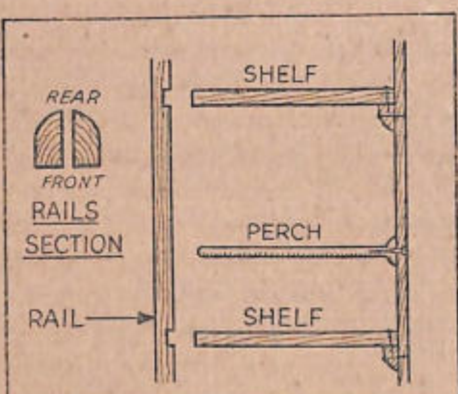
On the smooth, plywood-covered back we fix longitudinal strips of wood $\frac{3}{4}$-in. by $\frac{1}{2}$-in., with the long axis of the section vertical. One edge of this strip should be rounded off, and it is possible to buy plain moulding about this size from joiners in most localities. Before fixing the strips to the plywood we mark them off in lengths of $16\frac{1}{2}$-in., marking with the pencil as we go along; it is easier to cut several of these at one time, so the cutting of the moulding into these short lengths should be done before anything else.

Fixing the Mouldings.

Our next task is to take a reliable straightedge of the length required and, with the aid of a spirit-level, mark off on the plywood back the level of the top shelf; do not put it too high. Having marked off this, we next measure down 12-in. and, again with spirit-level or by measuring from the upper line, or by using a stick as a gauge, we mark off another horizontal line on the plywood; the same procedure is repeated as many times as are considered necessary, not, of course, right down to the floor: down to somewhere about the height of the trouser pocket. Having marked off the lines, and having cut the moulding which serves to support the rear edge of the shelves when they are put in position, we now loosely tack the strips to the plywood, keeping the line of the pencil mark and arranging that there is a gap the thickness of ordinary plywood between the ends of adjoining strips of moulding; thus the mouldings are placed in position with regular interruptions at each $16\frac{1}{2}$-in.

Do not nail anything on securely at this stage, but fix them sufficiently firmly to hold the rear edge of the $\frac{3}{8}$-in. shelving which we will use. At each end of our wall we now fix up a vertical board, $\frac{3}{4}$-in. shelving for preference, about 9-in. wide; use a plumb-line for this, as it must be vertical, and it must also be at right-angles to the wall; fix it with brackets from outside. Now, on the inner surfaces of these end boards, mark out lines to correspond with the mouldings on the back wall or loosely attach 8-in. pieces of moulding, squaring and levelling off everything as you proceed. The next requirement is several lengths of $\frac{3}{8}$-in. by 9-in. shelving to rest on the mouldings; arrange the lengths to suit the space. Place these shelves in position; you will note that if your space is much over 4-ft. or 5-ft. the shelves will sag and look unsightly. Take them down again and proceed to make strips of hardwood oak for preference, which will be attached as verticals to the fronts of the shelves to remedy the sagging and for other useful purposes as well. The hardwood strips should be





Anyone who breeds budgerigars for exhibition on a fairly large scale is strongly advised to study carefully the author's detailed description of how his training cages are designed and constructed. This illustration clearly shows the excellent layout.

about $\frac{3}{8}$in- by $\frac{3}{4}$-in. Now, then, here is a tricky bit of work in which you can make a mess of things.

On the upper surface of the moulding on the back wall fix a piece of the $\frac{3}{8}$-in. shelving, just a narrow piece to project beyond the moulding and about 3-in. or 4-in. long. Repeat this on each strip of the moulding below; this serves as a gauge for marking off the vertical front rails, as they have to be notched to grasp the front edges of the shelves. I know you will think, as I did, that you can just stick these rails on the front edges of the shelves without notching them. Please do not do this, and save yourself no end of trouble by doing as I suggest.

Having fixed your small pieces of shelving, place one of your front rails against them, holding the rail perpendicular, and with the top end just above the top piece of shelving. Either tack the hardwood strip in position or get someone to hold it; with the pencil carefully mark off both the upper and lower edges of each shelf on the strip. Use this as a gauge for marking all the others. Lay all the strips side by side on a flat surface, use a square and mark off the positions of the notches. The notch is cut in the long axis of the section of the rail. The rails are positioned with the $\frac{3}{8}$-in. surface forwards, so the notches must be cut so as to grip the front edges of the shelves. Take great care over this part and you will be well rewarded; if you are careless, you will find that your cage fronts will not be interchangeable and the whole set-up will look untidy and amateurish; it will be an eyesore if you are careless.

To mark the depth to which notches are to be cut, use a cutting-gauge or, if you have none, use a pencil, but be accurate; when cutting the notches use a fine-toothed saw and make several saw-cuts for each notch; the wood will come out cleaner with a narrow chisel if you do this. Trim up all your rails and see they all correspond. The next thing to do is to prop up your lowest shelf so that it is straight and level. Do not be afraid to take time over this, for the whole structure depends on your care at this stage. Having securely propped up the lower shelf, place the others on their mouldings, if necessary supporting with a thin lath tacked on the front edges and positioned about the centre of the block running vertically upwards. One small nail will be sufficient into the front edges of the shelves. The shelves will not be straight, so you correct this by pressing on the hardwood front rails with the notches cut. Do not position these accurately yet, but distribute them along the front, spacing them roughly. It will be noted that the front rails are in pairs, the space between the two rails being just sufficient to allow a plywood slide to move out and in without force.

Now this is where the gaps in the moulding supporting the rear edges of the shelves come in. The gaps are for supporting the top rear corners of plywood slides which serve to divide the structure into seperate cages, and which are removable. These slides are inserted and withdrawn through the space between two adjoining vertical rails. Study the accompanying drawing for details of this. Now, having pressed the rails into position, make a plywood slide sufficiently large to project beyond the front rails by about 1-in. or a little more. Place this slide between a pair of rails and adjust these so that the top rear corner of the slide engages in the slot in the moulding. With a square, true everything up, tapping the rails one way or the other until they are vertical and in the position at which the slide is at right-angles to the cage back. Get the top and bottom position, and then, with a strong straight edge, the rails will come into the correct positions on the other shelves; always try the plyood slide to see that it moves easily, but not too loosely, between the rails.

Leg Support Ensures Rigidity.

Now bore the rails at the notched portions, if you have not already done so, countersink the hole, and screw the rails to the front edges of the shelves. With each pair of rails check up the distance from the next pair, top and bottom, and then see they are straight before screwing into the front of the shelves. If you have fixed your moulding accurately you will find that the notches correspond with the spaces between the front rails; if they do, nail the moulding securely to the rear wall and then the rear edge of the shelf to the moulding. The whole structure should now be perfectly rigid, but, before pulling away the props from the lowest shelf it is wise to tighten all the screws. It is also advisable to put a centre leg in the middle of the lowest shelf, i.e., between the shelf and the birdroom floor. There is not a great deal of weight in the structure, but shelves tend to warp slightly, and the leg steadies the whole framework.

You will be quite proud of your handiwork by this time. You can now spend some time in cutting the plywood slides and fitting them; they should be interchangeable, and in most cases are, but you may come across a stiff one here and there. Ease the slides with sandpaper, not with a plane. It is a matter of taste as to how the projecting part of the slide is shaped; this is the part which you grasp to withdraw it. Personally, I like it curved, as shown in the sketch. It is strong and, if the projecting portion is finished to match the front rails, it looks very nice. Have them all identical whichever design you adopt, and do not use little rings in the front edges of the slides to withdraw them; it looks dreadfully untidy. You require now only one fitting to complete your cage, the wire front; if you are a handy man you can make your own, but I would advise you not to make them singly by measuring each one; make up a jig to hold the punch-bars and all the fronts will be the same.

It will be noted that there are four punch-bars in each front apart from those of the doors. The two lowest ones are 1-in. apart, while the middle one is centrally placed between the top one and the second lowest, not the bottom one. The space between the two lowest punch-bars, after the front has been soldered is filled in with tin strip best cut by a tinsmith with a guillotine and of the width to suit, about 1-in. wide. This strip strengthens the front and keeps the seed from being thrown about; it takes the place of the bottom rail of a standard cage. The doors are situated one in the top left-hand corner and the other in the bottom right when facing the cage. The lower one is for feeding, and the top one is for running the bird into a show cage or spraying cage which attaches on the door opening; this will be described later.

The door fasteners are lengths of cage wire soldered across the middle of the door, bent so as to form a catch on the wire front when the door is closed. It is simple and secure. The doors open towards the centre.

Lacquer for Fronts.

Having made up the required number of fronts all of the same size and pattern, go over them to see that all the wires are secure, then wash them with warm water and soap and dry them thoroughly. The next job is to paint the fronts, and there is nothing to equal Chinese lacquer for the job; it is obtainable in a variety of colours, and the nicest is a pale green; if the interiors of the cages and the slides are finished with white or cream enamel, and the front edges of the shelves and the front rails are very lightly stained and varnished, the light green wire fronts show up splendidly. As already stated, the projecting portions of the slides should be slightly stained and varnished to match the rest of the woodwork of the front.

When making your cage front you will have left two long wires (the third from each end), and these serve to keep the top of the front in position. Bore two small holes in the underside of the front edge of a shelf, cut the two long wires a suitable length, insert them in the holes and the cage front slips into place. All it requires now is something to hold the bottom in position. You will have cut off all the bottom wires flush with the lowest punch-bar. Into the inner surface of the front rails drive a small staple (or a small screw will do) down near where the rail meets the floor of the cage. One on each side serves to prevent the front being pushed in. Lastly, a small brass turn-button screwed in fairly tightly to the front edge of the shelf will serve to keep the whole front in place, and by a single movement will allow you to slip out the front for cleaning the compartment. Now you cannot put your birds in and leave them without perches, so either get perches turned (this is preferable) or use show-cage perches, but provide them with double-ended screws so that when the screw is half-screwed into the base of the perch the perch can be screwed on to the back of the compartment. Put the perches about the same height as they are in show cages, and about the same distance apart, and screw them firmly home. Do not paint the perches.

No Projections at All.

You have probably noted by this time that, with the exception of the two vertical front rails here and there, there are no rails for the slides. The slide-rails in cages are an abomination, and the notch in the moulding keeps the whole slide wonderfully steady; there is nothing to catch dirt and nothing for the birds to chew and destroy. There is no bottom rail with seed and water dishes, nothing to stick shut, and the whole arrangement permits of cleaning and replenishment of seed, water and sand in the minimum of time.

I can vouch for the benefit to be obtained from adopting this arrangement; the measurements need not be the same as mine, but they must be uniform, not only because the finished article looks better, but the cage fronts are then interchangeable. If you want a separate compartment for each bird you put the slides in; if you want to give them a long cage to fly in, take them out; it is the work of a moment. If you want to clean a cage, pull out a slide just enough to let the occupant into the next compartment, push it in again, slip out the front of the dirty compartment, use a small-size carpet brush and an improvised shovel the length of the compartment front. Hold this just under the shelf, and you can sweep everything into it; this saves mess and dust. Look to your wire door fasteners occasionally to see they are secure; the birds cannot lift a swing door and there is no risk of their getting out.

Use glass dishes for seed and water; they are heavy and the birds do not haul them about as they do wooden trays; their beaks cannot grip a glass dish so easily. In each row of compartments I keep an end one unoccupied. By doing so, I have it clean always; I slip the bird in the next compartment into it to get the second one cleaned, clean the second, and then run the bird from the third one into that, and so on. The vacant cage comes then at the opposite end of the row, and the procedure is reversed next day.

CHAPTER VIII

SELECTION, CONDITIONING AND TRAINING

ALTHOUGH THE EXPERIENCED EXHIBITOR may, with a fair degree of accuracy be able to select his show birds from his outdoor flights, even in his case there is a possibility that a potentially good bird may be overlooked. One cannot, unless his stock is very limited, afford to cage individually all the birds he possesses, so there must be some guiding rules in the selection of exhibition stock from the flights. One can imagine the task facing the breeder who carries a stock of several hundred were it necessary to catch up each bird, steady it in a training cage, and condition it before passing judgment, favourable or otherwise.

I hope to show how the task of selecting exhibition birds may be simplified. In judging budgerigars at shows I invariably begin by looking for the bad ones first. I try to cut down numbers where the class exceeds, say, fifteen before I attempt to assess the value of one bird against another. I am not trying to teach judges their business, and I think it is an almost universal rule that they pick out the duds first, but I have seen beginner judges trying to sort out a large number of birds into their proper order without discarding those which obviously stand no chance: birds with broken tails, with spots missing, Yellows which are greenish and so on. When judging a large number of birds, get rid of the bad ones and allow the eye to focus on those in the running.

The same rule applies to the selection of exhibition birds from the flights. Take a net and catch up all the birds which are obviously below show standard, those which are too small, which are faulty in colour, which are misshapen; those which are known to be good show birds, but which are out of condition, should be allowed to remain.

When "cleansing" the stock pick the very worst ones first, then the next ones. Become more critical as you proceed, and finally, when you have a reasonably small number left, catch them up if in condition and establish them in roomy cages, possibly about three in each cage. The cages should not be too high, but they may be as long as is found convenient. The system of caging described elsewhere lends itself to this adaptation.

A certain amount of extra care should be taken in catching up potential show birds. It is easy to damage a bird through rough handling. A fairly big net should be used in which the rim is lightly, but bulkily, padded. Two or three may be caught at one time, so it is well to have an assistant with the cages ready so that he can have the door open, hold the opening towards you and, after the bird or birds have been placed inside, close the door securely while you proceed with the catching. I have seen people catching budgerigars while wearing a glove on the right hand; I do not like this practice; I like to feel the force with which I am gripping the bird, whether I am disarranging the feathers or holding the bird in the correct manner; this cannot be done safely with a glove. The birds will bite a bit, but it is nothing, and you will soon become used to being bitten and scarcely notice it.

If you want to find out what a real bite feels like, take hold of a sitting hen and allow her to bit just about the "quick" of the nail. I have caught up dozens of birds, both cocks and hens, in a very short space of time and never found the biting much to worry about. So do not handle budgies with the gloves on.

If possible, grasp the bird in the palm of your hand so that the shoulders and back rest in the palm and the thumb lies on one side of the neck and the forefinger is flexed along the other side. You can steady the bird's head in that way so that it cannot bite you, and it is the correct way to hold a budgerigar; if you grip it any other way it will struggle and possibly damage itself.

The middle, ring and little fingers should enfold the bird's wings and body. If it cannot flap its wings it will not struggle much, but, if allowed wing liberty, it will really fight against you. When putting the bird in the cage put it in head first and, when your hand is fully inside, release it; your hand closes the opening until your assistant is ready to close the door; do everything firmly but gently; do not slam birds in sidewise through the door opening and allow them to drop to the floor. Put your whole hand in with the bird in it, and then deliberately open your hand and allow the bird its freedom.

Before birds are put from flights into training cages it is well to look over the wires of the cage front, particularly the space between the end wires of the front and the end wood of the cage; if too narrow the bird may have its leg with the ring caught in the space; if too wide its head may be pushed out and caught. The space should be the same as the spaces between the wires of the front; this is a small point, but I frequently find it is neglect of the simple things which lets one down sooner or later. Also see to the door fasteners, which should be of a type which the birds cannot open. I dislike the doors in the cage front which slide upwards to open; budgies are clever creatures, and, after seeing their owner lifting the door a few times, they try it themselves. I have actually seen them do it in pairs, one at each end of the door, sharing the burden so to speak. Another thing I dislike about the sliding doors, even if fitted with satisfactory fasteners, is the possibility of allowing the door to drop on a bird as it is being removed; this frequently results in the loss of the tail feathers, for the bird being removed from a cage should be taken out head first.

Having caught all your potential winners, do not start to poke them about with a stick; you will have them dashing about all over the cage and they may damage themselves; they will resent this untimely stir up, so leave them quietly for a few days to settle down and get used to their cramped quarters and the new perches. Seed and water should be provided in dishes which cannot be easily hauled about inside the cage, and these should not be placed below the perches, or the food will be soiled with droppings. I have, again, seen budgies, which are mischievous little creatures, co-operating in hauling the seed and water dishes along the cage floor.

Train Them Leisurely.

After a few days you will find the birds have settled down, do not take fright so easily when you approach the cage, and you can eventually place the seed and water in the cage without having them leave their perches. Much depends on the training cage being placed in a position where there is a fair amount of "traffic." The frequent passing of people in front of the cage without the birds being interfered with gives them confidence. Do not be in a hurry to begin training, and do not hurry the training. I usually begin by disregarding the birds when feeding them; I used to take the seed and water out and leave the birds for an hour or so without any, so that they would appreciate the fact that, when I put my hand in the cage, it was possibly to give them food. I do not consider this is necessary, and it can be classed rather as a fad. After the birds have settled, the trainer should repeatedly move to the cage, not with his nose between the wires, but at about 18-in. to 2-ft., and talk quietly to the birds, study them without any jerky movements, and then after a minute or so walk right away or pass on to the next cage.

The birds do not mind being looked at, but object to being poked about with a nasty stick which rattles in the wires. A thing which is to be condemned is the habit of some breeders, who are anxious to show their birds off, taking their finger or a stick rapidly along the wire front to get the bird off the floor on to the perch. It must sound like a machine gun to the bird. If the bird is on the cage floor it is usually sufficient to tap the front rail, without showing the hand, when the bird, in order to see what is going on outside, will climb or jump on the perch. Likewise, when training the bird to the show cage, the finger tips may be gently rattled on the outside of the floor; the bird usually mounts the perch. To get it to move from one perch to the other, so that both sides can be examined, the finger tips should be moved gently just above the front rail carrying the seed and water dishes. By moving the finger tips gently backwards and forwards along the front the bird can be induced to jump and turn. I used to try to get my birds always to turn towards the front; I imagined that the tail was less likely to come to harm, but birds do not always do what you would like, and although, in a few cases, I had birds which invariably turned towards the front of the cage, others were unreliable in this respect; it did not make a great deal of difference except that it gave a momentary glimpse of the full-face view of head and body.

Do not keep the birds too long together; after they have settled down, separate them out and allow a cage for each bird; if kept in company too long they become restless when finally separated; they seem to form attachments and endeavour to renew these by climbing about the cage front.

Never mix sexes in training cages; keep cocks well away from hens, certainly out of sight of each other, although it is probably impracticable to put them out of hearing. Do not put cocks in one cage and hens in another immediately adjoining; if you do, they will all climb on the wire fronts and do their best to get through the partition which divides them.

Birds were shown in pairs, many years ago. I thought them very attractive, but not infrequently one member of the pair let the other down, and the pairs were difficult to judge. It is only in the team classes that the two sexes may be shown in one cage. When you have divided up the birds into single compartments, or cages, the real training begins. As mentioned elsewhere, the perches should be the same height from the floor as they are in the standard show cage, and they should be the same distance apart. This is provided for in my system of training cages, and is important; the birds learn to jump the correct height and distance. If trained in cages which have the perches too far apart they will overshoot when jumping in a show cage and they will not perform as they should. With perches in the training cages at the correct height and distance apart they feel quite at home in the show cage, and it becomes unnecessary to place them in the show cages except for a short period to accustom them to movement, i.e., to get them used to having the cage lifted, moved about and set down. By gentle methods get the birds accustomed to jumping from floor to perch and from perch to perch. They will soon perform quite nicely; when they do, leave them alone and many of them will continue this to-and-fro jump; they are practising for the judge who will eventually either put them up or down. They are doing their best, so leave them to it once you see that they are enjoying it. Approach the cage occasionally; the birds should remain on the perches and stand steady and look towards you; if any bird gets down on the floor when the cage is approached it requires more training; this should be done quietly and the stick used as little as possible.

Don't Permit Nibbling.

Once the birds are thoroughly steady and working nicely the stick may be used, cautiously at first. A stick should be unnecessary, but the birds must be accustomed to it so that they are not surprised at a show when a judge produces one and gives them a touch up. Do not allow the birds to nibble the end of the training stick; it is very attractive, but they should have a respect for the stick and not treat it as a plaything; reprove, gently, any bird which shows an inclination to nibble the training stick, and do not use the stick more than the minimum required to get the birds accustomed to it. Do not on any account use it for levering birds off the cage floor on to the perches and do not rattle it along the cage front. A millet spray is very useful for coaxing a bird on to the perches in the early stages; cut off a piece about an inch long and place it between the wires about an inch above the centre punch-bar and in line with the perch, and leave the bird alone. It will eventually mount the perch to eat the millet.

See that the cages are kept scrupulously clean when training and conditioning, which are carried out at the same time, although I have been dealing almost exclusively with training.

In the system of caging for training referred to already the cleaning of the cages is facilitated by keeping a spare compartment at the end of the line; this is cleaned thoroughly and has seed and water placed inside. The bird which is being trained and conditioned occupies the next compartment. The first thing we do is to attach to the upper left-hand door opening, after having opened the door, a spraying cage which hooks on the cage front. We pull down the sliding door in this cage; note that it is pulled down and not up; there is no chance of the door falling, as it has to be pushed up to close the opening. When the passage from the training cage into the spraying cage has been opened, one hand is inserted in the lower right-hand door opening (the feeding door) and the bird is gently coaxed into the spraying cage, which is fitted with a perch on which the bird can stand. The spraying cage is all wire with the exception of the perch, so there is no flooding of the floor as there is in the usual type. As the spar in the spraying cage runs parallel to the front of the training cage, i.e., across the spraying cage, the bird usually faces the front, so it is necessary to spray from both sides. These cages are unpainted and very heavily tinned, to go with the training cages.

Having sprayed the bird gently, but thoroughly, if necessary, the door of the spraying cage is pushed up to close the opening if this has not been already closed. A long wire handle is attached to the door, and this also serves to keep the door closed; the door in the upper left side of the end training cage (the clean spare cage) is opened, the spraying cage hung on the front again, and the door slid downwards; the bird is coaxed into the new cage and the spraying cage is removed, after which the upper left-hand door in the training cage is closed. The bird is now in a clean, dry cage with fresh seed and water. It cannot become soiled during the drying process. We clean out the vacated compartment, and the next bird in the line is sprayed and placed in the clean cage after the manner of the first. This procedure is continued down the line, and takes very little time, as the fronts are easily removable.

The spraying of budgerigars for exhibition goes a long way towards imparting a steadiness, but it can be overdone both in the act of spraying and in the continuance of the treatment. It is unnecessary to hose the bird down unless it is extremely dirty, when it should be given a good wetting once or twice to loosen the dirt. I disagree with the advice that budgies should be hand-washed when dirty; I live, of course, in a locality where there is no smoke or soot in the atmosphere, and I have never found it necessary to wash a bird. An experienced exhibitor who has carried out hand-washing for a long time may be able to do this satisfactorily, but I would advise the beginner to practise on a few birds which are not of much value from the exhibition aspect. For spraying soft rain-water is best, used with any of the bird sprays, so long as the mist ejected is a fine one and the water is not sent out in a jet. It is unnecessary to add anything to the spraying water; substances which are supposed to impart a sheen to the plumage are useless.

Anything which alters the natural colour or shade of the plumage will result not only in disqualification of the exhibitor from future shows, but it will probably, as it should, lead to a criminal charge of attempted fraud. Any person who tries to alter the natural coloration of the plumage by artificial means is attempting to rob someone else of money, and the law should be called in in every case where proof is forthcoming.

The spraying imparts a tightness and sheen to the plumage, but, if continued too long the bird gets too tight in feather, what is termed "drawn" (drawn together), and it loses its shapely appearance and may be turned down for lack of substance. When the birds have been separated off and have become reasonably steady the spraying should begin, just a light spray, a few puffs at first, and then daily for a few days, getting more thoroughly sprayed on each occasion. In the case of a few birds which are shy of the spraying cage I open the upper left-hand door of the front, hang on the spraying cage with the entrance open and stick a piece of millet spray between the wires of the spraying cage so that the bird has to enter the cage to reach the seed.

I may leave the cage on for a day at a time, and I invariably find that birds take to the spraying cage quite well. I have had many birds which waited at the door until the spraying cage was attached and seemed eager to get their "shower." The design and dimensions of the spraying cage will be noted in the drawing, and I can recommend it to anyone adopting the training-cage system which I use or, in fact, to anyone who uses cages with doors in the front. It is much easier to get the bird into a cage which is placed high, so that the door in the front should be as high as the front will allow. I usually dip the spraying cages in very hot water after use and then shake them dry. I have had them for years and they are equal to new.

CHAPTER IX

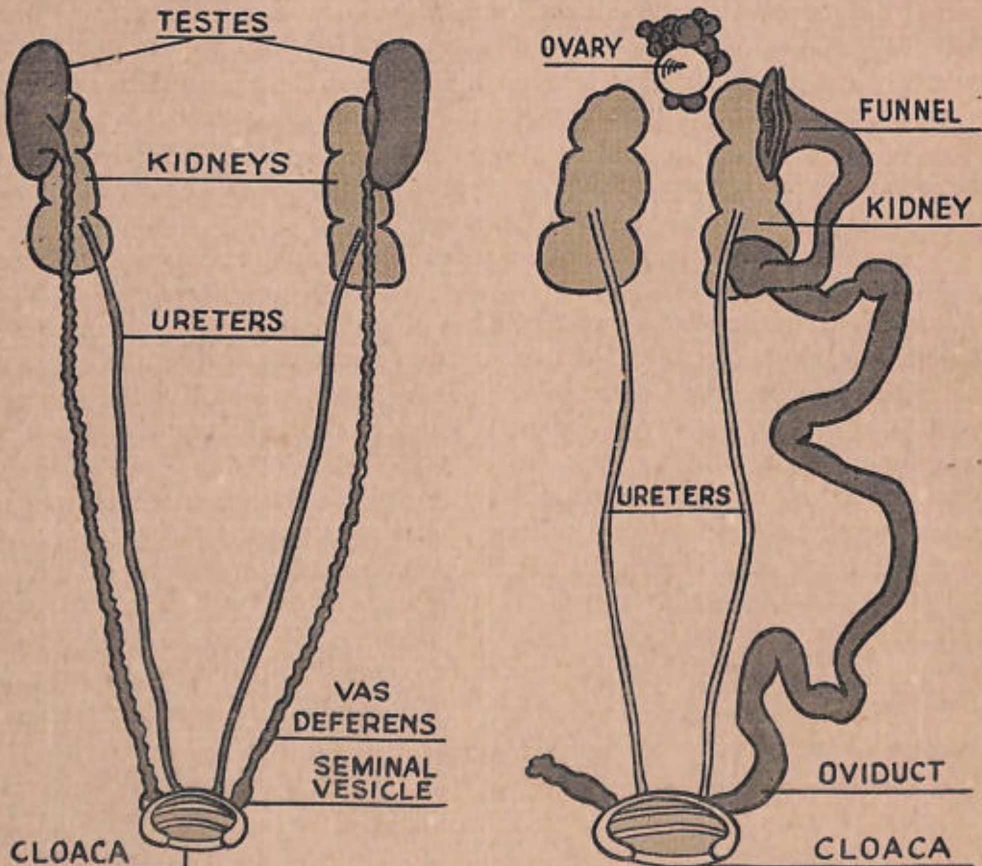
REPRODUCTIVE ORGANS

IT MAY BE OF INTEREST to carry out a brief survey of the means of reproduction and the internal organs which are involved. The prolificacy of the budgerigar has already been mentioned; now let us see how this little bird reproduces its kind. On the underside of the hen's body, near the root of the tail, there is a common orifice which has a double function, allowing the passage of excretory material and the entrance of the male sperm, and subsequently the passage of a fertilized egg. This opening is known as the cloaca and is common to both sexes. As will be seen from the illustration, the cloaca has leading into it, in the male, two tortuous tubes each connecting at its inner end with a testis. In the female one thicker tortuous tube will be seen and one rudimentary tube. In the illustrations the reproductive organs and the urinary organs are shown.

In addition to the tubes the cloaca communicates with the kidneys through straighter tubes, one on each side; the arrangement of the urinary organs is similar in both sexes. It will be noted that, whereas, in the male, two tubes from the reproductive organs (the testes) lead to the outlet, in the case of the female there is only one tube, usually the left, the right one atrophying before adult plumage is attained. The rudiment of the right tube can be seen in the diagram. The names of the different parts are necessary to understand the following description of the mechanism of reproduction, so let us mention those which are essential.

In the male, organs which produce the spermatozoa, or male sperm, are known as the testes. During the breeding season these organs enlarge and, after this season is over, they return to normal. In the testes the sperms are formed, and by means of the tubes, each known as a *vas deferens*, the sperms pass down to the distended, muscular portion just where the tube ends in the cloaca; this enlarged portion is known as the seminal vesicle, and it is here that the spermatozoa, manufactured in the testes, and conveyed by the *vas deferens*, is stored until it is ejected in the region of the cloaca of the female during the act of copulation or mating.

In the female the single ovary is covered with follicles in various stages of ripeness. Each follicle contains an ovum, or egg, which, as it becomes dilated with yolk and otherwise mature, bursts from the ovary and enters the funnel end of the oviduct. The tube nearest the funnel is narrow, and here the unfertilized ovum is delayed in its passage and may be fertilized by the



spermatozoa of the male which, having been deposited on the female cloaca, works its way up the oviduct to the narrow portion in which the ovum is lodged.

If we divide the oviduct into three approximately equal lengths we see that the third, at the funnel end, is narrow, and its function is to hold the ovum for fertilization. The middle third is wide and glandular, i.e., the lining of this part contains innumerable small glands which secrete or produce the white of the egg as we know it. In the terminal portion of the tube, adjoining the cloaca, the formation of the wall is both muscular and glandular. In this last third the shell membrane is formed and, finally, the shell. The finished product is expelled by the muscular action of this portion of the tube together with the action of other accessory muscles. Since several maladies met with during the breeding season are due to disturbance of the reproductive functions, it is necessary for the reader to study the diagrams and the text until he can grasp the principle of reproduction so far as the introduction of the spermatozoa, the fertilization of the ovum, and the passage of the fertilized egg along what we can regard as an assembly line are concerned. Disturbances of function will be dealt with later in the book, and it is easier to follow the text throughout if the essential terms are learned now.

Urine passed from the kidneys down the ureters finally reaches the cloaca in a semi-solid condition and, along with bowel contents, is excreted.

Summarizing the above, during the act of mating, the cloaca of the male is placed in close apposition to that of the female; the spermatozoa stored in the seminal vesicles of the male is injected into the cloaca of the female; from there it finds its way, by what is known as ciliary action, a form of swimming, up the oviduct to the narrow portion near the funnel end where, if all is well, an unfertilized ovum is waiting. The sperm enters the ovum, which becomes a fertilized egg; this egg, like a small yolk, passes down into the next portion of the oviduct where the glands lining this portion of the tube pour the "white of egg" on to the yolk; from here it passes on to the third or last portion, and here it has first a membrane added to enclose the egg and, finally, the hard shell is superimposed on the membrane. Lastly, the egg is expelled through the cloaca.

CHAPTER X

DISEASES AND AILMENTS

OF THE SMALL GROUP OF DISEASES to which budgerigars are liable, even if not prone, the only one which is important as having a possible ill-effect on the owner of a sick bird is psittacosis. This disease is epidemic in parrots and parrot-like birds, although not confined to these, being occasionally demonstrable in canaries, finches and fulmar petrels. In the infected bird there may be no manifestation of the disease, and it is in these "carriers" that risk of infection of human beings lies. Infected budgerigars may transmit the infection stated to be caused by a bacillus of the B.Coli group without themselves appearing in the least affected. The causal organism can be recovered from the droppings, and there is no doubt left that the organism causes a condition in man which may be indistinguishable, in the absence of laboratory test, from a severe fulminating pneumonia; alternatively or coincident with the pneumonic state the manifestation in man may take the form of a typhoid infection in which there is high intermittent fever and a rash resembling typhoid characterized by the presence of rose-pink spots on the abdomen. Psittacosis in man is a grave condition, the mortality being in the region of 40 per cent. of all persons infected, even though many show only slight manifestations which are transient. With the variety of antibiotics of the wide-spectrum group now available, e.g., chloromycetin, terramycin, aureomycin, etc., we have now means of effectively dealing with the malady in the human beings.

If the initial infection is merely the instigator and not the cause of a pneumococcal infection of the lungs, this manifestation would probably respond to adequate dosage of penicillin or sulphapyridine. In the budgerigar, as in all parrots, the disease shows itself as a severe catarrhal infection of the upper respiratory tract, the nasal discharge being marked. Diarrhœa is another of the symptoms and the droppings are green, slimy and offensive and encrust and mat together the plumage in the region of the cloaca.

It is probable that the infection in the case of man is airborne and caused through inspiring the dust from dried, infected droppings when cleaning cages or pens or scraping nest bottoms and through failing to isolate and treat as a potential danger any bird showing nasal discharge along with droppings as already described.

The habit of kissing pet birds and permitting them to feed from the lips of the owner is to be condemned, and it is almost wholly in cases where the infection is attributable to direct or close contact by feeding pet birds that we have had direct evidence that the birds are the carriers of the infection and *do* transmit the infection to man. No owner of a budgerigar should allow the bird to feed from his mouth, and any sign of nasal discharge in a pet budgerigar should warrant a visit to a veterinary surgeon *who is experienced in small-bird ailments*. Very few are, and many experienced fanciers have much more practical knowledge.

I hesitate to say that a bird which has a foul nasal discharge should be kept and some attempt made to treat the condition; I am quite aware sentimental value far outweighs monetary value in most cases, but the fact remains that, from the dried excrement of an infected bird is liable to come an infection which in man produces an acute febrile illness with a mortality rate of some 40 per cent. Whether the disease is communicable from one human being to another is not known, but it would seem less likely that the source of infection should be a human being, and we can take it, I think, that it is *almost* invariably a sick parrot or budgerigar, although finches and canaries are not above suspicion. Where enteritis is encountered in an aviary or birdroom there is no need to destroy a valuable stock. It is practically a thousand to one against the condition being psittacosis, but, as with all infections, scrupulous care of hands and clothing is necessary. Birds should be isolated and their pens or cages thoroughly disinfected. The incubation period, or time which it takes after infection for the disease to develop, varies from seven to twelve days.

Enteritis.—Birds which suffer from enteritis are generally seriously ill, although slight manifestation of the trouble may be met with now and again. The bird which has an attack of diarrhœa, the droppings being green and glutinous, need not necessarily be suffering from infectious enteritis. True infectious enteritis is transmissible from one bird to another and may sweep through the birdroom or aviaries of a breeder, causing grave damage to, if not total loss of, his stock.

One of the first signs of enteritis in the budgerigar is "softness" or looseness of feather; even before the characteristic diarrhœa we note that the bird is listless, fluffed into a ball, with eyes half closed and, unless disturbed, frequently seeming to be asleep. There is up-and-down rhythmic flicking of the tail and increased respiratory rate, the bird usually panting. Unusual tolerance of its owner's hand, tameness beyond that normally exhibited by the bird, is a sure sign of illness. The bird appears indifferent to its owner's hand. Birds seriously affected spend much of their time on the cage or aviary floor.

When on the perch in a more advanced stage of the infection there are spasms of side-to-side tail-wagging as the bird strains to rid itself of the irritant bowel contents. If diarrhœa is established the feathers round the vent are crusted and matted, while the vent appears to sag. The excretions are semi-solid or liquid, green in colour, and in serious cases blood-stained. Blood-staining of the fæces is an indication that the case is infectious enteritis or psittacosis. When this blood-staining is accompanied by nasal discharge the case may be, but is not necessarily, psittacosis; it should be regarded as this until proved other than this serious malady.

All enteritis should be regarded as infectious and the sufferer isolated, all cages and utensils being scalded and thoroughly cleaned.

Vertigo.—This is frequently observed in a closely in-bred strain where there has been no selection for retention of vigour and stamina and where exaggeration of head size has been sought after. The affected birds first fail to gain the perch accurately and, on occasion, appear to stagger and to lack secure hold on their perch. When they fail to perch through advancement of the disease, they can be seen to stagger about the cage floor, and finally, either by taking fits, or by developing paralysis of the legs, they sink, waste and finally pass out.

Blindness.—Like the previous condition, this may be due to close in-breeding, in which stamina has fallen off and in which the stock has degenerated through degeneracy becoming established in place of increase of vigour and stamina, as should be the aim of the in-breeder. Frequently excellence of colour, or unusual colour, tempts the in-breeder to run the risks of producing degenerates by a further season of in-breeding when the danger-sign of loss of vigour has already been observed. Blindness comes on gradually, and the bird first shows this sign when it cocks its head to one side to see.

Blindness occurs in one eye first, and it can be observed almost invariably that the bird rotates its head so that the eye in which sight still remains is turned towards the cage front from time to time. The bird appears to spasmodically twist its head and neck, but this is in an effort to see. The terminal stage is seen in the bird running about the cage floor, bumping into feeding dishes and cage ends or anything else which is in its way. For a time it may be able to survive by coming across the seed dish now and again in its wanderings, but eventually it dies. A bird which is known to be blind should be put out of its misery, and all stock from which such a bird has been bred should be discarded, even if apparently healthy. In fact, they ought to be destroyed, but birds which are sufficiently tame may be given to invalids as pets. They will be looked after and, not being in a situation in which they can breed, they die of old age without producing more defectives.

Fits.—Budgerigars, particularly hens, are subject to fits which are epileptiform in character. These are probably caused through some sexual disturbance, as the condition is frequently observed in birds which are sexually mature but which are not allowed to breed during the hot period of the year. I have not met fits in budgerigars when more than one is kept in a cage, but many solitary birds find their end in the struggle on the cage floor which is so distressing to watch. As I have stated, hens are more prone to fits than cocks, although I have met with the condition in the latter. This may, on occasion, be due to close in-breeding and, again, breeding for excessive size of head.

Should it occur in the young of an in-bred strain I regard it as the danger signal that the limits have been reached, and that further in-breeding with this line should not be carried out. The condition is not produced by in-breeding, but by the lack of vigour, by the failure to select strong, healthy birds for carrying out in-breeding. In-breeding has brought this and the two foregoing conditions out, whereas previously they where latent factors for degeneracy, all too frequently masked by out-breeding but nevertheless present. In-breeding has been said to " bring the dirt to the surface," and this was never more true than in the production of birds which suffer from vertigo, which have fits and which become blind for no apparent reason.

Growths.—A fibroid of the breast muscles is frequently met with in budgerigars which are kept as pets in cages, and may be due to lack of wing exercise. I successfully carried out on one occasion removal of a breast fibroid the size of a walnut from a tame talking budgerigar. Although the bird was ill for a considerable time, recovery took place and it survived for a period, but this was followed by the ultimate development of a fibroid in another area which it was considered inadvisable to remove.

On one occasion I examined a growth of the crop in which food swallowed was being passed out on to the breast. The bird was very emaciated, but survived, against my advice to the owner, for a time.

Obesity.—Although excess of fat is frequently found in the budgerigar which has been subjected to feeding with sweet and starchy tit-bits and which has been deprived of exercise, occasionally we find obesity which is pathological frequently present in more than one member of a bird family. I bred together two birds which were excessively fat, although given the minimum of food, and allowed space for wing exercise. The two young from this pair (many failed to survive for more than a few days) were pathologically fat just after they attained adult plumage; so long as they had baby plumage they appeared normal in every way, but, immediately after the first moult, they put on weight in spite of food restriction and administration of thyroid until both eventually could not become airborne even after frantic efforts, and they died in each case suddenly after taking fits or convulsions; they were found to have every internal organ loaded with fat. The breast muscles were wasted and their place almost completely taken by masses of rather firm fat. This condition is probably due to a glandular disease or failure of development of thyroid or lack of harmony between several glands.

Feather Plucking.—Again, strictly speaking, not a disease, but a vicious trait which is transmissible from offspring to young, even where eggs or young have been placed under normal birds for rearing. Birds which are addicted to feather plucking start on the blood quills of their young as soon as they begin to develop their plumage. Frequently this plucking, which I describe as "vampirism," is carried to such an extent that the young bird is stripped naked and may even be scalped. I have found that the vice is not confined to hens, and a cock is occasionally the only offender in a pair. I kill feather pluckers as soon as I detect this, and I also destroy young bred from the bird which is affected. On one occasion failure to recognize this as a transmissible vice almost cost me my entire stock of Greens, and, until I traced the offender, I could not explain why feather plucking had become so rife in a season.

Paralysis.—Paralysis may be insidious in onset, and in such a case the affected bird appears to develop some leg weakness; it tends to lie on the perch instead of standing; this tendency becomes more and more pronounced until the bird fails to retain its position on the perch and, after many falls, it takes to the cage floor. Whether this condition is due to a tumour of the nervous system or not I cannot say, but it seems to be caused through pressure in some part of this area; birds which lose the power of their legs die suddenly and are usually found to have passed away one fine morning. They feed well right up to the end. I have never had opportunity to do a post-mortem on a bird which died of paralysis, but it seems to be due to a tumour of the nervous system.

The two main *ailments* from which budgerigars suffer are, in hens, egg-binding and, in both sexes, chill.

Egg-binding.—There are two main causes of egg-binding, both due, not to low temperature during the nesting period, the usual explanation, but to physiological disturbance in the bird brought about through lack of vitamins in the diet. In the one form the egg which causes the binding is soft-shelled; in the other the egg is hard-shelled, the binding being due to lack of elasticity in the terminal third of the oviduct. Since supply of vitamin D in adequate quantity is a reliable preventive, the condition is brought about through a physiological dysfunction and not through structural defect of the oviduct or vent. In the case of the soft-shelled egg-binding there is too rapid passage of the egg through the middle and terminal portions of the oviduct; there is insufficient time for the deposition of calcium which forms the hard shell, and the egg enclosed in the membrane causes an obstruction. Difficulty in passage of the soft-shelled egg is due to the compressibility of the mass. Instead of the resistant egg which is normally passed along the oviduct by rhythmic contraction of the muscular walls of the terminal portion, when the soft-shelled egg is acted on by the muscles the mass adopts a sausage shape and remains stationary, causing a very troublesome form of egg-binding which is difficult to relieve; the obstruction is higher up. Although heat applied to the vent may cause relaxation of the muscular walls sufficient to allow the egg to pass to the vent, this is not invariable, and many hens succumb to egg-binding by a soft-shelled egg. In hard-shelled egg-binding there is loss of elasticity of the muscular wall of the terminal portion of the oviduct or of the vent itself.

It is not generally realized that it was birds which first used streamlining to good effect. The bird's egg is streamlined, the end in advance being more rounded than the one which follows. The thicker, leading end dilates the duct, whilst the muscular wall contracting on the egg can contract more strongly on the pointed end, and so the egg is squeezed along the duct. The rounder end is the one which the bird lays first. This streamlining is more evident in the eggs of many of the wild birds of this country, particularly in the egg of the plover. The pointing of one end serves two purposes; it assists in the pushing on of the egg until it is deposited in the nest, and it also prevents the eggs rolling about and coming to harm. In the nest of the plover the pointed ends are towards the centre of the nest: thus the eggs fit into the nest shape more readily.

The treatment of both forms of egg-binding is heat, and this heat should be used liberally and without delay; the egg-bound hen is usually found on the floor of the breeding pen, but she may occupy the nest, in which case, if overlooked, she will die.

The egg-bound hen should, if possible, be placed in a hospital cage with maximum heat turned on and left there until she has laid her egg, which is the usual result. The vent may be anointed with olive oil before the bird is placed in the cage, or she may be given a preliminary steaming by holding the vent over a jug of steaming hot water. If the binding is due to spasm the moist heat may bring about relaxation, and I have frequently had a bird pass the egg successfully during the steaming process. The increased incidence of egg-binding during the winter is due not to cold, but to deficiency of vitamin D through lack of sunlight and of green food. In the case of the soft-shelled egg-binding the condition is due to faulty calcium metabolism; the cells lining the terminal third of the oviduct are unable to secret and deposit on the membrane the calcium which forms the hard shell.

The administration of cod liver oil for a few weeks prior to, and throughout the egg-laying period, will obviate egg-binding, and the following procedure is recommended as being an improvement on the usual mixing of the oil with canary and/or millet. The oil, either the plain cod liver oil or reinforced with one of the concentrates such as Adexolin, should be mixed into pin-head oatmeal or, as it is sometimes called, kibbled groats, in the proportion of a dessertspoonful to a two-pound jam-jar filled with the kibbled groats. This should be thoroughly worked in with a spoon and left for three or four days before being fed to the birds. Each morning a teaspoonful of the treated groats should be sprinkled over the normal seed ration for each pair. As the oil is absorbed by the groats there is no sticky mess to contend with; the meal becomes a nice yellow brown after a few days, and is easily distinguished on colour from the untreated seed. After being given this for a few days it will be seen that the birds prefer this to the untreated groats, and it is because of this preference that I advise its being limited to one teaspoonful for each breeding pair.

Chill.—Budgerigars, although robust, hardy birds, are susceptible to sudden changes of temperature and to draughts. It is consequently inadvisable to turn into an open aviary in mid-winter birds which have been housed in a warm birdroom or which have been sent from a warmer climate. A sunny day should be chosen for putting the birds out, and, for the first few days, they should be confined to the shelter portions of the aviaries or breeding pens. These should be draught-proof or rendered so to begin with; after the birds have been hardened off they do not mind cold, or even draughts, and they are by no means delicate.

Should a budgerigar be suffering from chill, in general appearance it will resemble the bird which suffers from enteritis. It sits on its perch or on the cage bottom with feathers on end, all ragged and looking anything but alert and happy; the breeder should cultivate this habit of going 'round looking for trouble, and he will seldom overlook anything of a serious nature; the early manifestations are important, as a bird which has been weakened by failure to give prompt attention stands less chance of recovery than one which has been dealt with promptly and effectively. The treatment for a budgerigar suffering from chill is to place the bird in a show cage and set this in front of a good fire; or, better still, in a hospital cage. Do not roast the bird, but failure will be due to timidity rather than rashness in the use of heat

Cage and bird should be heated; it is wonderful how rapidly heat helps recovery of a bird which has been looking seriously ill. The ideal is to use a hospital cage for this treatment, as the heat can be regulated to a certain degree and maintained indefinitely until the bird recovers; another important feature of the hospital cage is the provision for cooling off gradually and of light for feeding. Any return of a bird which had been relieved by heat to a cold breeding pen without delay would produce a condition which was worse than the first. The bird which has been heat-treated must be cooled off, and this cooling process should occupy about a week, even longer in cold, wintry weather.

The only medicament which I have found effective in controlling, and apparently in a large percentage of cases of diarrhœa in curing, the condition is bismuth carbonate. This is very fine white powder obtainable from any chemist. The breeder of budgerigars should always have on hand about an ounce of this kept in a glass jar labelled Bism. Carb. Again, kibbled groats is the best vehicle for administering the corrective. About a cupful of groats should have mixed thoroughly into it a level teaspoonful of the powder. I adopt this method: A cupful of groats is put in a two-pound glass jam-jar which has been thoroughly cleaned; the teaspoonful of bismuth is added and stirred in with a spoon. In order to ensure that every particle of the kibbled groats is coated with the powder I shake the jar thoroughly in the manner of a cocktail mixer.

This mixture can be kept in readiness and, in the same way as cod liver oil is given, the treated groats should be sprinkled over the usual supply each morning; the birds eat the groats quite readily when treated with bismuth, and it will be found, almost invariably, to bring about a rapid change in the condition of the affected birds.

With regard to tonics, the efficacy of these is doubtful; birds which are active and healthy should not require the addition of tonics to food or drinking water. Of the various tonics on the market I have little experience, but, for my personal use, I employ one which contains infusions of tree barks and which I have found useful in restoring birds which are debilitated. It is administered in the drinking water by adding 8-10 drops to one ounce of the water; it must be changed daily, as it is unstable in certain waters. It should not be diluted and kept as stock.

French Moult.—Although French moult cannot be regarded, strictly speaking as either a disease or an ailment of the budgerigar, I feel that a summary of the condition and the mode of treatment cannot be omitted from a book such as this.

French moult is an infestation of the budgerigar by mites which, at least outwardly, resemble the ordinary fodder-mite found in many seeds. The affected bird manifests the trouble by dropping its flights and tail feathers on leaving the nest; in heavy infestation the feathers may be shed inside the nest and the affected bird is unable to fly and spends its time in crawling up and down the netting. The mite causing the condition eats its way into the follicle from which the feather grows, sets up irritation there which interferes with the attachment of the feather in the follicle; that much of the mutilation of the quill is due to the bird biting the feather is most probable, but there is no doubt that the quill is devitalized by the mite. It will be found, in affected feathers, that there is a blackish substance within the quill, more evident in birds in which the feathers are light, in Yellows and Lutinos.

Although affected birds will fully recover if immersed in warm baths containing Dettol, a tablespoonful to a pint of water, at intervals of three or four days for two weeks, all affected feathers having been removed first, the trouble renders the bird unsightly and should be prevented at all costs.

Prevention, on the latest tests, comprises thorough disinfestation of all cages, nests, etc., either by fumigation, by burning sulphur, or by twice weekly spraying with Dettol solution. The cages and nests should be thoroughly wetted with the disinfectant. This is not sufficient to ensure freedom from trouble, and in the light of present experience it is not the cages and nests which are the real offenders, but the breeding birds themselves. I find invariably that, where we get affected young, one or other parent shows signs of the trouble in the form of a black substance in the quills of flights or tail feathers; this being so, it is a matter of disinfecting the breeders before they are put up for breeding. There is less need of this where stock is wintered out of doors in unheated aviaries, but it is nevertheless a wise precaution to treat the birds as well as the cages; every bird to be used for breeding should be carefully examined for evidence of infestation, particular attention being paid to the flights and tail feathers; any feather with a "blood-quill" should be removed, as this is definite evidence. All affected feathers having been removed, the bird should be immersed in a warm Dettol bath, thoroughly soaked up to the neck, the head being protected by a soft cloth.

The bird should then be placed in a clean cage with low perches; several "dipped" birds can be kept in one cage, and they will be dry and quite presentable in about two hours. This dipping should be repeated in four or five days, and again in another week, after which the birds should be mite-free and any eggs which have survived the dipping and hatched should be out of the running. I think that if this were adopted as a normal pre-breeding procedure we should have no trouble with French moult which has done so much to hamper our work in the past.

This affection of the feathers does much to spoil the hobby, but, like everything connected with the breeding of budgerigars, we must face up to it and deal with it.

The budgerigar is a hardy, adaptable bird, easy to breed, and we must not complain if it is prone to a few ailments. The ease with which it can be bred, the adaptability to what diet is offered, and the lovely colours in which we have this small parrakeet makes it most attractive to the beginner and highly desirable as an exhibition bird to the experienced fancier.

It is the duty of every breeder to strive for perfection in his stock; that this is not easily attainable makes the hobby more attractive than it would be otherwise. I look forward to years in a hobby which has proved both educative and entertaining. Like everyone else, I expect to breed "Palace winners" each year, and still live in hope of doing so. Most of all do I enjoy the good fellowship which goes with this hobby; I wish all fanciers what they are striving to attain—success on the show bench or merely the pleasure they get from studying the birds.

CONCLUSION

And now I come to the end of a book which is the outcome of personal experience, and which has been made possible by careful observation and recording over many years in the Fancy.

There may be many shortcomings, and they are my responsibility; readers will look in vain for mating tables, for breeding plans, for business methods; I am unable to work out accurate colour expectations since they do not interest me; I do not work to any fixed plan, and my business methods are deplorable; were they otherwise I should be worried interminably.

I look on the breeding of budgerigars as a hobby; my profit is the pleasure and exercise of mind and body which it affords me. I am not conscious of having ever suffered loss in the hobby even in the darkest days; every unlooked-for occurrence, no matter how vexing at the moment, is a new experience, and, as years pass in a hobby which offers much pleasure and many disappointments, one becomes inured to both; there is no sense of catastrophe under any circumstances, and any triumph is restrained but, none the less, enjoyable; only the novice lives with his head in the clouds; he gradually becomes less of an optimist, and realizes that budgerigar breeding for the show bench involves principles which in no way differ from improvement in other forms of livestock.

To effect the improvement which is necessary entails careful consideration of what is required and of the way in which it may be effected; it is hoped that this book may be of help to those who are serving their apprenticeship and that, even to the experienced fancier, it is not devoid of interest.

INDEX