

BIRDS- Continued.

WHEN the sexes differ in beauty or in the power of singing, or in producing what I have called instrumental music, it is almost invariably the male who surpasses the female. These qualities, as we have just seen, are evidently of high importance to the male. When they are gained for only a part of the year it is always before the breeding-season. It is the male alone who elaborately displays his varied attractions, and often performs strange antics on the ground or in the air, in the presence of the female. Each male drives away, or if he can, kills his rivals. Hence we may conclude that it is the object of the male to induce the female to pair with him, and for this purpose he tries to excite or charm her in various ways; and this is the opinion of all those who have carefully studied the habits of living birds. But there remains a question which has an all important bearing on sexual selection, namely, does every male of the same species excite and attract the female equally? Or does she exert a choice, and prefer certain males? This latter question can be answered in the affirmative by much direct and indirect evidence. It is far more difficult to decide what qualities determine the choice of the females; but here again we have some direct and indirect evidence that it is to a large extent the external attractions of the male; though no doubt his vigour, courage, and other mental qualities come into play. We will begin with the indirect evidence.

Length of Courtship. - The lengthened period during which both sexes of certain birds meet day after day at an appointed place probably depends partly on the courtship being a prolonged affair, and partly on reiteration in the act of pairing. Thus in Germany and Scandinavia the balzen or leks of the black-cocks last from the middle of March, all through April into May. As many as forty or fifty, or even more birds congregate at the leks; and the same place is often frequented during successive years. The lek of the capercaillie lasts from the end of March to the middle or even end of May. In North America "the partridge dances" of the *Tetrao phasianellus* "last for a month or more." Other kinds of grouse, both in North America and Eastern Siberia,* follow nearly the same habits. The fowlers discover the hillocks where the ruffs congregate by the grass being trampled bare, and this shews that the same spot is long frequented. The Indians of Guiana are well acquainted with the cleared arenas, where they expect to find the beautiful cocks of the rock; and the natives of New Guinea know the trees where from ten to twenty male birds of paradise in full plumage congregate. In this latter case it is not expressly stated that the females meet on the same trees, but the hunters, if not specially asked, would probably not mention their presence, as their skins are valueless. Small parties of an African weaver (*Ploceus*) congregate, during the breeding-season, and perform for hours their graceful evolutions. Large numbers of the solitary snipe (*Scolopax major*) assemble during dusk in a morass; and the same place is frequented for the same purpose during successive years; here they may be seen running about "like so many rats," puffing out their feathers, flapping their wings, and uttering the strangest cries.*(2)

* Nordman describes (*Bull. Soc. Imp. des Nat. Moscou*, 1861, tom. xxxiv., p. 264) the balzen of *Tetrao urogalloides* in Amur Land. He estimated the number of birds assembled at above a hundred, not counting the females, which lie hid in the surrounding bushes. The noises uttered differ from those of *T. urogallus*.

*(2) With respect to the assemblages of the above-named grouse, see Brehm, *Thierleben*, B. iv., s. 350; also L. Lloyd, *Game Birds of Sweden*, 1867, pp. 19, 78. Richardson, *Fauna Bor. Americana: Birds*, p. 362. References in regard to the assemblages of other birds have

already been given. On Paradisea, see Wallace, in Annals and Mag. of Nat. Hist., vol. xx., 1857, p. 412. On the snipe, Lloyd, *ibid.*, p. 221.

Some of the above birds, - the black-cock, capercailzie, pheasant-grouse, ruff, solitary snipe, and perhaps others, - are, as is believed, polygamists. With such birds it might have been thought that the stronger males would simply have driven away the weaker, and then at once have taken possession of as many females as possible; but if it be indispensable for the male to excite or please the female, we can understand the length of the courtship and the congregation of so many individuals of both sexes at the same spot. Certain strictly monogamous species likewise hold nuptial assemblages; this seems to be the case in Scandinavia with one of the ptarmigans, and their leks last from the middle of March to the middle of May. In Australia the lyre-bird (*Menura superba*) forms "small round hillocks," and the *M. Alberti* scratches for itself shallow holes, or, as they are called by the natives, corroborating places, where it is believed both sexes assemble. The meetings of the *M. superba* are sometimes very large; and an account has lately been published* by a traveller, who heard in a valley beneath him, thickly covered with scrub, "a din which completely astonished" him; on crawling onwards he beheld, to his amazement, about one hundred and fifty of the magnificent lyre-cocks, "ranged in order of battle, and fighting with indescribable fury." The bowers of the bower-birds are the resort of both sexes during the breeding-season; and "here the males meet and contend with each other for the favours of the female, and here the latter assemble and coquet with the males." With two of the genera, the same bower is resorted to during many years.*(2)

* Quoted by Mr. T. W. Wood, in *The Student*, April, 1870, p. 125.

*(2) Gould, *Handbook of the Birds of Australia*, vol. i., pp. 300, 308, 448, 451. On the ptarmigan, above alluded to, see Lloyd, *ibid.*, p. 129.

The common magpie (*Corvus pica*, Linn.), as I have been informed by the Rev. W. Darwin Fox, used to assemble from all parts of Delamere Forest, in order to celebrate the great magpie marriage." Some years ago these birds abounded in extraordinary numbers, so that a gamekeeper killed in one morning nineteen males, and another killed by a single shot seven birds at roost together. They then had the habit of assembling very early in the spring at particular spots, where they could be seen in flocks, chattering, sometimes fighting, bustling and flying about the trees. The whole affair was evidently considered by the birds as one of the highest importance. Shortly after the meeting they all separated, and were then observed by Mr. Fox and others to be paired for the season. In any district in which a species does not exist in large numbers, great assemblages cannot, of course, be held, and the same species may have different habits in different countries. For instance, I have heard of only one instance, from Mr. Wedderburn, of a regular assemblage of black game in Scotland, yet these assemblages are so well known in Germany and Scandinavia that they have received special names.

Unpaired Birds. - From the facts now given, we may conclude that the courtship of birds belonging to widely different groups, is often a prolonged, delicate, and troublesome affair. There is even reason to suspect, improbable as this will at first appear, that some males and females of the same species, inhabiting the same district, do not always please each other, and consequently do not pair. Many accounts have been published of either the male or female of a pair having been shot, and quickly replaced by another. This has been observed more frequently with the magpie than with any other bird, owing perhaps to its conspicuous appearance and nest. The illustrious Jenner states that in Wiltshire one of a pair was

daily shot no less than seven times successively, "but all to no purpose, for the remaining magpie soon found another mate"; and the last pair reared their young. A new partner is generally found on the succeeding day; but Mr. Thompson gives the case of one being replaced on the evening of the same day. Even after the eggs are hatched, if one of the old birds is destroyed a mate will often be found; this occurred after an interval of two days, in a case recently observed by one of Sir J. Lubbock's keepers.* The first and most obvious conjecture is that male magpies must be much more numerous than females; and that in the above cases, as well as in many others which could be given, the males alone had been killed. This apparently holds good in some instances, for the gamekeepers in Delamere Forest assured Mr. Fox that the magpies and carrion-crows which they formerly killed in succession in large numbers near their nests, were all males; and they accounted for this fact by the males being easily killed whilst bringing food to the sitting females. Macgillivray, however, gives, on the authority of an excellent observer, an instance of three magpies successively killed on the same nest, which were all females; and another case of six magpies successively killed whilst sitting on the same eggs, which renders it probable that most of them were females; though, as I hear from Mr. Fox, the male will sit on the eggs when the female is killed.

* On magpies, Jenner, in *Philosophical Transactions*, 1824, p. 21. Macgillivray, *Hist. British Birds*, vol. i., p. 570. Thompson, in *Annals and Magazine of Natural History*, vol. viii., 1842, p. 494.

Sir J. Lubbock's gamekeeper has repeatedly shot, but how often he could not say, one of a pair of jays (*Garrulus glandarius*), and has never failed shortly afterwards to find the survivor re-matched. Mr. Fox, Mr. F. Bond, and others have shot one of a pair of carrion-crows (*Corvus corone*), but the nest was soon again tenanted by a pair. These birds are rather common; but the peregrine-falcon (*Falco peregrinus*) is rare, yet Mr. Thompson states that in Ireland "if either an old male or female be killed in the breeding-season (not an uncommon circumstance), another mate is found within a very few days, so that the eyries, notwithstanding such casualties, are sure to turn out their complement of young." Mr. Jenner Weir has known the same thing with the peregrine-falcons at Beachy Head. The same observer informs me that three kestrels (*Falco tinnunculus*), all males, were killed one after the other whilst attending the same nest; two of these were in mature plumage, but the third was in the plumage of the previous year. Even with the rare golden eagle (*Aquila chrysaetos*), Mr. Birkbeck was assured by a trustworthy gamekeeper in Scotland, that if one is killed, another is soon found. So with the white owl (*Strix flammea*), "the survivor readily found a mate, and the mischief went on."

White of Selborne, who gives the case of the owl, adds that he knew a man, who from believing that partridges when paired were disturbed by the males fighting, used to shoot them; and though he had widowed the same female several times, she always soon found a fresh partner. This same naturalist ordered the sparrows, which deprived the house-martins of their nests, to be shot; but the one which was left, "be it cock or hen, presently procured a mate, and so for several times following." I could add analogous cases relating to the chaffinch, nightingale, and redstart. With respect to the latter bird (*Phoenicurus phoenicurus*), a writer expresses much surprise how the sitting female could so soon have given effectual notice that she was a widow, for the species was not common in the neighbourhood. Mr. Jenner Weir has mentioned to me a nearly similar case; at Blackheath he never sees or hears the note of the wild bullfinch, yet when one of his caged males has died, a wild one in the course of a few days has generally come and perched near the widowed female, whose call-note is not loud. I will give only one other fact, on the authority of this same observer; one of a pair of

starlings (*Sturnus vulgaris*) was shot in the morning; by noon a new mate was found; this was again shot, but before night the pair was complete; so that the disconsolate widow or widower was thrice consoled during the same day. Mr. Engleheart also informs me that he used during several years to shoot one of a pair of starlings which built in a hole in a house at Blackheath; but the loss was always immediately repaired. During one season he kept an account, and found that he had shot thirty-five birds from the same nest; these consisted of both males and females, but in what proportion he could not say: nevertheless, after all this destruction, a brood was reared.*

* On the peregrine falcon, see Thompson, Nat. Hist. of Ireland: Birds, vol. i., 1849, p. 39. On owls, sparrows, and partridges, see White, Nat. Hist. of Selborne, ed. of 1825, vol. i., p. 139. On the *Phoenicura*, see Loudon's Mag. of Nat. Hist., vol. vii., 1834, p. 245. Brehm (*Thierleben*, B. iv., s. 991) also alludes to cases of birds thrice mated during the same day.

These facts well deserve attention. How is it that there are birds enough ready to replace immediately a lost mate of either sex? Magpies, jays, carrion-crows, partridges, and some other birds, are always seen during the spring in pairs, and never by themselves; and these offer at first sight the most perplexing cases. But birds of the same sex, although of course not truly paired, sometimes live in pairs or in small parties, as is known to be the case with pigeons and partridges. Birds also sometimes live in triplets, as has been observed with starlings, carrion-crows, parrots, and partridges. With partridges two females have been known to live with one male, and two males with one female. In all such cases it is probable that the union would be easily broken; and one of the three would readily pair with a widow or widower. The males of certain birds may occasionally be heard pouring forth their love-song long after the proper time, shewing that they have either lost or never gained a mate. Death from accident or disease of one of a pair would leave the other free and single; and there is reason to believe that female birds during the breeding-season are especially liable to premature death. Again, birds which have had their nests destroyed, or barren pairs, or retarded individuals, would easily be induced to desert their mates, and would probably be glad to take what share they could of the pleasures and duties of rearing offspring although not their own.* Such contingencies as these probably explain most of the foregoing cases.*(2) Nevertheless, it is a strange fact that within the same district, during the height of the breeding-season, there should be so many males and females always ready to repair the loss of a mated bird. Why do not such spare birds immediately pair together? Have we not some reason to suspect, and the suspicion has occurred to Mr. Jenner Weir, that as the courtship of birds appears to be in many cases prolonged and tedious, so it occasionally happens that certain males and females do not succeed, during the proper season, in exciting each other's love, and consequently do not pair? This suspicion will appear somewhat less improbable after we have seen what strong antipathies and preferences female birds occasionally evince towards particular males.

* See White (Nat. Hist. of Selborne, 1825, vol. i., p. 140) on the existence, early in the season, of small coveys of male partridges, of which fact I have heard other instances. See Jenner, on the retarded state of the generative organs in certain birds, in *Phil. Transact.*, 1824. In regard to birds living in triplets, I owe to Mr. Jenner Weir the cases of the starlings and parrots, and to Mr. Fox, of partridges; on carrion-crows, see the *Field*, 1868, p. 415. On various male birds singing after the proper period, see L. Jenyns, *Observations in Natural History*, 1846, p. 87.

*(2) The following case has been given (*The Times*, Aug. 6, 1868)

by the Rev. F. . Morris, on the authority of the Hon. and Rev. O. W. Forester. "The gamekeeper here found a hawk's nest this year, with five young ones on it. He took four and killed them, but left one with its wings clipped as a decoy to destroy the old ones by. They were both shot next day, in the act of feeding the young one, and the keeper thought it was done with. The next day he came again and found two other charitable hawks, who had come with an adopted feeling to succour the orphan. These two he killed, and then left the nest. On returning afterwards he found two more charitable individuals on the same errand of mercy. One of these he killed; the other he also shot, but could not find. No more came on the like fruitless errand."

Mental Qualities of Birds, and their Taste for the Beautiful. -

Before we further discuss the question whether the females select the more attractive males or accept the first whom they may encounter, it will be advisable briefly to consider the mental powers of birds. Their reason is generally, and perhaps justly, ranked as low; yet some facts could be given* leading to an opposite conclusion. Low powers of reasoning, however, are compatible, as we see with mankind, with strong affections, acute perception, and a taste for the beautiful; and it is with these latter qualities that we are here concerned. It has often been said that parrots become so deeply attached to each other that when one dies the other pines for a long time; but Mr. Jenner Weir thinks that with most birds the strength of their affection has been much exaggerated. Nevertheless when one of a pair in a state of nature has been shot, the survivor has been heard for days afterwards uttering a plaintive call; and Mr. St. John gives various facts proving the attachment of mated birds.*⁽²⁾ Mr. Bennett relates*⁽³⁾ that in China after a drake of the beautiful mandarin teal had been stolen, the duck remained disconsolate, though sedulously courted by another mandarin drake, who displayed before her all his charms. After an interval of three weeks the stolen drake was recovered, and instantly the pair recognised each other with extreme joy. On the other hand, starlings, as we have seen, may be consoled thrice in the same day for the loss of their mates. Pigeons have such excellent local memories, that they have been known to return to their former homes after an interval of nine months, yet, as I hear from Mr. Harrison Weir, if a pair which naturally would remain mated for life be separated for a few weeks during the winter, and afterwards matched with other birds, the two when brought together again, rarely, if ever, recognise each other.

* I am indebted to Prof. Newton for the following passage from Mr. Adam's Travels of a Naturalist, 1870, p. 278. Speaking of Japanese nut-hatches in confinement, he says: "Instead of the more yielding fruit of the yew, which is the usual food of the nut-hatch of Japan, at one time I substituted hard hazel-nuts. As the bird was unable to crack them, he placed them one by one in his water-glass, evidently with the notion that they would in time become softer- an interesting proof of intelligence on the part of these birds."

*⁽²⁾ A Tour in Sutherlandshire, vol. i., 1849, p. 185. Dr. Buller says (Birds of New Zealand, 1872, p. 56) that a male king lory was killed; and the female "fretted and moped, refused her food, and died of a broken heart."

*⁽³⁾ Wanderings in New South Wales, vol. ii., 1834, p. 62.

Birds sometimes exhibit benevolent feelings; they will feed the deserted young ones even of distinct species, but this perhaps ought to be considered as a mistaken instinct. They will feed, as shewn in an earlier part of this work, adult birds of their own species which have become blind. Mr. Buxton gives a curious account of a parrot which took care of a frost-bitten and crippled bird of a distinct species, cleansed her feathers, and defended her from the attacks of the other parrots which roamed freely about his garden. It is a still more curious fact that these birds apparently evince some

sympathy for the pleasures of their fellows. When a pair of cockatoos made a nest in an acacia tree, "it was ridiculous to see the extravagant interest taken in the matter by the others of the same species." These parrots, also, evinced unbounded curiosity, and clearly had "the idea of property and possession."* They have good memories, for in the Zoological Gardens they have plainly recognised their former masters after an interval of some months.

* "Acclimatization of Parrots", by C. Buxton, M. P., Annals and Mag. of Nat. Hist., Nov., 1868, p. 381.

Birds possess acute powers of observation. Every mated bird, of course, recognises its fellow. Audubon states that a certain number of mocking-thrushes (*Mimus polyglottus*) remain all the year round in Louisiana, whilst others migrate to the Eastern States; these latter, on their return, are instantly recognised, and always attacked, by their southern brethren. Birds under confinement distinguish different persons, as is proved by the strong and permanent antipathy or affection which they shew, without any apparent cause, towards certain individuals. I have heard of numerous instances with jays, partridges, canaries, and especially bullfinches. Mr. Hussey has described in how extraordinary a manner a tamed partridge recognised everybody: and its likes and dislikes were very strong. This bird seemed "fond of gay colours, and no new gown or cap could be put on without catching his attention."* Mr. Hewitt has described the habits of some ducks (recently descended from wild birds), which, at the approach of a strange dog or cat, would rush headlong into the water, and exhaust themselves in their attempts to escape; but they knew Mr. Hewitt's own dogs and cats so well that they would lie down and bask in the sun close to them. They always moved away from a strange man, and so they would from the lady who attended them if she made any great change in her dress. Audubon relates that he reared and tamed a wild turkey which always ran away from any strange dog; this bird escaped into the woods, and some days afterwards Audubon saw, as he thought, a wild turkey, and made his dog chase it; but, to his astonishment, the bird did not run away, and the dog, when he came up, did not attack the bird, for they mutually recognised each other as old friends.*(2)

* The Zoologist, 1847-48, p. 1602.

*(2) Hewitt on wild ducks, Journal of Horticulture, Jan. 13, 1863, p. 39. Audubon on the wild turkey, Ornithological Biography, vol. i., p. 14. On the mocking-thrush, *ibid.*, vol. i., p. 110.

Mr. Jenner Weir is convinced that birds pay particular attention to the colours of other birds, sometimes out of jealousy, and sometimes as a sign of kinship. Thus he turned a reed-bunting (*Emberiza schaeniculus*), which had acquired its black head-dress, into his aviary, and the newcomer was not noticed by any bird, except by a bullfinch, which is likewise black-headed. This bullfinch was a very quiet bird, and had never before quarrelled with any of its comrades, including another reed-bunting, which had not as yet become black-headed: but the reed-bunting with a black head was so unmercifully treated that it had to be removed. *Spiza cyanea*, during the breeding-season, is of a bright blue colour; and though generally peaceable, it attacked *S. ciris*, which has only the head blue, and completely scalped the unfortunate bird. Mr. Weir was also obliged to turn out a robin, as it fiercely attacked all the birds in his aviary with any red in their plumage, but no other kinds; it actually killed a red-breasted cross-bill, and nearly killed a goldfinch. On the other hand, he has observed that some birds, when first introduced, fly towards the species which resemble them most in colour, and settle by their sides.

As male birds display their fine plumage and other ornaments with so much care before the females, it is obviously probable that these

appreciate the beauty of their suitors. It is, however, difficult to obtain direct evidence of their capacity to appreciate beauty. When birds gaze at themselves in a looking-glass (of which many instances have been recorded) we cannot feel sure that it is not from jealousy of a supposed rival, though this is not the conclusion of some observers. In other cases it is difficult to distinguish between mere curiosity and admiration. It is perhaps the former feeling which, as stated by Lord Lilford,* attracts the ruff towards any bright object, so that, in the Ionian Islands, "it will dart down to a bright-coloured handkerchief, regardless of repeated shots." The common lark is drawn down from the sky, and is caught in large numbers, by a small mirror made to move and glitter in the sun. Is it admiration or curiosity which leads the magpie, raven, and some other birds to steal and secrete bright objects, such as silver articles or jewels?

* The Ibis, vol. ii., 1860, p. 344.

Mr. Gould states that certain humming-birds decorate the outsides of their nests "with the utmost taste; they instinctively fasten thereon beautiful pieces of flat lichen, the larger pieces in the middle, and the smaller on the part attached to the branch. Now and then a pretty feather is intertwined or fastened to the outer sides, the stem being always so placed that the feather stands out beyond the surface." The best evidence, however, of a taste for the beautiful is afforded by the three genera of Australian bower-birds already mentioned. Their bowers (see fig. 46), where the sexes congregate and play strange antics, are variously constructed, but what most concerns us is, that they are decorated by the several species in a different manner. The satin bower-bird collects gaily-coloured articles, such as the blue tail-feathers of parrakeets, bleached bones and shells, which it sticks between the twigs or arranges at the entrance. Mr. Gould found in one bower a neatly-worked stone tomahawk and a slip of blue cotton, evidently procured from a native encampment. These objects are continually re-arranged, and carried about by the birds whilst at play. The bower of the spotted bower-bird "is beautifully lined with tall grasses, so disposed that the heads nearly meet, and the decorations are very profuse." Round stones are used to keep the grass-stems in their proper places, and to make divergent paths leading to the bower. The stones and shells are often brought from a great distance. The regent bird, as described by Mr. Ramsay, ornaments its short bower with bleached land-shells belonging to five or six species, and with "berries of various colours, blue, red, and black, which give it when fresh a very pretty appearance. Besides these there were several newly-picked leaves and young shoots of a pinkish colour, the whole shewing a decided taste for the beautiful." Well may Mr. Gould say that "these highly decorated halls of assembly must be regarded as the most wonderful instances of bird-architecture yet discovered"; and the taste, as we see, of the several species certainly differs.*

* On the ornamented nests of humming-birds, Gould, Introduction to the Trochilidae, 1861, p. 19. On the bower-birds, Gould, Handbook of the Birds of Australia, 1865, vol. i., pp. 444-461. Ramsay, in the Ibis, 1867, p. 456.

Preference for particular Males by the Females.- Having made these preliminary remarks on the discrimination and taste of birds, I will give all the facts known to me which bear on the preference shewn by the female for particular males. It is certain that distinct species of birds occasionally pair in a state of nature and produce hybrids. Many instances could be given: thus Macgillivray relates how a male blackbird and female thrush "fell in love with each other," and produced offspring.* Several years ago eighteen cases had been recorded of the occurrence in Great Britain of hybrids between the

black grouse and pheasant;*(2) but most of these cases may perhaps be accounted for by solitary birds not finding one of their own species to pair with. With other birds, as Mr. Jenner Weir has reason to believe, hybrids are sometimes the result of the casual intercourse of birds building in close proximity. But these remarks do not apply to the many recorded instances of tamed or domestic birds, belonging to distinct species, which have become absolutely fascinated with each other, although living with their own species. Thus Waterton*(3) states that out of a flock of twenty-three Canada geese, a female paired with a solitary bernicle gander, although so different in appearance and size; and they produced hybrid offspring. A male wigeon (*Mareca penelope*), living with females of the same species, has been known to pair with a pintail duck, *Querquedula acuta*. Lloyd describes the remarkable attachment between a shield-drake (*Tadorna vulpanser*) and a common duck. Many additional instances could be given; and the Rev. E. S. Dixon remarks that "those who have kept many different species of geese together well know what unaccountable attachments they are frequently forming, and that they are quite as likely to pair and rear young with individuals of a race (species) apparently the most alien to themselves as with their own stock."

* History of Brit. Birds, vol. ii., p. 92.

*(2) Zoologist, 1853-1854, p. 3940.

*(3) Waterton, Essays on Nat. Hist., 2nd series, pp. 42 and 117. For the following statements see on the wigeon, Loudon's Mag. of Nat. Hist., vol. ix., p. 616; L. Lloyd, Scandinavian Adventures, vol. i., 1854, p. 452. Dixon, Ornamental and Domestic Poultry p. 137; Hewitt, in Journal of Horticulture, Jan. 13, 1863, p. 40; Bechstein, Stubenvogel, 1840, s. 230. Mr. J. Jenner Weir has lately given me an analogous case with ducks of two species.

The Rev. W. D. Fox informs me that he possessed at the same time a pair of Chinese geese (*Anser cygnoides*), and a common gander with three geese. The two lots kept quite separate, until the Chinese gander seduced one of the common geese to live with him. Moreover, of the young birds hatched from the eggs of the common geese, only four were pure, the other eighteen proving hybrids; so that the Chinese gander seems to have had prepotent charms over the common gander. I will give only one other case; Mr. Hewitt states that a wild duck, reared in captivity "after breeding a couple of seasons with her own mallard, at once shook him off on my placing a male pintail on the water. It was evidently a case of love at first sight, for she swam about the new-comer caressingly, though he appeared evidently alarmed and averse to her overtures of affection. From that hour she forgot her old partner. Winter passed by, and the next spring the pintail seemed to have become a convert to her blandishments, for they nested and produced seven or eight young ones."

What the charm may have been in these several cases, beyond mere novelty, we cannot even conjecture. Colour, however, sometimes comes into play; for in order to raise hybrids from the siskin (*Fringilla spinus*) and the canary, it is much the best plan, according to Bechstein, to place birds of the same tint together. Mr. Jenner Weir turned a female canary into his aviary, where there were male linnets, goldfinches, siskins, greenfinches, chaffinches, and other birds, in order to see which she would choose; but there never was any doubt, and the greenfinch carried the day. They paired and produced hybrid offspring.

The fact of the female preferring to pair with one male rather than with another of the same species is not so likely to excite attention, as when this occurs, as we have just seen, between distinct species. The former cases can best be observed with domesticated or confined birds; but these are often pampered by high feeding, and sometimes have their instincts vitiated to an extreme degree. Of this latter fact I could give sufficient proofs with pigeons, and

especially with fowls, but they cannot be here related. Vitiating instincts may also account for some of the hybrid unions above mentioned; but in many of these cases the birds were allowed to range freely over large ponds, and there is no reason to suppose that they were unnaturally stimulated by high feeding.

With respect to birds in a state of nature, the first and most obvious supposition which will occur to every one is that the female at the proper season accepts the first male whom she may encounter; but she has at least the opportunity for exerting a choice, as she is almost invariably pursued by many males. Audubon- and we must remember that he spent a long life in prowling about the forests of the United States and observing the birds- does not doubt that the female deliberately chooses her mate; thus, speaking of a woodpecker, he says the hen is followed by half-a-dozen gay suitors, who continue performing strange antics, "until a marked preference is shewn for one." The female of the red-winged starling (*Agelaius phoeniceus*) is likewise pursued by several males, "until, becoming fatigued, she alights, receives their addresses, and soon makes a choice." He describes also how several male night-jars repeatedly plunge through the air with astonishing rapidity, suddenly turning, and thus making a singular noise; "but no sooner has the female made her choice than the other males are driven away." With one of the vultures (*Cathartes aura*) of the United States, parties of eight, ten, or more males and females assemble on fallen logs, "exhibiting the strongest desire to please mutually," and after many caresses, each male leads off his partner on the wing. Audubon likewise carefully observed the wild flocks of Canada geese (*Anser canadensis*), and gives a graphic description of their love-antics; he says that the birds which had been previously mated "renewed their courtship as early as the month of January, while the others would be contending or coquetting for hours every day, until all seemed satisfied with the choice they had made, after which, although they remained together, any person could easily perceive that they were careful to keep in pairs. I have observed also that the older the birds the shorter were the preliminaries of their courtship. The bachelors and old maids whether in regret, or not caring to be disturbed by the bustle, quietly moved aside and lay down at some distance from the rest."* Many similar statements with respect to other birds could be cited from this same observer.

* Audubon, *Ornithological Biography*, vol. i., pp. 191, 349; vol. ii., pp. 42, 275; vol. iii., p. 2.

Turning now to domesticated and confined birds, I will commence by giving what little I have learnt respecting the courtship of fowls. I have received long letters on this subject from Messrs. Hewitt and Tegetmeier, and almost an essay from the late Mr. Brent. It will be admitted by every one that these gentlemen, so well known from their published works, are careful and experienced observers. They do not believe that the females prefer certain males on account of the beauty of their plumage; but some allowance must be made for the artificial state under which these birds have long been kept. Mr. Tegetmeier is convinced that a gamecock, though disfigured by being dubbed and with his hackles trimmed, would be accepted as readily as a male retaining all his natural ornaments. Mr. Brent, however, admits that the beauty of the male probably aids in exciting the female; and her acquiescence is necessary. Mr. Hewitt is convinced that the union is by no means left to mere chance, for the female almost invariably prefers the most vigorous, defiant, and mettlesome male; hence it is almost useless, as he remarks, "to attempt true breeding if a game-cock in good health and condition runs the locality, for almost every hen on leaving the roosting-place will resort to the game-cock, even though that bird may not actually drive away the male of her own variety." Under ordinary circumstances the males and females of the fowl seem to come to a mutual understanding by means of

certain gestures, described to me by Mr. Brent. But hens will often avoid the officious attentions of young males. Old hens, and hens of a pugnacious disposition, as the same writer informs me, dislike strange males, and will not yield until well beaten into compliance. Ferguson, however, describes how a quarrelsome hen was subdued by the gentle courtship of a Shanghai cock.*

* Rare and Prize Poultry, 1854, p. 27.

There is reason to believe that pigeons of both sexes prefer pairing with birds of the same breed; and dovecot-pigeons dislike all the highly improved breeds.* Mr. Harrison Weir has lately heard from a trustworthy observer, who keeps blue pigeons, that these drive away all other coloured varieties, such as white, red, and yellow; and from another observer, that a female dun carrier could not, after repeated trials, be matched with a black male, but immediately paired with a dun. Again, Mr. Tegetmeier had a female blue turbit that obstinately refused to pair with two males of the same breed, which were successively shut up with her for weeks; but on being let out she would have immediately accepted the first blue dragon that offered. As she was a valuable bird, she was then shut up for many weeks with a silver (i. e., very pale blue) male, and at last mated with him. Nevertheless, as a general rule, colour appears to have little influence on the pairing of pigeons. Mr. Tegetmeier, at my request, stained some of his birds with magenta, but they were not much noticed by the others.

* Variation of Animals and Plants under Domestication, vol. ii., p. 103.

Female pigeons occasionally feel a strong antipathy towards certain males, without any assignable cause. Thus M.M. Boitard and Corbie, whose experience extended over forty-five years, state: "Quand une femelle eprouve de l'antipathie pour un male avec lequel on veut l'accoupler, malgre tous les feux de l'amour, malgre l'alpiste et le chenevis dont on la nourrit pour augmenter son ardeur malgre un emprisonnement de six mois et meme d'un an, elle refuse constamment ses caresses; les avances empressees, les agaceries, les tournoiemens, les tendres roucoulemens, rien ne peut lui plaire ni l'emouvoir; gonflee, boudeuse, blottie dans un coin de sa prison, elle n'en sort que pour boire et manger, ou pour repousser avec une espece de rage des caresses devenues trop pressantes."* On the other hand, Mr. Harrison Weir has himself observed, and has heard from several breeders, that a female pigeon will occasionally take a strong fancy for a particular male, and will desert her own mate for him. Some females, according to another experienced observer, Riedel,*⁽²⁾ are of a profligate disposition, and prefer almost any stranger to their own mate. Some amorous males, called by our English fanciers "gay birds," are so successful in their gallantries, that, as Mr. H. Weir informs me, they must be shut up on account of the mischief which they cause.

* Boitard and Corbie, Les Pigeons, &c., 1824, p. 12. Prosper Lucas (Traite de l'Heredit. Nat., tom. ii., 1850, p. 296) has himself observed nearly similar facts with pigeons.

*⁽²⁾ Die Taubenzucht, 1824, s. 86.

Wild turkeys in the United States, according to Audubon, "sometimes pay their addresses to the domesticated females, and are generally received by them with great pleasure." So that these females apparently prefer the wild to their own males.*

* Ornithological Biography, vol. i., p. 13. See to the same effect, Dr. Bryant, in Allen's Mammals and Birds of Florida, p. 344.

Here is a more curious case. Sir R. Heron during many years kept an account of the habits of the peafowl, which he bred in large numbers. He states that "the hens have frequently great preference to a particular peafowl. They were all so fond of an old pied cock, that one year, when he was confined, though still in view, they were constantly assembled close to the trellice-walls of his prison, and would not suffer a japanned peacock to touch them. On his being let out in the autumn, the oldest of the hens instantly courted him and was successful in her courtship. The next year he was shut up in a stable, and then the hens all courted his rival."* This rival was a japanned or black-winged peacock, to our eyes a more beautiful bird than the common kind.

* Proceedings, Zoological Society, 1835, p. 54. The japanned peacock is considered by Mr. Sclater as a distinct species, and has been named *Pavo nigri-pennis*; but the evidence seems to me to shew that it is only a variety.

Lichtenstein, who was a good observer and had excellent opportunities of observation at the Cape of Good Hope, assured Rudolphi that the female widow-bird (*Chera progne*) disowns the male when robbed of the long tail-feathers with which he is ornamented during the breeding-season. I presume that this observation must have been made on birds under confinement.* Here is an analogous case; Dr. Jaeger,*⁽²⁾ director of the Zoological Gardens of Vienna, states that a male silver-pheasant, who had been triumphant over all other males and was the accepted lover of the females, had his ornamental plumage spoiled. He was then immediately superseded by a rival, who got the upper hand and afterwards led the flock.

* Rudolphi, *Beitrage zur Anthropologie*, 1812, s. 184.

*⁽²⁾ *Die Darwin'sche Theorie, und ihre Stellung zu Moral und Religion*, 1869, s. 59.

It is a remarkable fact, as shewing how important colour is in the courtship of birds, that Mr. Boardman, a well-known collector and observer of birds for many years in the Northern United States, has never in his large experience seen an albino paired with another bird; yet he has had opportunities of observing many albinos belonging to several species.* It can hardly be maintained that albinos in a state of nature are incapable of breeding, as they can be raised with the greatest facility under confinement. It appears, therefore, that we must attribute the fact that they do not pair to their rejection by their normally coloured comrades.

* This statement is given by Mr. A. Leith Adams, in his *Field and Forest Rambles*, 1873, p. 76, and accords with his own experience.

Female birds not only exert a choice, but in some few cases they court the male, or even fight together for his possession. Sir R. Heron states that with peafowl, the first advances are always made by the female; something of the same kind takes place, according to Audubon, with the older females of the wild turkey. With the capercailzie, the females flit round the male whilst he is parading at one of the places of assemblage, and solicit his attention.* We have seen that a tame wild-duck seduced an unwilling pintail drake after a long courtship. Mr. Bartlett believes that the *Lophophorus*, like many other gallinaceous birds, is naturally polygamous, but two females cannot be placed in the same cage with a male, as they fight so much together. The following instance of rivalry is more surprising as it relates to bullfinches, which usually pair for life. Mr. Jenner Weir introduced a dull-coloured and ugly female into his aviary, and she immediately attacked another mated female so unmercifully that the latter had to be separated. The new female did all the courtship, and was at last successful, for she paired with the

male; but after a time she met with a just retribution, for, ceasing to be pugnacious, she was replaced by the old female, and the male then deserted his new and returned to his old love.

* In regard to peafowl, see Sir R. Heron, Proc. Zoolog. Soc., 1835, p. 54, and the Rev. E. S. Dixon, Ornamental Poultry, 1848, p. 8. For the turkey, Audubon, *ibid.*, p. 4. For the capercaillie, Lloyd, Game Birds of Sweden, 1867, p. 23.

In all ordinary cases the male is so eager that he will accept any female, and does not, as far as we can judge, prefer one to the other; but, as we shall hereafter see, exceptions to this rule apparently occur in some few groups. With domesticated birds, I have heard of only one case of males shewing any preference for certain females, namely, that of the domestic cock, who, according to the high authority of Mr. Hewitt, prefers the younger to the older hens. On the other hand, in effecting hybrid unions between the male pheasant and common hens, Mr. Hewitt is convinced that the pheasant invariably prefers the older birds. He does not appear to be in the least influenced by their colour; but "is most capricious in his attachments":* from some inexplicable cause he shews the most determined aversion to certain hens, which no care on the part of the breeder can overcome. Mr. Hewitt informs me that some hens are quite unattractive even to the males of their own species, so that they may be kept with several cocks during a whole season, and not one egg out of forty or fifty will prove fertile. On the other hand, with the long-tailed duck (*Harelda glacialis*), "it has been remarked," says M. Ekstrom, "that certain females are much more courted than the rest. Frequently, indeed, one sees an individual surrounded by six or eight amorous males." Whether this statement is credible, I know not; but the native sportsmen shoot these females in order to stuff them as decoys.*(2)

* Mr. Hewitt, quoted in Tegetmeier's Poultry Book, 1866, p. 165.

*(2) Quoted in Lloyd's Game Birds of Sweden, p. 345.

With respect to female birds feeling a preference for particular males, we must bear in mind that we can judge of choice being exerted only by analogy. If an inhabitant of another planet were to behold a number of young rustics at a fair courting a pretty girl, and quarrelling about her like birds at one of their places of assemblage, he would, by the eagerness of the wooers to please her and to display their finery, infer that she had the power of choice. Now with birds the evidence stands thus: they have acute powers of observation, and they seem to have some taste for the beautiful both in colour and sound. It is certain that the females occasionally exhibit, from unknown causes, the strongest antipathies and preferences for particular males. When the sexes differ in colour or in other ornaments the males with rare exceptions are the more decorated, either permanently or temporarily during the breeding-season. They sedulously display their various ornaments, exert their voices, and perform strange antics in the presence of the females. Even well-armed males, who, it might be thought, would altogether depend for success on the law of battle, are in most cases highly ornamented; and their ornaments have been acquired at the expense of some loss of power. In other cases ornaments have been acquired, at the cost of increased risk from birds and beasts of prey. With various species many individuals of both sexes congregate at the same spot, and their courtship is a prolonged affair. There is even reason to suspect that the males and females within the same district do not always succeed in pleasing each other and pairing.

What then are we to conclude from these facts and considerations? Does the male parade his charms with so much pomp and rivalry for no purpose? Are we not justified in believing that the female exerts a choice, and that she receives the addresses of the male who pleases

her most? It is not probably she consciously deliberates; but she is most excited or attracted by the most beautiful, or melodious, or gallant males. Nor need it be supposed that the female studies each stripe or spot of colour; that the peahen, for instance, admires each detail in the gorgeous train of the peacock- she is probably struck only by the general effect. Nevertheless, after hearing how carefully the male Argus pheasant displays his elegant primary wing-feathers, and erects his ocellated plumes in the right position for their full effect; or again, how the male goldfinch alternately displays his gold-bespangled wings, we ought not to feel too sure that the female does not attend to each detail of beauty. We can judge, as already remarked, of choice being exerted, only from analogy; and the mental powers of birds do not differ fundamentally from ours. From these various considerations we may conclude that the pairing of birds is not left to chance; but that those males, which are best able by their various charms to please or excite the female, are under ordinary circumstances accepted. If this be admitted, there is not much difficulty in understanding how male birds have gradually acquired their ornamental characters. All animals present individual differences, and as man can modify his domesticated birds by selecting the individuals which appear to him the most beautiful, so the habitual or even occasional preference by the female of the more attractive males would almost certainly lead to their modification; and such modifications might in the course of time be augmented to almost any extent, compatible with the existence of the species.

Variability of Birds, and especially of their Secondary Sexual Characters. - Variability and inheritance are the foundations for the work of selection. That domesticated birds have varied greatly, their variations being inherited, is certain. That birds in a state of nature have been modified into distinct races is now universally admitted.* Variations may be divided into two classes; those which appear to our ignorance to arise spontaneously, and those which are directly related to the surrounding conditions, so that all or nearly all the individuals of the same species are similarly modified. Cases of the latter kind have recently been observed with care by Mr. J. A. Allen,*(2) who shews that in the United States many species of birds gradually become more strongly coloured in proceeding southward, and more lightly coloured in proceeding westward to the arid plains of the interior. Both sexes seem generally to be affected in a like manner, but sometimes one sex more than the other. This result is not incompatible with the belief that the colours of birds are mainly due to the accumulation of successive variations through sexual selection; for even after the sexes have been greatly differentiated, climate might produce an equal effect on both sexes, or a greater effect on one sex than on the other, owing to some constitutional difference.

* According to Dr. Blasius (*Ibis*, vol. ii., 1860, p. 297), there are 425 indubitable species of birds which breed in Europe, besides sixty forms, which are frequently regarded as distinct species. Of the latter, Blasius thinks that only ten are really doubtful, and that the other fifty ought to be united with their nearest allies; but this shews that there must be a considerable amount of variation with some of our European birds. It is also an unsettled point with naturalists, whether several North American birds ought to be ranked as specifically distinct from the corresponding European species. So again many North American forms which until lately were named as distinct species, are now considered to be local races.

*(2) *Mammals and Birds of East Florida*, also an *Ornithological Reconnaissance of Kansas*, &c. Notwithstanding the influence of climate on the colours birds, it is difficult to account for the dull or dark tints of almost all the species inhabiting certain countries, for instance, the Galapagos Islands under the equator, the wide temperate plains of Patagonia, and, as it appears, Egypt (see Mr. Hartshorne in the *American Naturalist*, 1873, p. 747). These

countries are open, and afford little shelter to birds; but it seems doubtful whether the absence of brightly coloured species can be explained on the principle of protection, for on the Pampas, which are equally open, though covered by green grass, and where the birds would be equally exposed to danger, many brilliant and conspicuously coloured species are common. I have sometimes speculated whether the prevailing dull tints of the scenery in the above-named countries may not have affected the appreciation of bright colours by the birds inhabiting them.

Individual differences between the members of the same species are admitted by every one to occur under a state of nature. Sudden and strongly marked variations are rare; it is also doubtful whether if beneficial they would often be preserved through selection and transmitted to succeeding generations.* Nevertheless, it may be worth while to give the few cases which I have been able to collect, relating chiefly to colour, - simple albinism and melanism being excluded. Mr. Gould is well known to admit the existence of few varieties, for he esteems very slight differences as specific; yet he states*(2) that near Bogota certain humming-birds belonging to the genus *Cyananthus* are divided into two or three races or varieties, which differ from each other in the colouring of the tail - "some having the whole of the feathers blue, while others have the eight central ones tipped with beautiful green." It does not appear that intermediate gradations have been observed in this or the following cases. In the males alone of one of the Australian parrakeets "the thighs in some are scarlet, in others grass-green." In another parrakeet of the same country "some individuals have the band across the wing-coverts bright-yellow, while in others the same part is tinged with red."*(3) In the United States some few of the males of the scarlet tanager (*Tanagra rubra*) have "a beautiful transverse band of glowing red on the smaller wing-coverts";*(4) but this variation seems to be somewhat rare, so that its preservation through sexual selection would follow only under usually favourable circumstances. In Bengal the honey buzzard (*Pernis cristata*) has either a small rudimental crest on its head, or none at all: so slight a difference, however, would not have been worth notice, had not this same species possessed in southern India a well-marked occipital crest formed of several graduated feathers."*(5)

* I had always perceived (Origin of Species) that rare and strongly-marked deviations of structure, deserving to be called monstrosities, could seldom be preserved through natural selection, and that the preservation of even highly-beneficial variations would depend to a certain extent on chance. I had also fully appreciated the importance of mere individual differences, and this led me to insist so strongly on the importance of that unconscious form of selection by man, which follows from the preservation of the most valued individuals of each breed, without any intention on his part to modify the characters of the breed. But until I read an able article in the North British Review (March 1867, p. 289, et seq.), which has been of more use to me than any other Review, I did not see how great the chances were against the preservation of variations, whether slight or strongly pronounced, occurring only in single individuals.

*(2) Introduction to the Trochilidae, p. 102.

*(3) Gould, Handbook of Birds of Australia, vol. ii., pp. 32 and 68.

*(4) Audubon, Ornithological Biography, 1838, vol. iv., p. 389.

*(5) Jerdon, Birds of India, vol. i., p. 108; and Mr. Blyth, in Land and Water, 1868, p. 381.

The following case is in some respects more interesting. A pied variety of the raven, with the head, breast, abdomen, and parts of the wings and tail-feathers white, is confined to the Feroe Islands. It is not very rare there, for Graba saw during his visit from eight to ten living specimens. Although the characters of this variety are

not quite constant, yet it has been named by several distinguished ornithologists as a distinct species. The fact of the pied birds being pursued and persecuted with much clamour by the other ravens of the island was the chief cause which led Brunnich to conclude that they were specifically distinct; but this is now known to be an error.* This case seems analogous to that lately given of albino birds not pairing from being rejected by their comrades.

* Graba, Tagebuch Reise nach Faro, 1830, ss. 51-54. Macgillivray, History of British Birds, vol. iii., p. 745. Ibis, vol. v., 1863, p. 469.

In various parts of the northern seas a remarkable variety of the common guillemot (*Uria troile*) is found; and in Ferroe, one out of every five birds, according to Graba's estimation, presents this variation. It is characterised* by a pure white ring round the eye, with a curved narrow white line, an inch and a half in length, extending back from the ring. This conspicuous character has caused the bird to be ranked by several ornithologists as a distinct species under the name of *U. lacrymans*, but it is now known to be merely a variety. It often pairs with the common kind, yet intermediate gradations have never been seen; nor is this surprising, for variations which appear suddenly, are often, as I have elsewhere shewn,* (2) transmitted either unaltered or not at all. We thus see that two distinct forms of the same species may co-exist in the same district, and we cannot doubt that if the one had possessed any advantage over the other, it would soon have been multiplied to the exclusion of the latter. If, for instance, the male pied ravens, instead of being persecuted by their comrades, had been highly attractive (like the above pied peacock) to the black female ravens their numbers would have rapidly increased. And this would have been a case of sexual selection.

* Graba, *ibid.*, s. 54. Macgillivray, *ibid.*, vol. v., p. 327.

* (2) Variation of Animals and Plants under Domestication, vol. ii., p. 92.

With respect to the slight individual differences which are common, in a greater or less degree, to all the members of the same species, we have every reason to believe that they are by far the most important for the work of selection. Secondary sexual characters are eminently liable to vary, both with animals in a state of nature and under domestication.* There is also reason to believe, as we have seen in our eighth chapter, that variations are more apt to occur in the male than in the female sex. All these contingencies are highly favourable for sexual selection. Whether characters thus acquired are transmitted to one sex or to both sexes, depends, as we shall see in the following chapter, on the form of inheritance which prevails.

* On these points see also Variation of Animals and Plants under Domestication, vol. i., p. 253; vol. ii., pp. 73, 75.

It is sometimes difficult to form an opinion whether certain slight differences between the sexes of birds are simply the result of variability with sexually-limited inheritance, without the aid of sexual selection, or whether they have been augmented through this latter process. I do not here refer to the many instances where the male displays splendid colours or other ornaments, of which the female partakes to a slight degree; for these are almost certainly due to characters primarily acquired by the male having been more or less transferred to the female. But what are we to conclude with respect to certain birds in which, for instance, the eyes differ slightly in colour in the two sexes?* In some cases the eyes differ conspicuously; thus with the storks of the genus *Xenorhynchus*, those of the male

are blackish-hazel, whilst those of the females are gamboge-yellow; with many hornbills (*Buceros*), as I hear from Mr. Blyth,*⁽²⁾ the males have intense crimson eyes, and those of the females are white. In the *Buceros bicornis*, the hind margin of the casque and a stripe on the crest of the beak are black in the male, but not so in the female. Are we to suppose that these black marks and the crimson colour of the eyes have been preserved or augmented through sexual selection in the males? This is very doubtful; for Mr. Bartlett shewed me in the Zoological Gardens that the inside of the mouth of this *Buceros* is black in the male and flesh-coloured in the female; and their external appearance or beauty would not be thus affected. I observed in Chile*⁽³⁾ that the iris in the condor, when about a year old, is dark-brown, but changes at maturity into yellowish-brown in the male, and into bright red in the female. The male has also a small, longitudinal, leaden-coloured, fleshy crest or comb. The comb of many gallinaceous birds is highly ornamental, and assumes vivid colours during the act of courtship; but what are we to think of the dull-coloured comb of the condor, which does not appear to us in the least ornamental? The same question may be asked in regard to various other characters, such as the knob on the base of the beak of the Chinese goose (*Anser cygnoides*), which is much larger in the male than in the female. No certain answer can be given to these questions; but we ought to be cautious in assuming that knobs and various fleshy appendages cannot be attractive to the female, when we remember that with savage races of man various hideous deformities—deep scars on the face with the flesh raised into protuberances, the septum of the nose pierced by sticks or bones, holes in the ears and lips stretched widely open— are all admired as ornamental.

* See, for instance, on the irides of a *Podica* and *Gallicrex* in *Ibis*, vol. ii., 1860, p. 206; and vol. V., 1863, p. 426.

*⁽²⁾ See also Jerdon, *Birds of India*, vol. i., pp. 243-245

*⁽³⁾ *Zoology of the Voyage of H. M. S. Beagle*, 1841, p. 6.

Whether or not unimportant differences between the sexes, such as those just specified, have been preserved through sexual selection, these differences, as well as all others, must primarily depend on the laws of variation. On the principle of correlated development, the plumage often varies on different parts of the body, or over the whole body, in the same manner. We see this well illustrated in certain breeds of the fowl. In all the breeds the feathers on the neck and loins of the males are elongated, and are called hackles; now when both sexes acquire a top-knot, which is a new character in the genus, the feathers on the head of the male become hackle-shaped, evidently on the principle of correlation; whilst those on the head of the female are of the ordinary shape. The colour also of the hackles forming the top-knot of the male, is often correlated with that of the hackles on the neck and loins, as may be seen by comparing these feathers in the golden and silver-spangled Polish, the Houdans, and Creve-coeur breeds. In some natural species we may observe exactly the same correlation in the colours of these same feathers, as in the males of the splendid gold and Amherst pheasants.

The structure of each individual feather, generally causes any change in its colouring to be symmetrical; we see this in the various laced, spangled, and pencilled breeds of the fowl; and on the principle of correlation the feathers over the whole body are often coloured in the same manner. We are thus enabled without much trouble to rear breeds with their plumage marked almost as symmetrically as in natural species. In laced and spangled fowls the coloured margins of the feathers are abruptly defined; but in a mongrel raised by me from a black Spanish cock glossed with green, and a white game-hen, all the feathers were greenish-black, excepting towards their extremities, which were yellowish-white; but between the white extremities and the black bases, there was on each feather a symmetrical, curved zone of dark-brown. In some instances the shaft of

the feather determines the distribution of the tints; thus with the body-feathers of a mongrel from the same black Spanish cock and a silver-spangled Polish hen, the shaft, together with a narrow space on each side, was greenish-black, and this was surrounded by a regular zone of dark-brown, edged with brownish-white. In these cases we have feathers symmetrically shaded, like those which give so much elegance to the plumage of many natural species. I have also noticed a variety of the common pigeon with the wing-bars symmetrically zoned with three bright shades, instead of being simply black on a slaty-blue ground, as in the parent-species.

In many groups of birds the plumage is differently coloured in the several species, yet certain spots, marks, or stripes are retained by all. Analogous cases occur with the breeds of the pigeon, which usually retain the two wing-bars, though they may be coloured red, yellow, white, black, or blue, the rest of the plumage being of some wholly different tint. Here is a more curious case, in which certain marks are retained, though coloured in a manner almost exactly the opposite of what is natural; the aboriginal pigeon has a blue tail, with the terminal halves of the outer webs of the two outer tail feathers white; now there is a sub-variety having a white instead of a blue tail, with precisely that part black which is white in the parent-species.*

* Bechstein, Naturgeschichte Deutschlands, B. iv., 1795, s. 31, on a sub-variety of the monck pigeon.

Formation and Variability of the Ocelli or eye-like Spots on the Plumage of Birds.- As no ornaments are more beautiful than the ocelli on the feathers of various birds, on the hairy coats of some mammals, on the scales of reptiles and fishes, on the skin of amphibians, on the wings of many Lepidoptera and other insects, they deserve to be especially noticed. An ocellus consists of a spot within a ring of another colour, like the pupil within the iris, but the central spot is often surrounded by additional concentric zones. The ocelli on the tail-coverts of the peacock offer a familiar example, as well as those on the wings of the peacock-butterfly (*Vanessa*). Mr. Trimen has given me a description of a S. African moth (*Gynanisa isis*), allied to our emperor moth, in which a magnificent ocellus occupies nearly the whole surface of each hinder wing; it consists of a black centre, including a semi-transparent crescent-shaped mark, surrounded by successive, ochre-yellow, black, ochre-yellow, pink, white, pink, brown, and whitish zones. Although we do not know the steps by which these wonderfully beautiful and complex ornaments have been developed, the process has probably been a simple one, at least with insects; for, as Mr. Trimen writes to me, "no characters of mere marking or colouration are so unstable in the Lepidoptera as the ocelli, both in number and size." Mr. Wallace, who first called my attention to this subject, shewed me a series of specimens of our common meadow-brown butterfly (*Hipparchia janira*) exhibiting numerous gradations from a simple minute black spot to an elegantly-shaded ocellus. In a S. African butterfly (*Cyllo leda*, Linn.), belonging to the same family, the ocelli are even still more variable. In some specimens (see A, fig. 53) large spaces on the upper surface of the wings are coloured black, and include irregular white marks; and from this state a complete gradation can be traced into a tolerably perfect ocellus (A1), and this results from the contraction of the irregular blotches of colour. In another series of specimens a gradation can be followed from excessively minute white dots, surrounded by a scarcely visible black line (B), into perfectly symmetrical and large ocelli (B1).* In cases like these, the development of a perfect ocellus does not require a long course of variation and selection.

* This woodcut has been engraved from a beautiful drawing, most kindly made for me by Mr. Trimen; see also his description of the

wonderful amount of variation in the coloration and shape of the wings this butterfly, in his *Rhopalocera Africae, Australis*, p. 186.

With birds and many other animals, it seems to follow from the comparison of allied species that circular spots are often generated by the breaking up and contraction of stripes. In the tragopan pheasant faint white lines in the female represent the beautiful white spots in the male;* and something of the same kind may be observed in the two sexes of the Argus pheasant. However this may be, appearances strongly favour the belief that on the one hand, a dark spot is often formed by the colouring matter being drawn towards a central point from a surrounding zone, which latter is thus rendered lighter; and, on the other hand, that a white spot is often formed by the colour being driven away from a central point, so that it accumulates in a surrounding darker zone. In either case an ocellus is the result. The colouring matter seems to be a nearly constant quantity, but is redistributed, either centripetally or centrifugally. The feathers of the common guinea-fowl offer a good instance of white spots surrounded by darker zones; and wherever the white spots are large and stand near each other, the surrounding dark zones become confluent. In the same wing-feather of the Argus pheasant dark spots may be seen surrounded by a pale zone, and white spots by a dark zone. Thus the formation of an ocellus in its most elementary state appears to be a simple affair. By what further steps the more complex ocelli, which are surrounded by many successive zones of colour, have been generated, I will not pretend to say. But the zoned feathers of the mongrels from differently coloured fowls, and the extraordinary variability of the ocelli on many Lepidoptera, lead us to conclude that their formation is not a complex process, but depends on some slight and graduated change in the nature of the adjoining tissues.

* Jerdon, *Birds of India*, vol. iii., p. 517.

Gradation of Secondary Sexual Characters.- Cases of gradation are important, as shewing us that highly complex ornaments may be acquired by small successive steps. In order to discover the actual steps by which the male of any existing bird has acquired his magnificent colours or other ornaments, we ought to behold the long line of his extinct progenitors; but this is obviously impossible. We may, however, generally gain a clue by comparing all the species of the same group, if it be a large one; for some of them will probably retain, at least partially, traces of their former characters. Instead of entering on tedious details respecting various groups, in which striking instances of gradation could be given, it seems the best plan to take one or two strongly marked cases, for instance that of the peacock, in order to see if light can be thrown on the steps by which this bird has become so splendidly decorated. The peacock is chiefly remarkable from the extraordinary length of his tail-coverts; the tail itself not being much elongated. The barbs along nearly the whole length of these feathers stand separate or are decomposed; but this is the case with the feathers of many species, and with some varieties of the domestic fowl and pigeon. The barbs coalesce towards the extremity of the shaft forming the oval disc or ocellus, which is certainly one of the most beautiful objects in the world. It consists of an iridescent, intensely blue, indented centre, surrounded by a rich green zone, this by a broad coppery-brown zone, and this by five other narrow zones of slightly different iridescent shades. A trifling character in the disc deserves notice; the barbs, for a space along one of the concentric zones are more or less destitute of their barbules, so that a part of the disc is surrounded by an almost transparent zone, which gives it a highly finished aspect. But I have elsewhere described* an exactly analogous variation in the hackles of a sub-variety of the game-cock, in which the tips, having a metallic lustre, "are separated

From the lower part of the feather by a symmetrically shaped transparent zone, composed of the naked portions of the barbs." The lower margin or base of the dark-blue centre of the ocellus is deeply indented on the line of the shaft. The surrounding zones likewise shew traces, as may be seen in the drawing (see fig. 54), of indentations, or rather breaks. These indentations are common to the Indian and Javan peacocks (*Pavo cristatus* and *P. muticus*); and they seem to deserve particular attention, as probably connected with the development of the ocellus; but for a long time I could not conjecture their meaning.

* Variation of Animals and Plants under Domestication, vol. i., p. 254.

If we admit the principle of gradual evolution, there must formerly have existed many species which presented every successive step between the wonderfully elongated tail-coverts of the peacock and the short tail-coverts of all ordinary birds; and again between the magnificent ocelli of the former, and the simpler ocelli or mere coloured spots on other birds; and so with all the other characters of the peacock. Let us look to the allied Gallinaceae for any still-existing gradations. The species and sub-species of *Polyplectron* inhabit countries adjacent to the native land of the peacock; and they so far resemble this bird that they are sometimes called peacock-pheasants. I am also informed by Mr. Bartlett that they resemble the peacock in their voice and in some of their habits. During the spring the males, as previously described, strut about before the comparatively plain-coloured females, expanding and erecting their tail and wing-feathers, which are ornamented with numerous ocelli. I request the reader to turn back to the drawing (see fig. 51) of a *Polyplectron*; In *P. napoleonis* the ocelli are confined to the tail, and the back is of a rich metallic blue; in which respects this species approaches the Java peacock *P. hardwickii* possesses a peculiar topknot, which is also somewhat like that of the Java peacock. In all species the ocelli on the wings and tail are either circular or oval, and consist of a beautiful, iridescent, greenish-blue or greenish-purple disc, with a black border. This border in *P. chinquis* shades into brown. edged with cream colour, so that the ocellus is here surrounded with variously shaded, though not bright, concentric zones. The unusual length of the tail-coverts is another remarkable character in *Polyplectron*; for in some of the species they are half, and in others two-thirds as long as the true tail-feathers. The tail-coverts are ocellated as in the peacock. Thus the several species of *Polyplectron* manifestly make a graduated approach to the peacock in the length of their tail-coverts, in the zoning of the ocelli, and in some other characters.

Notwithstanding this approach, the first species of *Polyplectron* which I examined almost made me give up the search; for I found not only that the true tail-feathers, which in the peacock are quite plain, were ornamented with ocelli, but that the ocelli on all the feathers differed fundamentally from those of the peacock, in there being two on the same feather (see fig. 55), one on each side of the shaft.

Hence I concluded that the early progenitors of the peacock could not have resembled a *Polyplectron*. But on continuing my search, I observed that in some of the species the two ocelli stood very near each other; that in the tail-feathers of *P. hardwickii* they touched each other; and, finally, that on the tail-coverts of this same species as well as of *P. malaccense* (see fig. 56) they were actually confluent. As the central part alone is confluent, an indentation is left at both the upper and lower ends; and the surrounding coloured zones are likewise indented. A single ocellus is thus formed on each tail-covert, though still plainly betraying its double origin. These confluent ocelli differ from the single ocelli of the peacock in having an indentation at both ends, instead of only at the lower or

basal end. The explanation, however, of this difference is not difficult; in some species of *Polyplectron* the two oval ocelli on the same feather stand parallel to each other; in other species (as in *P. chinquis*) they converge towards one end; now the partial confluence of two convergent ocelli would manifestly leave a much deeper indentation at the divergent than at the convergent end. It is also manifest that if the convergence were strongly pronounced and the confluence complete, the indentation at the convergent end would tend to disappear.

The tail-feathers in both species of the peacock are entirely destitute of ocelli, and this apparently is related to their being covered up and concealed by the long tail-coverts. In this respect they differ remarkably from the tail-feathers of *Polyplectron*, which in most of the species are ornamented with larger ocelli than those on the tail-coverts. Hence I was led carefully to examine the tail-feathers of the several species, in order to discover whether their ocelli shewed any tendency to disappear; and to my great satisfaction, this appeared to be so. The central tail-feathers of *P. napoleonis* have the two ocelli on each side of the shaft perfectly developed; but the inner ocellus becomes less and less conspicuous on the more exterior tail-feathers, until a mere shadow or rudiment is left on the inner side of the outermost feather. Again, in *P. malaccense*, the ocelli on the tail-coverts are, as we have seen, confluent; and these feathers are of unusual length, being two-thirds of the length of the tail-feathers, so that in both these respects they approach the tail-coverts of the peacock. Now in *P. malaccense*, the two central tail-feathers alone are ornamented, each with two brightly-coloured ocelli, the inner ocellus having completely disappeared from all the other tail-feathers. Consequently the tail-coverts and tail-feathers of this species of *Polyplectron* make a near approach in structure and ornamentation to the corresponding feathers of the peacock.

As far, then, as gradation throws light on the steps by which the magnificent train of the peacock has been acquired, hardly anything more is needed. If we picture to ourselves a progenitor of the peacock in an almost exactly intermediate condition between the existing peacock, with his enormously elongated tail-coverts, ornamented with single ocelli, and an ordinary gallinaceous bird with short tail-coverts, merely spotted with some colour, we shall see a bird allied to *Polyplectron*- that is, with tail-coverts, capable of erection and expansion, ornamented with two partially confluent ocelli, and long enough almost to conceal the tail-feathers, the latter having already partially lost their ocelli. The indentation of the central disc and of the surrounding zones of the ocellus, in both species of peacock, speaks plainly in favour of this view, and is otherwise inexplicable. The males of *Polyplectron* are no doubt beautiful birds, but their beauty, when viewed from a little distance, cannot be compared with that of the peacock. Many female progenitors of the peacock must, during a long line of descent, have appreciated this superiority; for they have unconsciously, by the continued preference for the most beautiful males, rendered the peacock the most splendid of living birds.

Argus pheasant.- Another excellent case for investigation is offered by the ocelli on the wing-feathers of the Argus pheasant, which are shaded in so wonderful a manner as to resemble balls lying loose within sockets, and consequently differ from ordinary ocelli. No one, I presume, will attribute the shading, which has excited the admiration of many experienced artists, to chance- to the fortuitous concurrence of atoms of colouring matter. That these ornaments should have been formed through the selection of many successive variations, not one of which was originally intended to produce the ball-and-socket effect, seems as incredible as that one of Raphael's Madonnas should have been formed by the selection of chance daubs of paint made by a long succession of young artists, not one of whom intended at first to draw the human figure. In order to discover how

the ocelli have been developed, we cannot look to a long line of progenitors, nor to many closely-allied forms, for such do not now exist. But fortunately the several feathers on the wing suffice to give us a clue to the problem, and they prove to demonstration that a gradation is at least possible from a mere spot to a finished ball-and-socket ocellus.

The wing-feathers, bearing the ocelli, are covered with dark stripes (see fig. 57) or with rows of dark spots (see fig. 59), each stripe or row of spots running obliquely down the outer side of the shaft to one of the ocelli. The spots are generally elongated in a line transverse to the row in which they stand. They often become confluent either in the line of the row- and then they form a longitudinal stripe- or transversely, that is, with the spots in the adjoining rows, and then they form transverse stripes. A spot sometimes breaks up into smaller spots, which still stand in their proper places.

It will be convenient first to describe a perfect ball-and-socket ocellus. This consists of an intensely black circular ring, surrounding a space shaded so as exactly to resemble a ball. The figure here given has been admirably drawn by Mr. Ford and well engraved, but a woodcut cannot exhibit the exquisite shading of the original. The ring is almost always slightly broken or interrupted (see fig. 57) at a point in the upper half, a little to the right of and above the white shade on the enclosed ball; it is also sometimes broken towards the base on the right hand. These little breaks have an important meaning. The ring is always much thickened, with the edges ill-defined towards the left-hand upper corner, the feather being held erect, in the position in which it is here drawn. Beneath this thickened part there is on the surface of the ball an oblique almost pure-white mark, which shades off downwards into a pale-lead hue, and this into yellowish and brown tints, which insensibly become darker and darker towards the lower part of the ball. It is this shading which gives so admirably the effect of light shining on a convex surface. If one of the balls be examined, it will be seen that the lower part is of a brown tint and is indistinctly separated by a curved oblique line from the upper part which is yellower and more leaden; this curved oblique line runs at right angles to the longer axis of the white patch of light, and indeed of all the shading; but this difference in colour, which cannot of course be shewn in the woodcut, does not in the least interfere with the perfect shading of the ball. It should be particularly observed that each ocellus stands in obvious connection either with a dark stripe, or with a longitudinal row of dark spots for both occur indifferently on the same feather. Thus in fig. 57 (see figure) stripe A runs to ocellus (a); B runs to ocellus (b); stripe C is broken in the upper part, and runs down to the next succeeding ocellus, not represented in the woodcut; D to the next lower one, and so with the stripes E and F. Lastly, the several ocelli are separated from each other by a pale surface bearing irregular black marks.

I will next describe the other extreme of the series, namely, the first trace of an ocellus. The short secondary wing-feather (see fig. 58), nearest to the body, is marked like the other feathers, with oblique, longitudinal, rather irregular, rows of very dark spots. The basal spot, or that nearest the shaft, in the five lower rows (excluding the lowest one) is a little larger than the other spots of the same row, and a little more elongated in a transverse direction. It differs also from the other spots by being bordered on its upper side with some dull fulvous shading. But this spot is not in any way more remarkable than those on the plumage of many birds, and might easily be overlooked. The next higher spot does not differ at all from the upper ones in the same row. The larger basal spots occupy exactly the same relative position on these feathers as do the perfect ocelli on the longer wing-feathers.

By looking to the next two or three succeeding wing-feathers, an absolutely insensible gradation can be traced from one of the last described basal spots, together with the next higher one in the same

row, to a curious ornament, which cannot be called an ocellus, and which I will name, from the want of a better term, an "elliptic ornament." These are shewn in the accompanying figure (see fig. 59). We here see several oblique rows, A, B, C, D, &c. (see the lettered diagram on the right hand), of dark spots of the usual character. Each row of spots runs down to and is connected with one of the elliptic ornaments, in exactly the same manner as each stripe in fig. 57 (see figure) runs down to, and is connected with, one of the ball-and-socket ocelli. Looking to any one row, for instance, B, in fig. 59 (see figure), the lowest mark (b) is thicker and considerably longer than the upper spots, and has its left extremity pointed and curved upwards. This black mark is abruptly bordered on its upper side by a rather broad space of richly shaded tints, beginning with a narrow brown zone, which passes into orange, and this into a pale leaden tint, with the end towards the shaft much paler. These shaded tints together fill up the whole inner space of the elliptic ornament. The mark (b) corresponds in every respect with the basal shaded spot of the simple feather described in the last paragraph (see fig. 58), but is more highly developed and more brightly coloured. Above and to the right of this spot (see b, fig. 59), with its bright shading, there is a long narrow, black mark (c), belonging to the same row, and which is arched a little downwards so as to face (b). This mark is sometimes broken into two portions. It is also narrowly edged on the lower side with a fulvous tint. To the left of and above (c), in the same oblique direction, but always more or less distinct from it, there is another black mark (d). This mark is generally sub-triangular and irregular in shape, but in the one lettered in the diagram it is unusually narrow, elongated, and regular. It apparently consists of a lateral and broken prolongation of the mark (c), together with its confluence with a broken and prolonged part of the next spot above; but I do not feel sure of this. These three marks, b, c, and d, with the intervening bright shades, form together the so-called elliptic ornament. These ornaments placed parallel to the shaft, manifestly correspond in position with the ball-and-socket ocelli. Their extremely elegant appearance cannot be appreciated in the drawing, as the orange and leaden tints, contrasting so well with the black marks, cannot be shewn.

Between one of the elliptic ornaments and a perfect ball-and-socket ocellus, the gradation is so perfect that it is scarcely possible to decide when the latter term ought to be used. The passage from the one into the other is effected by the elongation and greater curvature in opposite directions of the lower black mark (see b, fig. 59), and more especially of the upper one (c), together with the contraction of the elongated sub-triangular or narrow mark (d), so that at last these three marks become confluent, forming an irregular elliptic ring. This ring is gradually rendered more and more circular and regular, increasing at the same time in diameter. I have here given a drawing (see fig. 60) of the natural size of an ocellus not as yet quite perfect. The lower part of the black ring is much more curved than is the lower mark in the elliptic ornament (see b, fig. 59). The upper part of the ring consists of two or three separate portions; and there is only a trace of the thickening of the portion which forms the black mark above the white shade. This white shade itself is not as yet much concentrated; and beneath it the surface is brighter coloured than in a perfect ball-and-socket ocellus. Even in the most perfect ocelli traces of the junction of three or four elongated black marks, by which the ring has been formed, may often be detected. The irregular sub-triangular or narrow mark (see d, fig. 59), manifestly forms, by its contraction and equalisation, the thickened portion of the ring above the white shade on a perfect ball-and-socket ocellus. The lower part of the ring is invariably a little thicker than the other parts (see fig. 57), and this follows from the lower black mark of the elliptic ornament (see b, fig. 59) having originally been thicker than the upper mark (c). Every step can be followed in the process of confluence and

modification; and the blacking which surrounds the ball of the ocellus is unquestionably formed by the union and modification of the three black marks, b, c, d, of the elliptic ornament. The irregular zigzag black marks between the successive ocelli (see again fig. 57) are plainly due to the breaking up of the somewhat more regular but similar marks between the elliptic ornaments.

The successive steps in the shading of the ball-and-socket ocelli can be followed out with equal clearness. The brown, orange, and pale-leadened narrow zones, which border the lower black mark of the elliptic ornament, can be seen gradually to become more and more softened and shaded into each other, with the upper lighter part towards the left-hand corner rendered still lighter, so as to become almost white, and at the same time more contracted. But even in the most perfect ball-and-socket ocelli a slight difference in the tints, though not in the shading, between the upper and lower parts of the ball can be perceived, as before noticed; and the line of separation is oblique, in the same direction as the bright coloured shades of the elliptic ornaments. Thus almost every minute detail in the shape and colouring of the ball-and-socket ocelli can be shewn to follow from gradual changes in the elliptic ornaments; and the development of the latter can be traced by equally small steps from the union of two almost simple spots, the lower one (see fig. 58) having some dull fulvous shading on its upper side.

The extremities of the longer secondary feathers which bear the perfect ball-and-socket ocelli, are peculiarly ornamented (see fig. 61). The oblique longitudinal stripes suddenly cease upwards and become confused; and above this limit the whole upper end of the feather (a) is covered with white dots, surrounded by little black rings, standing on a dark ground. The oblique stripe belonging to the uppermost ocellus (b) is barely represented by a very short irregular black mark with the usual, curved, transverse base. As this stripe is thus abruptly cut off, we can perhaps understand from what has gone before, how it is that the upper thickened part of the ring is here absent; for, as before stated, this thickened part apparently stands in some relation with a broken prolongation from the next higher spot. From the absence of the upper and thickened part of the ring, the uppermost ocellus, though perfect in all other respects, appears as if its top had been obliquely sliced off. It would, I think, perplex any one, who believes that the plumage of the Argus pheasant was created as we now see it, to account for the imperfect condition of the uppermost ocellus. I should add that on the secondary wing-feather farthest from the body all the ocelli are smaller and less perfect than on the other feathers, and have the upper part of the ring deficient, as in the case just mentioned. The imperfection here seems to be connected with the fact that the spots on this feather shew less tendency than usual to become confluent into stripes; they are, on the contrary, often broken up into smaller spots, so that two or three rows run down to the same ocellus.

There still remains another very curious point, first observed by Mr. T. W. Wood,* which deserves attention. In a photograph, given me by Mr. Ward, of a specimen mounted as in the act of display, it may be seen that on the feathers which are held perpendicularly, the white marks on the ocelli, representing light reflected from a convex surface, are at the upper or further end, that is, are directed upwards; and the bird whilst displaying himself on the ground would naturally be illuminated from above. But here comes the curious point; the outer feathers are held almost horizontally, and their ocelli ought likewise to appear as if illuminated from above, and consequently the white marks ought to be placed on the upper sides of the ocelli; and, wonderful as is the fact, they are thus placed! Hence the ocelli on the several feathers, though occupying very different positions with respect to the light, all appear as if illuminated from above, just as an artist would have shaded them. Nevertheless they are not illuminated from strictly the same point as they ought to be; for the white marks on the ocelli of the feathers

which are held almost horizontally, are placed rather too much towards the further end; that is, they are not sufficiently lateral. We have, however, no right to expect absolute perfection in a part rendered ornamental through sexual selection, any more than we have in a part modified through natural selection for real use; for instance, in that wondrous organ the human eye. And we know what Helmholtz, the highest authority in Europe on the subject, has said about the human eye; that if an optician had sold him an instrument so carelessly made, he would have thought himself fully justified in returning it.*(2)

* The Field, May 28, 1870.

*(2) Popular Lectures on Scientific Subjects, Eng. trans., 1873, pp. 219, 227, 269, 390.

We have now seen that a perfect series can be followed, from simple spots to the wonderful ball-and-socket ornaments. Mr. Gould, who kindly gave me some of these feathers, fully agrees with me in the completeness of the gradation. It is obvious that the stages in development exhibited by the feathers on the same bird do not at all necessarily shew us the steps passed through by the extinct progenitors of the species; but they probably give us the clue to the actual steps, and they at least prove to demonstration that a gradation is possible. Bearing in mind how carefully the male Argus pheasant displays his plumes before the female, as well as the many facts rendering it probable that female birds prefer the more attractive males, no one who admits the agency of sexual selection in any case will deny that a simple dark spot with some fulvous shading might be converted, through the approximation and modification of two adjoining spots, together with some slight increase of colour, into one of the so-called elliptic ornaments. These latter ornaments have been shewn to many persons, and all have admitted that they are beautiful, some thinking them even more so than the ball-and-socket ocelli. As the secondary plumes became lengthened through sexual selection, and as the elliptic ornaments increased in diameter, their colours apparently became less bright; and then the ornamentation of the plumes had to be gained by an improvement in the pattern and shading; and this process was carried on until the wonderful ball-and-socket ocelli were finally developed. Thus we can understand- and in no other way as it seems to me- the present condition and origin of the ornaments on the wing-feathers of the Argus pheasant.

From the light afforded by the principle of gradation- from what we know of the laws of variation- from the changes which have taken place in many of our domesticated birds- and, lastly, from the character (as we shall hereafter see more clearly) of the immature plumage of young birds- we can sometimes indicate, with a certain amount of confidence, the probable steps by which the males have acquired their brilliant plumage and various ornaments; yet in many cases we are involved in complete darkness. Mr. Gould several years ago pointed out to me a humming-bird, the *Urostitte benjamini*, remarkable for the curious differences between the sexes. The male, besides a splendid gorget, has greenish-black tail-feathers, with the four central ones tipped with white; in the female, as with most of the allied species, the three outer tail-feathers on each side are tipped with white, so that the male has the four central, whilst the female has the six exterior feathers ornamented with white tips. What makes the case more curious is that, although the colouring of the tail differs remarkably in both sexes of many kinds of humming-birds, Mr. Gould does not know a single species, besides the *Urostitte*, in which the male has the four central feathers tipped with white.

The Duke of Argyll, in commenting on this case,* passes over sexual selection, and asks, "What explanation does the law of

natural selection give of such specific varieties as these?" He answers "none whatever"; and I quite agree with him. But can this be so confidently said of sexual selection? Seeing in how many ways the tail-feathers of humming-birds differ, why should not the four central feathers have varied in this one species alone, so as to have acquired white tips? The variations may have been gradual, or somewhat abrupt as in the case recently given of the humming-birds near Bogota, in which certain individuals alone have the "central tail-feathers tipped with beautiful green." In the female of the *Urosticte* I noticed extremely minute or rudimental white tips to the two outer of the four central black tail-feathers; so that here we have an indication of change of some kind in the plumage of this species. If we grant the possibility of the central tail-feathers of the male varying in whiteness, there is nothing strange in such variations having been sexually selected. The white tips, together with the small white ear-tufts, certainly add, as the Duke of Argyll admits, to the beauty of the male; and whiteness is apparently appreciated by other birds, as may be inferred from such cases as the snow-white male of the bell-bird. The statement made by Sir R. Heron should not be forgotten, namely, that his peahens, when debarred from access to the pied peacock, would not unite with any other male, and during that season produced no offspring. Nor is it strange that variations in the tail-feathers of the *Urosticte* should have been specially selected for the sake of ornament, for the next succeeding genus in the family takes its name of *Metallura* from the splendour of these feathers. We have, moreover, good evidence that humming-birds take especial pains in displaying their tail-feathers; Mr. Belt,*⁽²⁾ after describing the beauty of the *Florisuga mellivora*, says, "I have seen the female sitting on a branch, and two males displaying their charms in front of her. One would shoot up like a rocket, then suddenly expanding the snow-white tail, like an inverted parachute, slowly descend in front of her, turning round gradually to shew off back and front.... The expanded white tail covered more space than all the rest of the bird, and was evidently the grand feature in the performance. Whilst one male was descending, the other would shoot up and come slowly down expanded. The entertainment would end in a fight between the two performers; but whether the most beautiful or the most pugnacious was the accepted suitor, I know not." Mr. Gould, after describing the peculiar plumage of the *Urosticte*, adds, "that ornament and variety is the sole object, I have myself but little doubt."*⁽³⁾ If this be admitted, we can perceive that the males which during former times were decked in the most elegant and novel manner would have gained an advantage, not in the ordinary struggle for life, but in rivalry with other males, and would have left a larger number of offspring to inherit their newly-acquired beauty.

* The Reign of Law, 1867, p. 247.

*⁽²⁾ The Naturalist in Nicaragua, 1874, p. 112.

*⁽³⁾ Introduction to the Trochilidae, 1861, p. 110.