THE DESCENT OF MAN

AND

SELECTION IN RELATION TO SEX

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PART TWO

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CHAPTER XII

SECONDARY SEXUAL CHARACTERS OF FISHES, AMPHIBIANS, AND REPTILES

FISHES: Courtship and battles of the males—Larger size of the females—Males, bright colors and ornamental appendages; other strange characters—Colors and appendages acquired by the males during the breeding season alone—Fishes with both sexes brilliantly colored—Protective colors—The less conspicuous colors of the female cannot be accounted for on the principle of protection—Male fishes building nests, and taking charge of the ova and young. AMPHIBIANS: Differences in structure and color between the sexes—Vocal organs. REPTILES: Chelonians—Crocodiles—Snakes, colors in some cases protective—Lizards, battles of—Ornamental appendages—Strange differences in structure between the sexes—Colors—Sexual differences almost as great as with birds

WE have now arrived at the great sub-kingdom of the Vertebrata, and will commence with the lowest class, that of Fishes. The males of Plagiostomous fishes (sharks, rays) and of Chimæroid fishes are provided with claspers which serve to retain the female, like the various structures possessed by many of the lower animals. Besides the claspers, the males of many rays have clusters of strong sharp spines on their heads, and several rows along "the upper outer surface of their pectoral fins." These are present in the males of some species, which have other parts of their bodies smooth. They are only temporarily developed during the breeding season; and Dr. Günther suspects that they are brought into action as prehensile organs by the doubling inward and downward of the two

sides of the body. It is a remarkable fact that the females and not the males of some species, as of *Raia clavata*, have their backs studded with large hook-formed spines.[1]

The males alone of the capelin (*Mallotus villosus*, one of Salmonidæ) are provided with a ridge of closely set, brush-like scales, by the aid of which two males, one on each side, hold the female, while she runs with great swiftness on the sandy beach, and there deposits her spawn.[2] The widely distinct *Monacanthus scopas* presents a somewhat analogous structure. The male, as Dr. Günther informs me, has a cluster of stiff, straight spines, like those of a comb, on the sides of the tail; and these in a specimen six inches long were nearly one and a half inch in length; the female has in the same place a cluster of bristles, which may be compared with those of a toothbrush. In another species, *M. peronii*, the male has a brush like that possessed by the female of the last species, while the sides of the tail in the female are smooth. In some other species of the same genus the tail can be perceived to be a little roughened in the male and perfectly smooth in the female; and lastly, in others both sexes have smooth sides.

The males of many fish fight for the possession of the females. Thus the male stickleback (*Gasterosteus leiurus*) has been described as "mad with delight" when the female comes out of her hiding-place and surveys the nest which he has made for her. "He darts round her in every direction, then to his accumulated materials for the nest, then back again in an instant; and as she does not advance he endeavors to push her with his snout, and then tries to pull her by the tail and side-spine to the nest."[3] The males are said to be polygamists;[4] they are extraordinarily

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[1] See Yarrell's "History of British Fishes," volume ii., 1836, pp. 417, 425, and 436. Dr. Günther informs me that the spines in *R. clavata* are peculiar to the female.

[2] "The Am. Naturalist," April, 1871, p. 119.

[3] See Mr. R. Warington's interesting articles in "The Annals and Magazine of Natural History," October, 1852, and November, 1855.

[4] Noel Humphreys, "River Gardens," 1857.

bold and pugnacious, while "the females are quite pacific." Their battles are at times desperate; "for these puny combatants fasten tight on each other for several seconds, tumbling over and over again, until their strength appears completely exhausted." With the rough-tailed stickleback (*G. trachurus*) the males while fighting swim round and round each other, biting and endeavoring to pierce each other with their raised lateral spines. The same writer adds,[5] "the bite of these little furies is very severe. They also use their lateral spines with such fatal effect that I have seen one during a battle absolutely rip his opponent quite open, so that he sank to the bottom and died." When a fish is conquered, "his gallant bearing forsakes him; his gay colors fade away; and he hides his disgrace among his peaceable companions, but is for some time the constant object of his conqueror's persecution."

The male salmon is as pugnacious as the little stickleback; and so is the male trout, as I hear from Dr. Gunther. Mr. Shaw saw a violent contest between two male salmon which lasted the whole day; and Mr. R. Buist, Superintendent of Fisheries, informs me that he has often watched from the bridge at Perth the males driving away their rivals, while the females were spawning. The males "are constantly fighting and tearing each other on the spawning-beds, and many so injure each other as to cause the death of numbers, many being seen swimming near the banks of the river in a state of exhaustion, and apparently in a dying state."[6] Mr. Buist informs me that in June, 1868, the keeper of the Stormontfield breeding-ponds visited the northern Tyne and found about 300 dead salmon, all of which with one exception were males; and he was convinced that they had lost their lives by fighting.

The most curious point about the male salmon is that

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[5] Loudon's "Mag. of Nat. History," vol. iii., 1830, p. 331.

[6] "The Field," June 29, 1867. For Mr. Shaw's statement, see "Edinburgh Review," 1843. Another experienced observer (Scrope's "Days of Salmon Fishing," p. 60) remarks that, like the stag, the male would, if he could, keep all other males away.

during the breeding season, besides a slight change in color, "the lower jaw elongates, and a cartilaginous projection turns upward from the point, which, when the jaws are closed, occupies a deep cavity between the intermaxillary

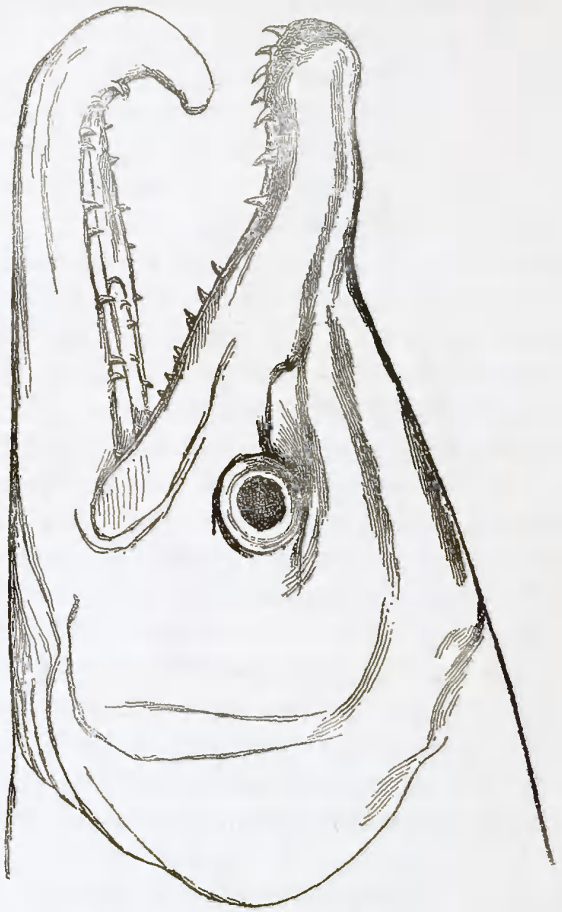

FIG. 27.—Head of male common salmon (*Salmo salar*) during the breeding season.

[This drawing, as well as all the others in the present chapter, have been executed by the well-known artist, Mr. G. Ford, from specimens in the British Museum, under the kind superintendence of Dr. Gunther.]

bones of the upper jaw"[1] (Figs. 27 and 28). In our salmon this change of structure lasts only during the breeding season; but in the *Salmo lycaodon* of N.-W. America the

[1] Yarrell, "History of British Fishes," vol. ii., 1836, p. 10.

change, as Mr. J. K. Lord[8] believes, is permanent, and best marked in the older males which have previously ascended the rivers. In these old males the jaw becomes developed into an immense hook-like projection, and the teeth grow into regular fangs, often more than half an inch in length.

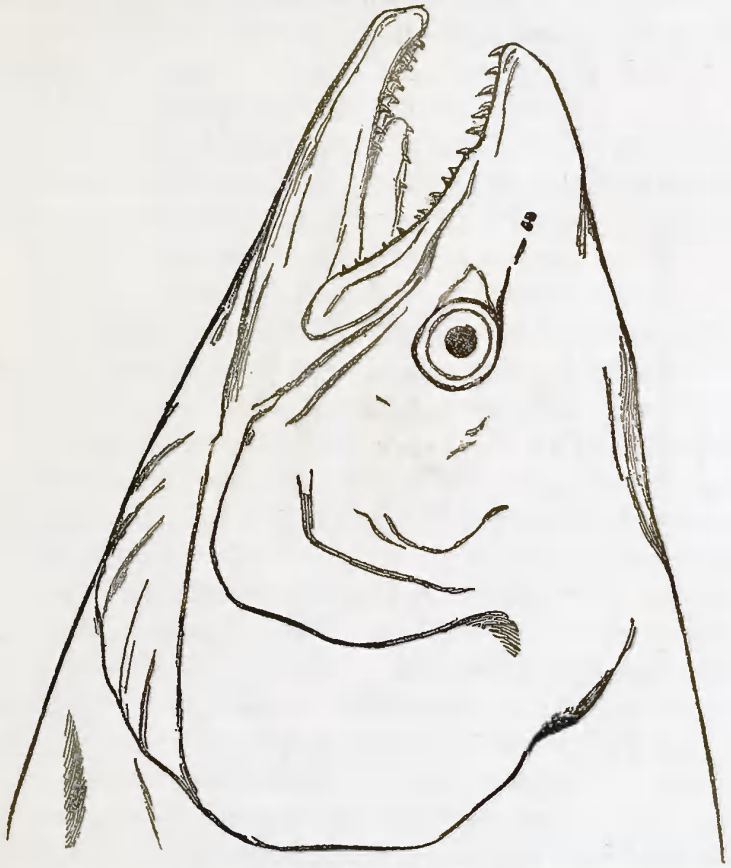

FIG. 28.—Head of female salmon.

With the European salmon, according to Mr. Lloyd,[9] the temporary hook-like structure serves to strengthen and project the jaws, when one male charges another with wonderful violence; but the greatly developed teeth of the male American salmon may be compared with the tusks of many

[8] "The Naturalist in Vancouver's Island," vol. i., 1866, p. 54.
[9] "Scandinavian Adventures," vol. i., 1854, pp. 100, 104.

male mammals, and they indicate an offensive rather than a protective purpose.

The salmon is not the only fish in which the teeth differ in the two sexes, as this is the case with many rays. In the thornback (*Raia clavat*) the adult male has sharp-pointed teeth, directed backward, while those of the female are broad and flat, and form a pavement; so that these teeth differ in the two sexes of the same species more than is usual in distinct genera of the same family. The teeth of the male become sharp only when he is adult: while young they are broad and flat like those of the female. As so frequently occurs with secondary sexual characters, both sexes of some species of rays (for instance *R. batis*), when adult, possess sharp-pointed teeth; and here a character, proper to and primarily gained by the male, appears to have been transmitted to the offspring of both sexes. The teeth are likewise pointed in both sexes of *R. maculata*, but only when quite adult; the males acquiring them at an earlier age than the females. We shall hereafter meet with analogous cases in certain birds, in which the male acquires the plumage common to both sexes when adult, at a somewhat earlier age than does the female. With other species of rays the males, even when old, never possess sharp teeth, and consequently the adults of both sexes are provided with broad, flat teeth like those of the young, and like those of the mature females of the above-mentioned species.[10] As the rays are bold, strong, and voracious fish, we may suspect that the males require their sharp teeth for fighting with their rivals; but as they possess many parts modified and adapted for the prehension of the female, it is possible that their teeth may be used for this purpose.

In regard to size, M. Carbonnier[11] maintains that the female of almost all fishes is larger than the male; and Dr. Gunther does not know of a single instance in which

[10] See Yarrell's account of the rays in his "Hist. of British Fishes," vol. ii., 1836, p. 416, with an excellent figure, and pp. 422, 432.

[11] As quoted in "The Farmer," 1868, p. 369.

the male is actually larger than the female. With some Cyprinodonts the male is not even half as large. As in many kinds of fishes the males habitually fight together, it is surprising that they have not generally become larger and stronger than the females through the effects of sexual selection. The males suffer from their small size, for, according to M. Carbonnier, they are liable to be devoured by the females of their own species when carnivorous, and no doubt by other species. Increased size must be in some manner of more importance to the females than strength and size are to the males for fighting with other males; and this perhaps is to allow of the production of a vast number of ova.

In many species the male alone is ornamented with bright colors; or these are much brighter in the male than in the female. The male, also, is sometimes provided with appendages which appear to be of no more use to him for the ordinary purposes of life than are the tail feathers to the peacock. I am indebted for most of the following facts to the kindness of Dr. Günther. There is reason to suspect that many tropical fishes differ sexually in color and structure; and there are some striking cases with our British fishes. The male *Callionymus lyra* has been called the *gemmeous dragonet* "from its brilliant, gem-like colors." When fresh caught from the sea the body is yellow of various shades, striped and spotted with vivid blue on the head; the dorsal fins are pale brown with dark longitudinal bands; the ventral, caudal and anal fins being bluish black. The female, or sordid dragonet, was considered by Linnæus, and by many subsequent naturalists, as a distinct species; it is of a dingy reddish brown, with the dorsal fin brown and the other fins white. The sexes differ also in the proportional size of the head and mouth, and in the position of the eye;[12] but the most striking difference is the extraordinary elongation in the male (Fig. 29) of the dorsal fin. Mr. W.

[12] I have drawn up this description from Yarrell's "British Fishes," vol. i., 1836, pp. 261 and 266.

Saville Kent remarks that this "singular appendage appears, from my observations of the species in confinement, to be subservient to the same end as the wattles, crests, and other abnormal adjuncts of the male in gallinaceous birds, for the purpose of fascinating their mates." [13] The young males resemble the adult females in structure and color. Through-

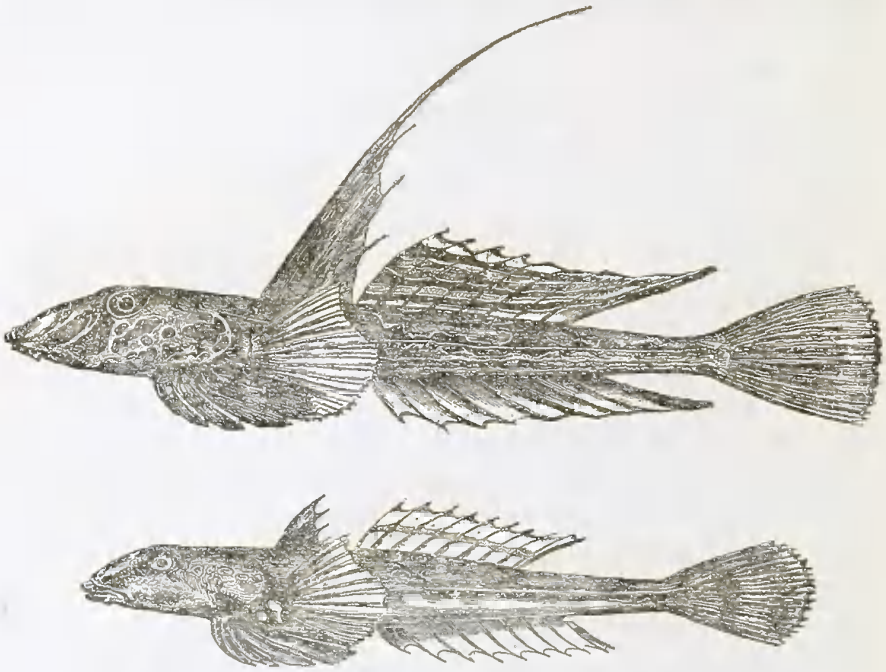

Fig. 29.—Callionymus lyra. Upper figure, male; lower figure, female.
N.B.—The lower figure is more reduced than the upper.

out the genus Callionymus,[14] the male is generally much more brightly spotted than the female, and in several species not only the dorsal but the anal fin is much elongated in the males.

The male of the *Cottus scorpius*, or sea-scorpion, is slenderer and smaller than the female. There is also a great difference in color between them. It is difficult, as Mr.

[13] "Nature," July, 1873, p. 264.

[14] "Catalogue of Acanth. Fishes in the British Museum," by Dr. Günther, 1861, pp. 138–151.

Lloyd[15] remarks, "for any one who has not seen this fish during the spawning season, when its hues are brightest, to conceive the admixture of brilliant colors with which it, in other respects so ill-favored, is at that time adorned." Both sexes of the *Labrus mixtus*, although very different in color, are beautiful; the male being orange with bright blue stripes, and the female bright red with some black spots on the back.

In the very distinct family of the Cyprinodontidæ—inhabitants of the fresh waters of foreign lands—the sexes

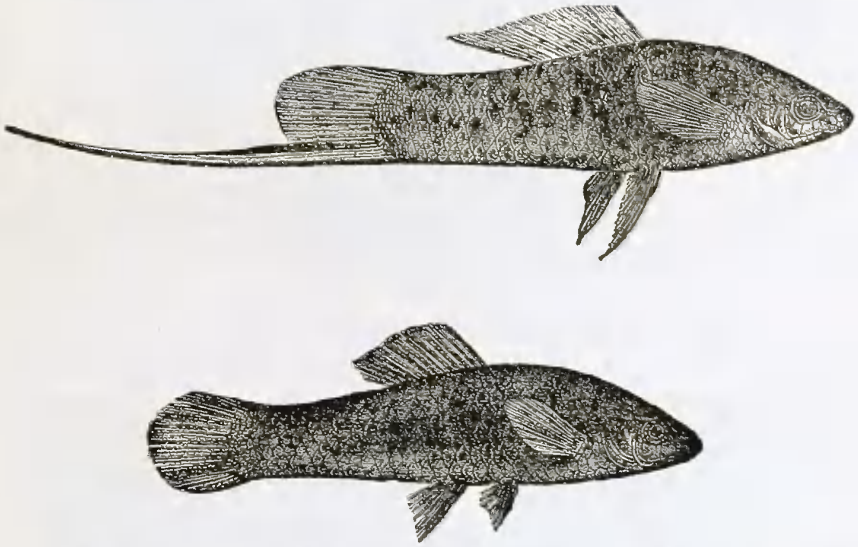

Fig. 30.—Xiphophorus Hellerii. Upper figure, male; lower figure, female.

sometimes differ much in various characters. In the male of the *Mollienesia petenensis*,[16] the dorsal fin is greatly developed and is marked with a row of large, round, ocellated, bright-colored spots; while the same fin in the female is smaller, of a different shape, and marked only with irregularly curved brown spots. In the male, the basal margin

[15] "Game Birds of Sweden," etc., 1871, p. 466.

[16] With respect to this and the following species I am indebted to Dr. Günther for information: see also his paper on the "Fishes of Central America," in "Transact. Zoolog. Soc.," vol. vi., 1868, p. 485.

of the anal fin is also a little produced and dark colored. In the male of an allied form, the *Xiphophorus Hellerii* (Fig. 30), the inferior margin of the caudal fin is developed into a long filament, which, as I hear from Dr. Günther, is striped with bright colors. This filament does not contain any muscles, and apparently cannot be of any direct use to the fish. As in the case of the Callionymus, the males while young resemble the adult females in color and structure. Sexual differences such as these may be strictly compared with those which are so frequent with gallinaceous birds.[17]

In a siluroid fish, inhabiting the fresh waters of South America, the *Plecostomus barbatus*[18] (Fig. 31), the male has its mouth and inter-operculum fringed with a beard of stiff hairs, of which the female shows hardly a trace. These hairs are of the nature of scales. In another species of the same genus, soft flexible tentacles project from the front part of the head of the male, which are absent in the female. These tentacles are prolongations of the true skin, and therefore are not homologous with the stiff hairs of the former species; but it can hardly be doubted that both serve the same purpose. What this purpose may be, it is difficult to conjecture; ornament does not here seem probable, but we can hardly suppose that stiff hairs and flexible filaments can be useful in any ordinary way to the males alone. In that strange monster, the *Chimæra monstrosa*, the male has a hook-shaped bone on the top of the head, directed forward, with its end rounded and covered with sharp spines; in the female "this crown is altogether absent," but what its use may be to the male is utterly unknown.[19]

The structures as yet referred to are permanent in the male after he has arrived at maturity; but with some Blen-

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[17] Dr. Günther makes this remark, "Catalogue of Fishes in the British Museum," vol. iii., 1861, p. 141.

[18] See Dr. Günther on this genus, in "Proc. Zoolog. Soc.," 1868, p. 232.

[19] F. Buckland, in "Land and Water," July, 1868, p. 377, with a figure. Many other cases could be added of structures peculiar to the male, of which the uses are not known.

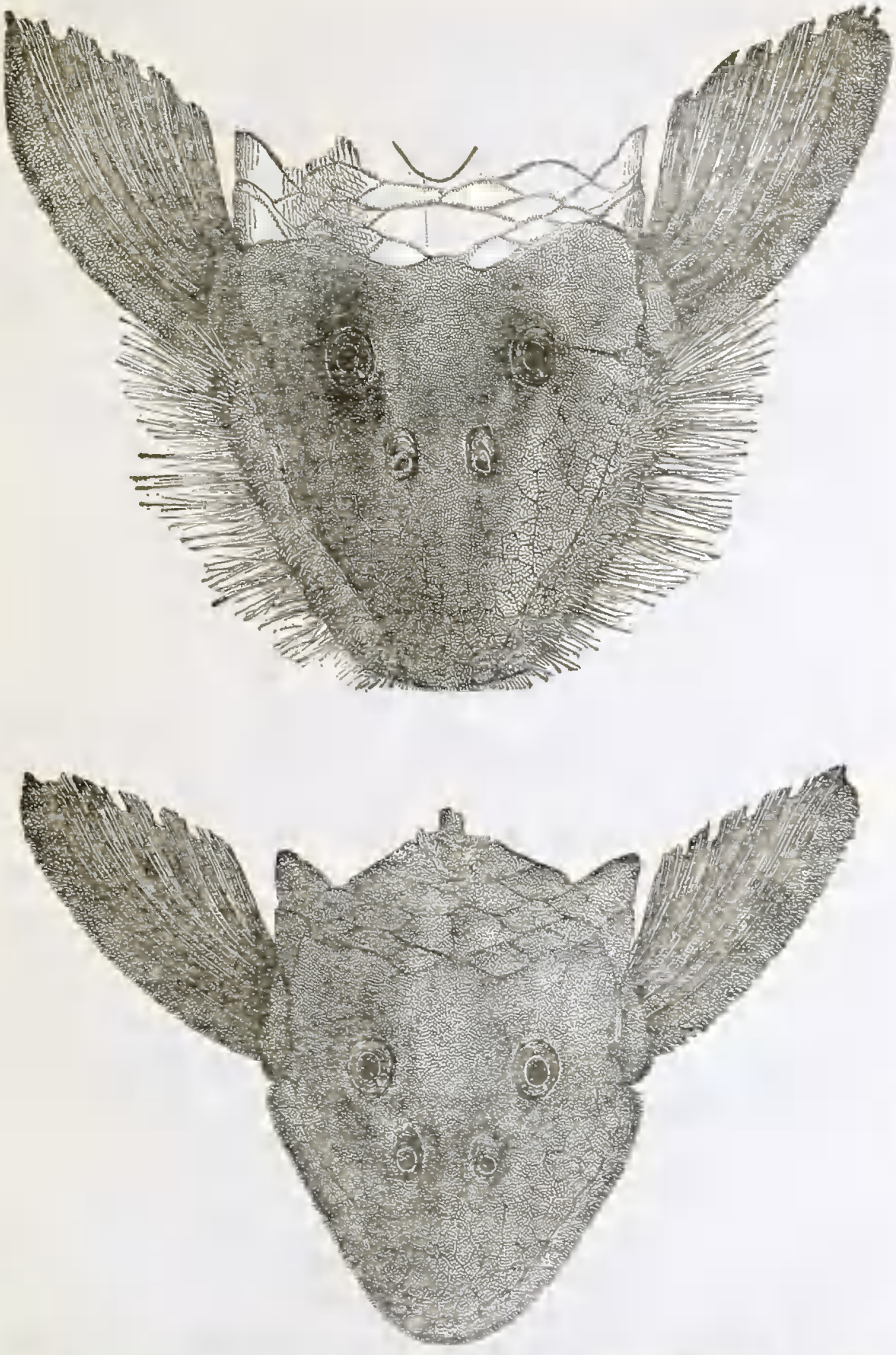

Fig. 31.—Plecostomus barbatus. Upper figure, head of male; lower figure, female.

nies, and in another allied genus,[20] a crest is developed on the head of the male only during the breeding season, and the body at the same time becomes more brightly colored. There can be little doubt that this crest serves as a temporary sexual ornament, for the female does not exhibit a trace of it. In other species of the same genus both sexes possess a crest, and in at least one species neither sex is thus provided. In many of the Chromidæ, for instance in Geophagus and especially in Cichla, the males, as I hear from Prof. Agassiz,[21] have a conspicuous protuberance on the forehead which is wholly wanting in the females and in the young males. Prof. Agassiz adds, "I have often observed these fishes at the time of spawning when the protuberance is largest, and at other seasons when it is totally wanting, and the two sexes show no difference whatever in the outline of the profile of the head. I never could ascertain that it subserves any special function, and the Indians on the Amazon know nothing about its use." These protuberances resemble, in their periodical appearance, the fleshy caruncles of the heads of certain birds; but whether they serve as ornaments must remain at present doubtful.

I hear from Prof. Agassiz and Dr. Gunther, that the males of those fishes which differ permanently in color from the females often become more brilliant during the breeding season. This is likewise the case with a multitude of fishes, the sexes of which are identical in color at all other seasons of the year. The tench, roach, and perch may be given as instances. The male salmon at this season is "marked on the cheeks with orange-colored stripes, which give it the appearance of a Labrus, and the body partakes of a golden orange tinge. The females are dark in color, and are commonly called blackfish." [22] An analogous and even greater change takes place with the *Salmo eriox* or bull trout; the males of the char (*S. umbla*) are likewise at this season

[20] Dr. Günther, "Catalogue of Fishes," vol. iii. pp. 221 and 240.
[21] See also "A Journey in Brazil," by Prof. and Mrs. Agassiz, 1868, p. 220.
[22] Yarrell, "British Fishes," vol. ii., 1836, pp. 10, 12, 35.

rather brighter in color than the females.[23] The colors of the pike (*Esox recticulatus*) of the United States, especially of the male, become, during the breeding season, exceedingly intense, brilliant, and iridescent.[24] Another striking instance out of many is afforded by the male stickleback (*Gasterosteus leiurus*), which is described by Mr. Warington[25] as being then "beautiful beyond description." The back and eyes of the female are simply brown, and the belly white. The eyes of the male, on the other hand, are "of the most splendid green, having a metallic lustre like the green feathers of some humming-birds. The throat and belly are of a bright crimson, the back of an ashy green, and the whole fish appears as though it were somewhat translucent and glowed with an internal incandescence." After the breeding season these colors all change, the throat and belly become of a paler red, the back more green, and the glowing tints subside.

With respect to the courtship of fishes, other cases have been observed, since the first edition of this book appeared, besides that already given of the stickleback. Mr. W. S. Kent says that the male of the *Labrus mixtus*, which, as we have seen, differs in color from the female, makes "a deep hollow in the sand of the tank, and then endeavors, in the most persuasive manner, to induce a female of the same species to share it with him, swimming backward and forward between her and the completed nest, and plainly exhibiting the greatest anxiety for her to follow." The males of *Cantharus lineatus* become, during the breeding season, of deep leaden black; they then retire from the shoal, and excavate a hollow as a nest. "Each male now mounts vigilant guard over his respective hollow, and vigorously attacks and drives away any other fish of the same sex. Toward his companions of the opposite sex his conduct is far different;

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[23] W. Thompson, in "Annals and Mag. of Nat. History," vol. vi., 1841, p. 440.

[24] "The American Agriculturist," 1868, p. 100.

[25] "Annals and Mag. of Nat. Hist.," Oct. 1852.

many of the latter are now distended with spawn, and these he endeavors by all the means in his power to lure singly to his prepared hollow, and there to deposit the myriad ova with which they are laden, which he then protects and guards with the greatest care." [26]

A more striking case of courtship, as well as of display, by the males of a Chinese Macropus, has been given by M. Carbonnier, who carefully observed these fishes under confinement.[27] The males are most beautifully colored, more so than the females. During the breeding season they contend for the possession of the females; and, in the act of courtship, expand their fins, which are spotted and ornamented with brightly-colored rays, in the same manner, according to M. Carbonnier, as the peacock. They then also bound about the females with much vivacity, and appear by "l'étalage de leurs vives couleurs chercher à attirer l'attention des femelles, lesquelles ne paraissaient indifférentes à ce manége, elles nageaient avec une molle lenteur vers les mâles et semblaient se complaire dans leur voisinage." After the male has won his bride, he makes a little disk of froth by blowing air and mucus out of his mouth. He then collects the fertilized ova dropped by the female, in his mouth; and this caused M. Carbonnier much alarm, as he thought that they were going to be devoured. But the male soon deposits them in the disk of froth, afterward guarding them, repairing the froth, and taking care of the young when hatched. I mention these particulars, because, as we shall presently see, there are fishes, the males of which hatch their eggs in their mouths; and those who do not believe in the principle of gradual evolution might ask how could such a habit have originated; but the difficulty is much diminished when we know that there are fishes which thus collect and carry the eggs; for, if delayed by any cause in depositing them, the habit of hatching them in their mouths might have been acquired.

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[26] "Nature," May, 1873, p. 25.

[27] "Bull. de la Soc. d'Acclimat.," Paris, July, 1869, and Jan. 1870.

To return to our more immediate subject. The case stands thus: female fishes, as far as I can learn, never willingly spawn except in the presence of the males; and the males never fertilize the ova except in the presence of the females. The males fight for the possession of the females. In many species, the males while young resemble the females in color; but when adult become much more brilliant, and retain their colors throughout life. In other species the males become brighter than the females and otherwise more highly ornamented, only during the season of love. The males sedulously court the females, and in one case, as we have seen, take pains in displaying their beauty before them. Can it be believed that they would thus act to no purpose during their courtship? And this would be the case unless the females exert some choice and select those males which please or excite them most. If the female exerts such choice, all the above facts on the ornamentation of the males become at once intelligible by the aid of sexual selection.

We have next to inquire whether this view of the bright colors of certain male fishes having been acquired through sexual selection can, through the law of the equal transmission of characters to both sexes, be extended to those groups in which the males and females are brilliant in the same, or nearly the same, degree and manner. In such a genus as Labrus, which includes some of the most splendid fishes in the world—for instance, the Peacock Labrus (*L. pavo*), described,[28] with pardonable exaggeration, as formed of polished scales of gold, incrusting lapis-lazuli, rubies, sapphires, emeralds, and amethysts—we may, with much probability, accept this belief; for we have seen that the sexes in at least one species of the genus differ greatly in color. With some fishes, as with many of the lowest animals, splendid colors may be the direct result of the nature of their tissues and of the surrounding conditions, without the aid of

[28] Bory de Saint Vincent, in "Dict. Class. d'Hist. Nat.," tom. ix., 1826, p. 151.

selection of any kind. The gold-fish (*Cyprinus auratus*), judging from the analogy of the golden variety of the common carp, is perhaps a case in point, as it may owe its splendid colors to a single abrupt variation, due to the conditions to which this fish has been subjected under confinement. It is, however, more probable that these colors have been intensified through artificial selection, as this species has been carefully bred in China from a remote period.[29] Under natural conditions it does not seem probable that beings so highly organized as fishes, and which live under such complex relations, should become brilliantly colored without suffering some evil or receiving some benefit from so great a change, and consequently without the intervention of natural selection.

What, then, are we to conclude in regard to the many fishes both sexes of which are splendidly colored? Mr. Wallace[30] believes that the species which frequent reefs, where corals and other brightly colored organisms abound, are brightly colored in order to escape detection by their enemies; but according to my recollection they were thus rendered highly conspicuous. In the fresh waters of the tropics there are no brilliantly colored corals or other organisms for the fishes to resemble; yet many species in the Amazons are beautifully colored, and many of the carnivorous Cyprinidæ in India are ornamented with "bright longitudinal lines of various tints."[31] Mr. McClelland, in describing these fishes, goes so far as to suppose that "the peculiar brilliancy of their colors" serves as "a better mark

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[29] Owing to some remarks on this subject, made in my work "On the Variation of Animals under Domestication," Mr. W. F. Mayers ("Chinese Notes and Queries," Aug. 1868, p. 123) has searched the ancient Chinese encyclopædias. He finds that gold-fish were first reared in confinement during the Sung Dynasty, which commenced A.D. 960. In the year 1129 these fishes abounded. In another place it is said that since the year 1548 there has been "produced at Hangchow a variety called the fire-fish, from its intensely red color. It is universally admired, and there is not a household where it is not cultivated, *in rivalry as to its color* and as a source of profit."

[30] "Westminster Review," July, 1867, p. 7.

[31] "Indian Cyprinidæ," by Mr. J. McClelland, "Asiatic Researches," vol. xix. part ii., 1839, p. 230.

for kingfishers, terns, and other birds which are destined to keep the number of these fishes in check"; but at the present day few naturalists will admit that any animal has been made conspicuous as an aid to its own destruction. It is possible that certain fishes may have been rendered conspicuous in order to warn birds and beasts of prey that they were unpalatable, as explained when treating of caterpillars; but it is not, I believe, known that any fish, at least any fresh-water fish, is rejected from being distasteful to fish-devouring animals. On the whole, the most probable view, in regard to the fishes of which both sexes are brilliantly colored, is that their colors were acquired by the males as a sexual ornament, and were transferred equally, or nearly so, to the other sex.

We have now to consider whether, when the male differs in a marked manner from the female in color or in other ornaments, he alone has been modified, the variations being inherited by his male offspring alone; or whether the female has been specially modified and rendered inconspicuous for the sake of protection, such modifications being inherited only by the females. It is impossible to doubt that color has been gained by many fishes as a protection: no one can examine the speckled upper surface of a flounder, and overlook its resemblance to the sandy bed of the sea on which it lives. Certain fishes, moreover, can, through the action of the nervous system, change their colors in adaptation to surrounding objects, and that within a short time.[32] One of the most striking instances ever recorded of an animal being protected by its color (as far as it can be judged of in preserved specimens), as well as by its form, is that given by Dr. Gunther[33] of a pipe-fish, which, with its reddish streaming filaments, is hardly distinguishable from the sea-weed to which it clings with its prehensile tail. But the question now under consideration is whether the females alone have been modified for this object. We

[32] G. Pouchet, L'Institut, Nov. 1, 1871, p. 134.

[33] "Proc. Zoolog. Soc.," 1865, p. 327, pl. xiv. and xv.

can see that one sex will not be modified through natural selection for the sake of protection more than the other, supposing both to vary, unless one sex is exposed for a longer period to danger, or has less power of escaping from such danger than the other; and it does not appear that with fishes the sexes differ in these respects. As far as there is any difference, the males, from being generally smaller and from wandering more about, are exposed to greater danger than the females; and yet, when the sexes differ, the males are almost always the more conspicuously colored. The ova are fertilized immediately after being deposited; and when this process lasts for several days, as in the case of the salmon,[34] the female, during the whole time, is attended by the male. After the ova are fertilized they are, in most cases, left unprotected by both parents, so that the males and females, as far as oviposition is concerned, are equally exposed to danger, and both are equally important for the production of fertile ova; consequently the more or less brightly colored individuals of either sex would be equally liable to be destroyed or preserved, and both would have an equal influence on the colors of their offspring.

Certain fishes, belonging to several families, make nests, and some of them take care of their young when hatched. Both sexes of the bright-colored *Crenilabrus massa* and *melops* work together in building their nests with sea-weed, shells, etc.[35] But the males of certain fishes do all the work, and afterward take exclusive charge of the young. This is the case with the dull-colored gobies,[36] in which the sexes are not known to differ in color, and likewise with the sticklebacks (Gasterosteus), in which the males become brilliantly colored during the spawning season. The male of the smooth-tailed stickleback (*G. leiurus*) performs the

[34] Yarrell, "British Fishes," vol. ii. p. 11.

[35] According to the observations of M. Gerbe; see Günther's "Record of Zoolog. Literature," 1865, p. 194.

[36] Cuvier, "Règne Animal," vol. ii., 1829, p. 242.

duties of a nurse with exemplary care and vigilance during a long time, and is continually employed in gently leading back the young to the nest, when they stray too far. He courageously drives away all enemies, including the females of his own species. It would indeed be no small relief to the male, if the female, after depositing her eggs, were immediately devoured by some enemy, for he is forced incessantly to drive her from the nest.[37]

The males of certain other fishes inhabiting South America and Ceylon, belonging to two distinct Orders, have the extraordinary habit of hatching, within their mouths or branchial cavities, the eggs laid by the females.[38] I am informed by Prof. Agassiz that the males of the Amazonian species which follow this habit, "not only are generally brighter than the females, but the difference is greater at the spawning season than at any other time." The species of Geophagus act in the same manner; and in this genus a conspicuous protuberance becomes developed on the forehead of the males during the breeding season. With the various species of Chromids, as Prof. Agassiz likewise informs me, sexual differences in color may be observed, "whether they lay their eggs in the water among aquatic plants or deposit them in holes, leaving them to come out without further care, or build shallow nests in the river mud, over which they sit, as our Pomotis does. It ought also to be observed that these sitters are among the brightest species in their respective families; for instance, Hygrogonous is bright green, with large black ocelli, encircled with the most brilliant red." Whether with all the species of Chromids it is the male alone which sits on the eggs is not known. It is, however, manifest that the fact of the eggs being protected or unprotected by the

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[37] See Mr. Warington's most interesting description of the habits of the *Gasterosteus leiurus*, in "Annals and Mag. of Nat. Hist.," November, 1855.

[38] Prof. Wyman, in "Proc. Boston Soc. of Nat. Hist.," Sept. 15, 1857. Also Prof. Turner, in "Journal of Anatomy and Phys.," Nov. 1, 1866, p. 78. Dr. Günther has likewise described other cases.

parents has had little or no influence on the differences in color between the sexes. It is further manifest, in all the cases in which the males take exclusive charge of the nests and young, that the destruction of the brighter-colored males would be far more influential on the character of the race than the destruction of the brighter-colored females; for the death of the male during the period of incubation or nursing would entail the death of the young, so that they could not inherit his peculiarities; yet, in many of these very cases, the males are more conspicuously colored than the females.

In most of the Lophobranchii (Pipe-fish, Hippocampi, etc.) the males have either marsupial sacs or hemispherical depressions on the abdomen, in which the ova laid by the female are hatched. The males also show great attachment to their young.[39] The sexes do not commonly differ much in color; but Dr. Gunther believes that the male Hippocampi are rather brighter than the females. The genus Solenostoma, however, offers a curious exceptional case,[40] for the female is much more vividly colored and spotted than the male, and she alone has a marsupial sac and hatches the eggs; so that the female of Solenostoma differs from all the other Lophobranchii in this latter respect, and from almost all other fishes, in being more brightly colored than the male. It is improbable that this remarkable double inversion of character in the female should be an accidental coincidence. As the males of several fishes, which take exclusive charge of the eggs and young, are more brightly colored than the females, and as here the female Solenostoma takes the same charge and is brighter than the male, it might be argued that the conspicuous colors of that sex, which is the more important of the two for the welfare of the offspring, must be in some manner protective. But

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[39] Yarrell, "Hist. of British Fishes," vol. ii., 1836, pp. 329, 338.

[40] Dr. Günther, since publishing an account of this species in "The Fishes of Zanzibar," by Col. Playfair, 1866, p. 137, has re-examined the specimens, and has given me the above information.

from the large number of fishes of which the males are either permanently or periodically brighter than the females, but whose life is not at all more important for the welfare of the species than that of the female, this view can hardly be maintained. When we treat of birds we shall meet with analogous cases, where there has been a complete inversion of the usual attributes of the two sexes, and we shall then give what appears to be the probable explanation, namely, that the males have selected the more attractive females, instead of the latter having selected, in accordance with the usual rule throughout the animal kingdom, the more attractive males.

On the whole, we may conclude that, with most fishes in which the sexes differ in color or in other ornamental characters, the males originally varied, with their variations transmitted to the same sex, and accumulated through sexual selection by attracting or exciting the females. In many cases, however, such characters have been transferred, either partially or completely, to the females. In other cases, again, both sexes have been colored alike for the sake of protection; but in no instance does it appear that the female alone has had her colors or other characters specially modified for this latter purpose.

The last point which need be noticed is that fishes are known to make various noises, some of which are described as being musical. Dr. Dufossé, who has especially attended to this subject, says that the sounds are voluntarily produced in several ways by different fishes: by the friction of the pharyngeal bones—by the vibration of certain muscles attached to the swim-bladder, which serves as a resounding board—and by the vibration of the intrinsic muscles of the swim-bladder. By this latter means the Trigla produces pure and long-drawn sounds which range over nearly an octave. But the most interesting case for us is that of two species of Ophidium, in which the males alone are provided with a sound-producing apparatus, consisting of small, movable bones, with proper muscles, in connection with the

swim-bladder.[41] The drumming of the Umbrinas in the European seas is said to be audible from a depth of twenty fathoms; and the fishermen of Rochelle assert "that the males alone make the noise during the spawning time; and that it is possible, by imitating it, to take them without bait."[42] From this statement, and more especially from the case of Ophidium, it is almost certain that in this, the lowest class of the Vertebrata, as with so many insects and spiders, sound-producing instruments have, at least in some cases, been developed through sexual selection, as a means for bringing the sexes together.

AMPHIBIANS

Urodela.—I will begin with the tailed amphibians. The sexes of salamanders or newts often differ much both in

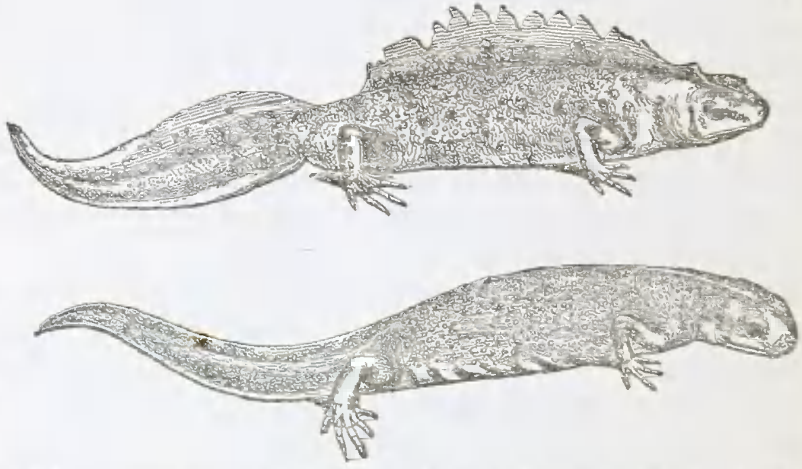

FIG. 32.—Triton cristatus (half natural size, from Bell's "British Reptiles"). Upper figure, male during the breeding season; lower figure, female.

color and structure. In some species prehensile claws are developed on the fore-legs of the males during the breeding

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[41] "Comptes Rendus." Tom. xlvi., 1858, p. 353. Tom. xlvii., 1858, p. 916. Tom. liv., 1862, p. 393. The noise made by the Umbrinas (*Sciæna aquila*) is said by some authors to be more like that of a flute or organ than drumming. Dr. Zouteveen, in the Dutch translation of this work (vol. ii. p. 36), gives some further particulars on the sounds made by fishes.

[42] The Rev. C. Kingsley, in "Nature," May, 1870, p. 40.

season: and at this season in the male *Triton palmipes* the hind feet are provided with a swimming-web, which is almost completely absorbed during the winter; so that their feet then resemble those of the female.[43] This structure no doubt aids the male in his eager search and pursuit of the female. While courting her he rapidly vibrates the end of his tail. With our common newts (*Triton punctatus* and *cristatus*) a deep, much indented crest is developed along the back and tail of the male during the breeding season, which disappears during the winter. Mr. St. George Mivart informs me that it is not furnished with muscles, and therefore cannot be used for locomotion. As during the season of courtship it becomes edged with bright colors, there can hardly be a doubt that it is a masculine ornament. In many species the body presents strongly contrasted, though lurid tints, and these become more vivid during the breeding season. The male, for instance, of our common little newt (*Triton punctatus*) is "brownish gray above, passing into yellow beneath, which in the spring becomes a rich bright orange, marked everywhere with round dark spots." The edge of the crest also is then tipped with bright red or violet. The female is usually of a yellowish brown color with scattered brown dots, and the lower surface is often quite plain.[44] The young are obscurely tinted. The ova are fertilized during the act of deposition, and are not subsequently tended by either parent. We may therefore conclude that the males have acquired their strongly marked colors and ornamental appendages through sexual selection; these being transmitted either to the male offspring alone, or to both sexes.

Anura or *Batrachia*.—With many frogs and toads the colors evidently serve as a protection, such as the bright green tints of tree frogs and the obscure mottled shades of many terrestrial species. The most conspicuously colored

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[43] Bell, "History of British Reptiles," 2d edit., 1849, pp. 156–159.
[44] Ibid., pp. 146, 151.

toad which I ever saw, the *Phryniscus nigricans*,[45] had the whole upper surface of the body as black as ink, with the soles of the feet and parts of the abdomen spotted with the brightest vermilion. It crawled about the bare sandy or open grassy plains of La Plata under a scorching sun, and could not fail to catch the eye of every passing creature. These colors are probably beneficial by making this animal known to all birds of prey as a nauseous mouthful.

In Nicaragua there is a little frog "dressed in a bright livery of red and blue" which does not conceal itself like most other species, but hops about during the daytime, and Mr. Belt says[46] that as soon as he saw its happy sense of security, he felt sure that it was uneatable. After several trials he succeeded in tempting a young duck to snatch up a young one, but it was instantly rejected; and the duck "went about jerking its head, as if trying to throw off some unpleasant taste."

With respect to sexual differences of color, Dr. Gunther does not know of any striking instance either with frogs or toads; yet he can often distinguish the male from the female by the tints of the former being a little more intense. Nor does he know of any striking difference in external structure between the sexes, excepting the prominences which become developed during the breeding season on the front legs of the male, by which he is enabled to hold the female.[47] It is surprising that these animals have not acquired more strongly marked sexual characters; for, though cold-blooded, their passions are strong. Dr. Gunther informs me that he has several times found an unfortunate female toad dead and smothered from having been so closely embraced by three or four males. Frogs have been ob-

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[45] "Zoology of the Voyage of the Beagle," 1843. Bell, ibid., p. 49.

[46] "The Naturalist in Nicaragua," 1874, p. 321.

[47] The male alone of the *Bufo sikimmensis* (Dr. Anderson, "Proc. Zoolog. Soc.," 1871, p. 204) has two plate-like callosities on the thorax and certain rugosities on the fingers, which perhaps subserve the same end as the above-mentioned prominences.

served by Prof. Hoffman in Giessen fighting all day long during the breeding season, and with so much violence that one had its body ripped open.

Frogs and toads offer one interesting sexual difference, namely, in the musical powers possessed by the males; but to speak of music, when applied to the discordant and overwhelming sounds emitted by male bull-frogs and some other species, seems, according to our taste, a singularly inappropriate expression. Nevertheless, certain frogs sing in a decidedly pleasing manner. Near Rio Janeiro I used often to sit in the evening to listen to a number of little Hylæ, perched on blades of grass close to the water, which sent forth sweet chirping notes in harmony. The various sounds are emitted chiefly by the males during the breeding season, as in the case of the croaking of our common frog.[48] In accordance with this fact the vocal organs of the males are more highly developed than those of the females. In some genera the males alone are provided with sacs which open into the larynx.[49] For instance, in the edible frog (*Rana esculenta*) "the sacs are peculiar to the males, and become, when filled with air in the act of croaking, large globular bladders, standing out one on each side of the head, near the corners of the mouth." The croak of the male is thus rendered exceedingly powerful, while that of the female is only a slight groaning noise.[50] In the several genera of the family the vocal organs differ considerably in structure, and their development in all cases may be attributed to sexual selection.

REPTILES

Chelonia.—Tortoises and turtles do not offer well-marked sexual differences. In some species the tail of the male is longer than that of the female. In some the plastron or lower surface of the shell of the male is slightly concave

[48] Bell, "History of British Reptiles," 1849, p. 93.
[49] J. Bishop, in "Todd's Cyclop. of Anat. and Phys.," vol. iv. p. 1503.
[50] Bell, ibid. p. 112–114.

in relation to the back of the female. The male of the mud-turtle of the United States (*Chrysemys picta*) has claws on its front feet twice as long as those of the female; and these are used when the sexes unite.[51] With the huge tortoise of the Galapagos Islands (*Testudo nigra*) the males are said to grow to a larger size than the females: during the pairing season, and at no other time, the male utters a hoarse bellowing noise, which can be heard at the distance of more than a hundred yards; the female, on the other hand, never uses her voice.[52]

With the *Testudo elegans* of India, it is said "that the combats of the males may be heard at some distance, from the noise they produce in butting against each other." [53]

Crocodilia.—The sexes apparently do not differ in color; nor do I know that the males fight together, though this is probable, for some kinds make a prodigious display before the females. Bartram[54] describes the male alligator as striving to win the female by splashing and roaring in the midst of a lagoon, "swollen to an extent ready to burst, with its head and tail lifted up, he spins or twirls round on the surface of the water, like an Indian chief rehearsing his feats of war." During the season of love a musky odor is emitted by the submaxillary glands of the crocodile, and pervades their haunts.[55]

Ophidia.—Dr. Gunther informs me that the males are always smaller than the females, and generally have longer and slenderer tails; but he knows of no other difference in external structure. In regard to color, he can almost always distinguish the male from the female by his more strongly pronounced tints; thus the black zigzag band on the back of the male English viper is more distinctly defined than in the female. The difference is much plainer

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[51] Mr. C. J. Maynard, "The American Naturalist," Dec. 1869, p. 555.

[52] See my "Journal of Researches during the Voyage of the Beagle," 1845, p. 384.

[53] Dr. Günther, "Reptiles of British India," 1864, p. 7.

[54] "Travels through Carolina," etc., 1791, p. 128.

[55] Owen, "Anatomy of Vertebrates," vol. i., 1866, p. 615.

in the rattlesnakes of North America, the male of which, as the keeper in the Zoological Gardens showed me, can at once be distinguished from the female by having more lurid yellow about its whole body. In South Africa the *Bucephalus capensis* presents an analogous difference, for the female "is never so fully variegated with yellow on the sides as the male." [56] The male of the Indian *Dipsas cynodon*, on the other hand, is blackish brown, with the belly partly black, while the female is reddish or yellowish olive, with the belly either uniform yellowish or marbled with black. In the *Tragops dispar* of the same country, the male is bright green, and the female bronze colored.[57] No doubt the colors of some snakes are protective, as shown by the green tints of tree-snakes, and the various mottled shades of the species which live in sandy places; but it is doubtful whether the colors of many kinds, for instance of the common English snake and viper, serve to conceal them; and this is still more doubtful with the many foreign species which are colored with extreme elegance. The colors of certain species are very different in the adult and young states.[58]

During the breeding season the anal scent-glands of snakes are in active function;[59] and so it is with the same glands in lizards, and, as we have seen, with the submaxillary glands of crocodiles. As the males of most animals search for the females, these odoriferous glands probably serve to excite or charm the female, rather than to guide her to the spot where the male may be found. Male snakes, though appearing so sluggish, are amorous; for many have been observed crowding round the same female, and even round her dead body. They are not known to fight together from rivalry. Their intellectual powers are higher than might have been anticipated. In the Zoological Gardens

[56] Sir Andrew Smith, "Zoolog. of S. Africa: Reptilia," 1849, pl. x.
[57] Dr. A. Günther, "Reptiles of British India," Ray Soc., 1864, pp. 304, 308.
[58] Dr. Stoliczka, "Journal of Asiatic Soc. of Bengal," vol. xxxix., 1870, pp. 205, 211.
[59] Owen, "Anatomy of Vertebrates," vol. i., 1866, p. 615.

they soon learn not to strike at the iron bar with which their cages are cleaned; and Dr. Keen of Philadelphia informs me that some snakes which he kept learned after four or five times to avoid a noose with which they were at first easily caught. An excellent observer in Ceylon, Mr. E. Layard, saw[60] a cobra thrust its head through a narrow hole and swallow a toad. "With this encumbrance he could not withdraw himself; finding this, he reluctantly disgorged the precious morsel, which began to move off; this was too much for snake philosophy to bear, and the toad was again seized, and again was the snake, after violent efforts to escape, compelled to part with its prey. This time, however, a lesson had been learned, and the toad was seized by one leg, withdrawn, and then swallowed in triumph."

The keeper in the Zoological Gardens is positive that certain snakes, for instance Crotalus and Python, distinguish him from all other persons. Cobras kept together in the same cage apparently feel some attachment toward each other.[61]

It does not, however, follow, because snakes have some reasoning power, strong passions, and mutual affection, that they should likewise be endowed with sufficient taste to admire brilliant colors in their partners, so as to lead to the adornment of the species through sexual selection. Nevertheless, it is difficult to account in any other manner for the extreme beauty of certain species; for instance, of the coral-snakes of South America, which are of a rich red with black and yellow transverse bands. I well remember how much surprise I felt at the beauty of the first coral-snake which I saw gliding across a path in Brazil. Snakes colored in this peculiar manner, as Mr. Wallace states on the authority of Dr. Gunther,[62] are found nowhere else in the

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[60] "Rambles in Ceylon," in "Annals and Mag. of Nat. Hist.," 2d series, vol. ix., 1852, p. 333.

[61] Dr. Günther, "Reptiles of British India," 1864, p. 340.

[62] "Westminster Rev.," July 1, 1867, p. 32.

world except in South America, and here no less than four genera occur. One of these, Elaps, is venomous, a second and widely distinct genus is doubtfully venomous, and the two others are quite harmless. The species belonging to these distinct genera inhabit the same districts, and are so like each other that no one "but a naturalist would distinguish the harmless from the poisonous kinds." Hence, as Mr. Wallace believes, the innocuous kinds have probably acquired their colors as a protection, on the principle of imitation; for they would naturally be thought dangerous by their enemies. The cause, however, of the bright colors of the venomous Elaps remains to be explained, and this may perhaps be sexual selection.

Snakes produce other sounds besides hissing. The deadly *Echis carinata* has on its sides some oblique rows of scales of a peculiar structure with serrated edges; and when this snake is excited, these scales are rubbed against each other, which produces "a curious prolonged, almost hissing sound." [63] With respect to the rattling of the rattlesnake, we have at last some definite information: for Prof. Aughey states,[64] that on two occasions, being himself unseen, he watched from a little distance a rattlesnake coiled up with head erect, which continued to rattle at short intervals for half an hour: and at last he saw another snake approach, and when they met they paired. Hence he is satisfied that one of the uses of the rattle is to bring the sexes together. Unfortunately he did not ascertain whether it was the male or the female which remained stationary and called for the other. But it by no means follows from the above fact that the rattle may not be of use to these snakes in other ways, as a warning to animals which would otherwise attack them. Nor can I quite disbelieve the several accounts which have appeared of their thus paralyzing their prey with fear. Some other snakes also make a distinct noise by rapidly vibrating their tails against

[63] Dr. Anderson, "Proc. Zoolog. Soc.," 1871, p. 196.
[64] "The American Naturalist," 1873, p. 85.

the surrounding stalks of plants; and I have myself heard this in the case of a Trigonocephalus in South America.

Lacertilia.—The males of some, probably of many, kinds of lizards fight together from rivalry. Thus the arboreal *Anolis cristatellus* of South America is extremely pugnacious: "During the spring and early part of the summer, two adult males rarely meet without a contest. On first seeing one another, they nod their heads up and down three or four times, and at the same time expanding the frill or pouch beneath the throat; their eyes glisten with rage, and after waving their tails from side to side for a few seconds, as if to gather energy, they dart at each other furiously, rolling over and over, and holding firmly with their teeth. The conflict generally ends in one of the combatants losing his tail, which is often devoured by the victor." The male of this species is considerably larger than the female;[65] and this, as far as Dr. Gunther has been able to ascertain, is the general rule with lizards of all kinds. The male alone of the *Cyrtodactylus rubidus* of the Andaman Islands possesses pre-anal pores; and these pores, judging from analogy, probably serve to emit an odor.[66]

The sexes often differ greatly in various external characters. The male of the above-mentioned Anolis is furnished with a crest which runs along the back and tail, and can be erected at pleasure; but of this crest the female does not exhibit a trace. In the Indian *Cophotis ceylanica*, the female has a dorsal crest, though much less developed than in the male; and so it is, as Dr. Gunther informs me, with the females of many Iguanas, Chameleons, and other lizards. In some species, however, the crest is equally developed in both sexes, as in the *Iguana tuberculata*. In the genus Sitana, the males alone are furnished with a large throat-pouch (Fig. 33), which can be folded up like a fan,

[65] Mr. N. L. Austen kept these animals alive for a considerable time; see "Land and Water," July, 1867, p. 9.

[66] Stoliczka, "Journal of Asiatic Soc. of Bengal," vol. xxxiv., 1870, p. 166.

and is colored blue, black, and red; but these splendid colors are exhibited only during the pairing season. The female does not possess even a rudiment of this appendage. In the *Anolis cristatellus*, according to Mr. Austen, the throat-pouch, which is bright red marbled with yellow, is present in the female, though in a rudimental condition. Again, in certain other lizards, both sexes are equally well provided with throat-pouches. Here we see with species belonging to the same group, as in so many previous cases, the same character either confined to the males or more largely developed in them than in the females, or again equally developed in both sexes. The little lizards of the genus Draco, which glide through the air on their rib-supported parachutes, and which in the beauty of their colors baffle description, are furnished with skinny appendages to the throat "like the wattles of gallinaceous birds." These become erected when the animal is excited. They occur in both sexes, but are best developed when the male arrives at maturity, at which age the middle appendage is sometimes twice as long as the head. Most of the species likewise have a low crest running along the neck; and this is much more developed in the full-grown males than in the females or young males.[67]

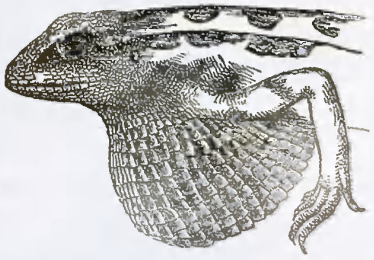

FIG. 33.—Sitana minor. Male with the gular pouch expanded (from Gunther's "Reptiles of India").

A Chinese species is said to live in pairs during the spring; "and if one is caught, the other falls from the tree to the ground, and allows itself to be captured with impunity"—I presume from despair.[68]

There are other and much more remarkable differences between the sexes of certain lizards. The male of *Cerato-*

[67] All the foregoing statements and quotations, in regard to Cophotis, Sitana, and Draco, as well as the following facts in regard to Ceratophora and Chamæleon, are from Dr. Günther himself, or from his magnificent work on the "Reptiles of British India," Ray Soc., 1864, pp. 122, 130, 135.

[68] Mr. Swinhoe, "Proc. Zoolog. Soc., 1870, p. 240.

phora aspera bears on the extremity of his snout an appendage half as long as the head. It is cylindrical, covered with scales, flexible, and apparently capable of erection: in the female it is quite rudimental. In a second species of the same genus a terminal scale forms a minute horn on the summit of the flexible appendage; and in a third species (*C. Stoddartii*, Fig. 34) the whole appendage is converted into a horn, which is usually of a white color, but assumes a purplish tint when the animal is excited. In the adult male of this latter species the horn is half an inch in length, but it is of quite minute size in the female and in the young. These appendages, as Dr. Gunther has remarked to me, may be compared with the combs of gallinaceous birds, and apparently serve as ornaments.

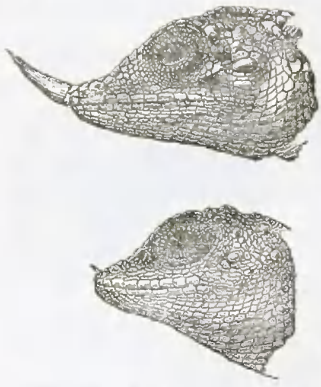

Fig. 34.—Ceratophora Stoddartii. Upper figure, male; lower figure, female.

In the genus Chamæleon we come to the acme of difference between the sexes. The upper part of the skull of the male (*C. bifurcus*, Fig. 35), an inhabitant of Madagascar, is produced into two great, solid, bony projections, covered with scales like the rest of the head; and of this wonderful modification of structure the female exhibits only a rudiment. Again, in *Chamæleon Owenii* (Fig. 36), from the West Coast of Africa, the male bears on his snout and forehead three curious horns, of which the female has not a trace. These horns consist of an excrescence of bone covered with a smooth sheath, forming part of the general integuments of the body, so that they are identical in structure with those of a bull, goat, or other sheath-horned ruminant. Although the three horns differ so much in appearance from the two great prolongations of the skull in *C. bifurcus*, we can hardly doubt that they serve the same general purpose in the economy of these two animals. The first conjecture, which will occur to every one, is that

they are used by the males for fighting together; and, as these animals are very quarrelsome,[69] this is probably a correct view. Mr. T. W. Wood also informs me that he once watched two individuals of *C. pumilus* fighting violently on the branch of a tree; they flung their heads about and tried to bite each other; they then rested for a time, and afterward continued their battle.

With many lizards, the sexes differ slightly in color,

FIG. 35.—Chamæleon bifurcus. Upper figure, male; lower figure, female.

the tints and stripes of the males being brighter and more distinctly defined than in the females. This, for instance, is the case with the above Cophotis and with the *Acanthodactylus capensis* of South Africa. In a Cordylus of the latter country, the male is either much redder or greener than the female. In the Indian *Calotes nigrilabris* there is

[69] Dr. Bucholz, "Monatsbericht K. Preuss. Akad.," Jan. 1874, p. 78.

a still greater difference; the lips also of the male are black, while those of the female are green. In our common little viviparous lizard (*Zootoca vivipara*) "the under side of the body and base of the tail in the male are bright orange, spotted with black; in the female these parts are pale grayish green without spots."[70] We have seen that the males alone of Sitana possess a throat-pouch; and this is splendidly tinted with blue, black, and red. In the *Proctotretus tenuis* of Chile the male alone is marked with spots of blue, green, and coppery red.[71] In many cases the males retain the same colors throughout the year, but in others they become much brighter during the breeding season; I may give as an additional instance the *Calotes maria*, which at this season has a bright red head, the rest of the body being green.[72]

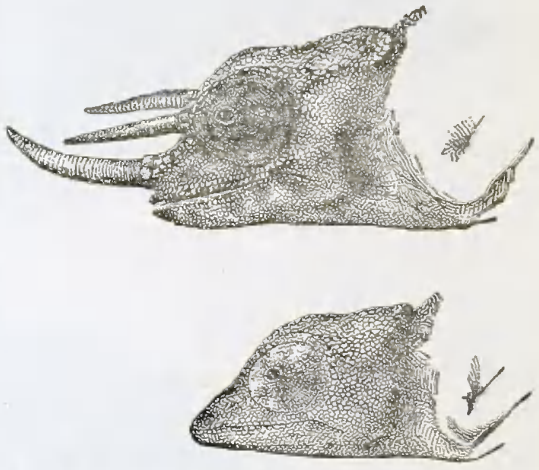

Fig. 36.—Chamæleon Owenii. Upper figure, male; lower figure, female

Both sexes of many species are beautifully colored exactly alike; and there is no reason to suppose that such colors are protective. No doubt with the bright green kinds, which live in the midst of vegetation, this color serves to conceal them, and in North Patagonia I saw a lizard (*Proctotretus multimaculatus*) which, when frightened, flattened its body, closed its eyes, and then from its mottled tints was hardly distinguishable from the surrounding sand.

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[70] Bell, "History of British Reptiles," 2d edit., 1849, p. 40.

[71] For Proctotretus, see "Zoology of the Voyage of the Beagle: Reptiles," by Mr. Bell, p. 8. For the Lizards of S Africa, see "Zoology of S. Africa: Reptiles," by Sir Andrew Smith, pl. 25 and 39. For the Indian Calotes, see "Reptiles of British India," by Dr. Günther, p. 143.

[72] Günther in "Proc. Zoolog. Soc.," 1870, p. 778, with a colored figure.

But the bright colors with which so many lizards are ornamented, as well as their various curious appendages, were probably acquired by the males as an attraction, and then transmitted either to their male offspring alone, or to both sexes. Sexual selection, indeed, seems to have played almost as important a part with reptiles as with birds; and the less conspicuous colors of the females in comparison with the males cannot be accounted for, as Mr. Wallace believes to be the case with birds, by the greater exposure of the females to danger during incubation.

CHAPTER XIII

SECONDARY SEXUAL CHARACTERS OF BIRDS

Sexual differences—Law of battle—Special weapons—Vocal organs—Instrumental music—Love-antics and dances—Decorations, permanent and seasonal—Double and single annual moults—Display of ornaments by the males

SECONDARY sexual characters are more diversified and conspicuous in birds, though not perhaps entailing more important changes of structure, than in any other class of animals. I shall, therefore, treat the subject at considerable length. Male birds sometimes, though rarely, possess special weapons for fighting with each other. They charm the female by vocal or instrumental music of the most varied kinds. They are ornamented by all sorts of combs, wattles, protuberances, horns, air-distended sacs, topknots, naked shafts, plumes and lengthened feathers gracefully springing from all parts of the body. The beak and naked skin about the head, and the feathers, are often gorgeously colored. The males sometimes pay their court by dancing, or by fantastic antics performed either on the ground or in the air. In one instance, at least, the male emits a musky odor, which we may suppose serves to charm or excite the female; for that excellent observer, Mr. Ramsay,[1] says of the Australian musk-duck (*Biziura lobata*) that "the smell which the male emits during the summer months is confined to that sex, and in some individuals is retained throughout the year; I have never, even in the breeding season, shot a female which had any smell of musk." So powerful is this odor during the pairing season, that it can be detected long before the bird can be

[1] "Ibis," vol. iii. (new series), 1867, p. 414.

seen.[2] On the whole, birds appear to be the most æsthetic of all animals, excepting of course man, and they have nearly the same taste for the beautiful as we have. This is shown by our enjoyment of the singing of birds, and by our women, both civilized and savage, decking their heads with borrowed plumes, and using gems which are hardly more brilliantly colored than the naked skin and wattles of certain birds. In man, however, when cultivated, the sense of beauty is manifestly a far more complex feeling, and is associated with various intellectual ideas.

Before treating of the sexual characters with which we are here more particularly concerned, I may just allude to certain differences between the sexes which apparently depend on differences in their habits of life; for such cases, though common in the lower, are rare in the higher, classes. Two humming-birds belonging to the genus Eustephanus, which inhabit the island of Juan Fernandez, were long thought to be specifically distinct, but are now known, as Mr. Gould informs me, to be the male and female of the same species, and they differ slightly in the form of the beak. In another genus of humming-birds (*Grypus*), the beak of the male is serrated along the margin and hooked at the extremity, thus differing much from that of the female. In the Neomorpha of New Zealand, there is, as we have seen, a still wider difference in the form of the beak in relation to the manner of feeding of the two sexes. Something of the same kind has been observed with the goldfinch (*Carduelis elegans*), for I am assured by Mr. J. Jenner Weir that the bird-catchers can distinguish the males by their slightly longer beaks. The flocks of males are often found feeding on the seeds of the teazle (Dipsacus), which they can reach with their elongated beaks, while the females more commonly feed on the seeds of the betony or Scrophularia. With a slight difference of this kind as a foundation, we can see how the beaks of the two sexes

[2] Gould, "Handbook to the Birds of Australia," 1865, vol. ii. p. 383.

might be made to differ greatly through natural selection. In some of the above cases, however, it is possible that the beaks of the males may have been first modified in relation to their contests with other males; and that this afterward led to slightly changed habits of life.

Law of Battle.—Almost all male birds are extremely pugnacious, using their beaks, wings, and legs for fighting together. We see this every spring with our robins and sparrows. The smallest of all birds, namely, the humming-bird, is one of the most quarrelsome. Mr. Gosse[3] describes a battle in which a pair seized hold of each other's beaks, and whirled round and round, till they almost fell to the ground; and M. Montes de Oca, in speaking of another genus of humming-bird, says that two males rarely meet without a fierce aërial encounter: when kept in cages "their fighting has mostly ended in the splitting of the tongue of one of the two, which then surely dies from being unable to feed."[4] With Waders, the males of the common water-hen (*Gallinula chloropus*) "when pairing, fight violently for the females: they stand nearly upright in the water and strike with their feet." Two were seen to be thus engaged for half an hour, until one got hold of the head of the other, which would have been killed had not the observer interfered; the female all the time looking on as a quiet spectator.[5] Mr. Blyth informs me that the males of an allied bird (*Gallicrex cristatus*) are a third larger than the females, and are so pugnacious during the breeding season that they are kept by the natives of Eastern Bengal for the sake of fighting. Various other birds are kept in India for the same purpose; for instance, the bulbuls (*Pycnonotus hæmorrhous*), which "fight with great spirit."[6]

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[3] Quoted by Mr. Gould, "Introduction to the Trochilidæ," 1861, p. 29.

[4] Gould, ibid., p. 52.

[5] W. Thompson, "The Natural History of Ireland: Birds," volume ii., 1850, p. 327.

[6] Jerdon, "Birds of India," 1863, vol. ii. p. 96.

The polygamous ruff (*Machetes pugnax*, Fig. 37) is notorious for his extreme pugnacity; and in the spring, the males, which are considerably larger than the females, congregate day after day at a particular spot, where the females propose to lay their eggs. The fowlers discover these spots by the turf being trampled somewhat bare. Here they fight very much like game-cocks, seizing each other with their beaks and striking with their wings. The great ruff of feathers round the neck is then erected, and, according to Col. Montagu, "sweeps the ground as a shield to defend the more tender parts"; and this is the only instance known to me, in the case of birds, of any structure serving as a shield. The ruff of feathers, however, from its varied and rich colors, probably serves in chief part as an ornament. Like most pugnacious birds, they seem always ready to fight, and when closely confined often kill each other; but Montagu observed that their pugnacity becomes greater during the spring, when the long feathers on their necks are fully developed; and at this period the least movement by any one bird provokes a general battle.[7] Of the pugnacity of web-footed birds, two instances will suffice: in Guiana "bloody fights occur during the breeding season between the males of the wild musk-duck (*Cairina moschata*); and where these fights have occurred the river is covered for some distance with feathers."[8] Birds which seem ill-adapted for fighting engage in fierce conflicts; thus the stronger males of the pelican drive away the weaker ones, snapping with their huge beaks and giving heavy blows with their wings. Male snipe fight together, "tugging and pushing each other with their bills in the most curious manner imaginable." Some few birds are believed never to fight; this is the case, according to Audubon, with one of the woodpeckers of the United States (*Picus auratus*),

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[7] Macgillivray, "Hist. Brit. Birds," vol. iv., 1852, pp. 177–181.

[8] Sir R. Schomburgk, in "Journal of Royal Geographical Society," vol. xiii., 1843, p. 31.

although "the hens are followed by even half a dozen of their gay suitors." [9]

FIG. 37.—The Ruff or Machetes pugnax (from Brehm's "Thierleben").

The males of many birds are larger than the females, and this no doubt is the result of the advantage gained by

[9] "Ornithological Biography," vol. i. p. 191. For pelicans and snipes, see vol. iii. pp. 138, 477

the larger and stronger males over their rivals during many generations. The difference in size between the two sexes is carried to an extreme point in several Australian species; thus the male musk-duck (Biziura) and the male *Cincloramphus cruralis* (allied to our pipits) are by measurement actually twice as large as their respective females.[10] With many other birds the females are larger than the males; and, as formerly remarked, the explanation often given, namely, that the females have most of the work in feeding their young, will not suffice. In some few cases, as we shall hereafter see, the females apparently have acquired their greater size and strength for the sake of conquering other females and obtaining possession of the males.

The males of many gallinaceous birds, especially of the polygamous kinds, are furnished with special weapons for fighting with their rivals, namely, spurs, which can be used with fearful effect. It has been recorded by a trustworthy writer[11] that in Derbyshire a kite struck at a game-hen accompanied by her chickens, when the cock rushed to the rescue, and drove his spur right through the eye and skull of the aggressor. The spur was with difficulty drawn from the skull, and as the kite, though dead, retained his grasp, the two birds were firmly locked together; but the cock when disentangled was very little injured. The invincible courage of the game-cock is notorious: a gentleman who long ago witnessed the brutal scene told me that a bird had both its legs broken by some accident in the cock-pit, and the owner laid a wager that if the legs could be spliced so that the bird could stand upright he would continue fighting. This was effected on the spot, and the bird fought with undaunted courage until he received his death-stroke. In Ceylon a closely allied, wild species, the *Gallus Stanleyi*, is known to fight desperately "in defence of his seraglio,"

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[10] Gould, "Handbook of Birds of Australia," vol. i. p. 395, vol. ii. p. 383.
[11] Mr. Hewitt in the "Poultry Book by Tegetmeier," 1866, p. 137.

so that one of the combatants is frequently found dead.[12] An Indian partridge (*Ortygornis guiaris*), the male of which is furnished with strong and sharp spurs, is so quarrelsome, "that the scars of former fights disfigure the breast of almost every bird you kill."[13]

The males of almost all gallinaceous birds, even those which are not furnished with spurs, engage during the breeding season in fierce conflicts. The Capercailzie and Black-cock (*Tetrao urogallus* and *T. tetrix*), which are both polygamists, have regular appointed places, where during many weeks they congregate in numbers to fight together and to display their charms before the females. Dr. W. Kovalevsky informs me that in Russia he has seen the snow all bloody on the arenas where the capercailzie have fought; and the black-cocks "make the feathers fly in every direction," when several "engage in a battle royal." The elder Brehm gives a curious account of the Balz, as the love-dances and love-songs of the black-cock are called in Germany. The bird utters almost continuously the strangest noises: "he holds his tail up and spreads it out like a fan, he lifts up his head and neck with all the feathers erect, and stretches his wings from the body. Then he takes a few jumps in different directions, sometimes in a circle, and presses the under part of his beak so hard against the ground that the chin feathers are rubbed off. During these movements he beats his wings and turns round and round. The more ardent he grows, the more lively he becomes, until at last the bird appears like a frantic creature." At such times the black-cocks are so absorbed that they become almost blind and deaf, but less so than the capercailzie: hence bird after bird may be shot on the same spot, or even caught by the hand. After performing these antics the males begin to fight: and the same black-cock, in order to prove his strength over several antagonists, will visit

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[12] Layard, "Annals and Mag. of Nat. Hist.," vol. xiv., 1854, p. 63.
[13] Jerdon, "Birds of India," vol. iii. p. 574.

in the course of one morning several Balz-places, which remain the same during successive years.[14]

The peacock with his long train appears more like a dandy than a warrior, but he sometimes engages in fierce contests: the Rev. W. Darwin Fox informs me that at some little distance from Chester two peacocks became so excited while fighting that they flew over the whole city, still engaged, until they alighted on the top of St. John's tower.

The spur, in those gallinaceous birds which are thus provided, is generally single; but Polyplectron (see Fig. 51, p. 512) has two or more on each leg; and one of the Blood-pheasants (*Ithaginis cruentus*) has been seen with five spurs. The spurs are generally confined to the male, being represented by mere knobs or rudiments in the female; but the females of the Java peacock (*Pavo muticus*) and, as I am informed by Mr. Blyth, of the small fire-backed pheasant (*Euplocamus erythropthalmus*) possess spurs. In Galloperdix it is usual for the males to have two spurs, and for the females to have only one on each leg.[15] Hence spurs may be considered as a masculine structure, which has been occasionally more or less transferred to the females. Like most other secondary sexual characters, the spurs are highly variable, both in number and development, in the same species.

Various birds have spurs on their wings. But the Egyptian goose (*Chenalopex ægyptiacus*) has only "bare obtuse knobs," and these probably show us the first steps by which true spurs have been developed in other species. In the spur-winged goose, *Plectropterus gambensis*, the males have much larger spurs than the females; and they use them, as I am informed by Mr. Bartlett, in fighting together, so that, in this case, the wing-spurs serve as sexual

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[14] Brehm, "Illust. Thierleben," 1867, B. iv. s. 351. Some of the foregoing statements are taken from L. Lloyd, "The Game Birds of Sweden," etc., 1867, p. 79.

[15] Jerdon, "Birds of India: on Ithaginis," vol. iii. p. 523; on Galloperdix, p. 541.

weapons; but, according to Livingstone, they are chiefly used in the defence of the young. The Palamedea (Fig. 38)

Fig. 38.—Palamedea cornuta (from Brehm), showing the double wing-spurs, and the filament on the head.

is armed with a pair of spurs on each wing; and these are such formidable weapons that a single blow has been

known to drive a dog howling away. But it does not appear that the spurs in this case, or in that of some of the spur-winged rails, are larger in the male than in the female.[16] In certain plovers, however, the wing-spurs must be considered as a sexual character. Thus in the male of our common peewit (*Vanellus cristatus*) the tubercle on the shoulder of the wing becomes more prominent during the breeding season, and the males fight together. In some species of Lobivanellus a similar tubercle becomes developed during the breeding season "into a short horny spur." In the Australian *L. lobatus* both sexes have spurs, but these are much larger in the males than in the females. In an allied bird, the *Holopterus armatus*, the spurs do not increase in size during the breeding season; but these birds have been seen in Egypt to fight together, in the same manner as our peewits, by turning suddenly in the air and striking sidewise at each other, sometimes with fatal results. Thus also they drive away other enemies.[17]

The season of love is that of battle; but the males of some birds, as of the game-fowl and ruff, and even the young males of the wild turkey and grouse,[18] are ready to fight whenever they meet. The presence of the female is the *teterima belli causa*. The Bengali baboos make the pretty little males of the amadavat (*Estrelda amandava*) fight together by placing three small cages in a row, with a female in the middle; after a little time the two males are turned loose, and immediately a desperate battle ensues.[19] When many males congregate at the same appointed spot and fight together, as in the case of grouse and various other

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[16] For the Egyptian goose, see Macgillivray, "British Birds," vol. iv. p. 639. For Plectropterus, "Livingstone's Travels," p. 254. For Palamedea, Brehm's "Thierleben," B. iv. s. 740. See also on this bird Azara, "Voyages dans l'Amérique mérid.," tom. iv., 1809, pp. 179, 253.

[17] See, on our peewit, Mr. R. Carr in "Land and Water," August 8, 1868, p. 46. In regard to Lobivanellus, see Jerdon's "Birds of India," vol. iii. p. 647, and Gould's "Handbook of Birds of Australia," vol. ii. p. 220. For the Holopterus, see Mr. Allen in the "Ibis," vol. v., 1863, p. 156.

[18] Audubon, "Ornith. Biography," vol. ii. p. 492; vol. i. pp. 4–13.

[19] Mr. Blyth, "Land and Water," 1867, p. 212.

birds, they are generally attended by the females,[20] which afterward pair with the victorious combatants. But in some cases the pairing precedes instead of succeeding the combat: thus, according to Audubon,[21] several males of the Virginian goat-sucker (*Caprimulgus virginianus*) "court, in a highly entertaining manner, the female, and no sooner has she made her choice than her approved gives chase to all intruders, and drives them beyond his dominions." Generally the males try to drive away or kill their rivals before they pair. It does not, however, appear that the females invariably prefer the victorious males. I have indeed been assured by Dr. W. Kovalevsky that the female capercailzie sometimes steals away with a young male who has not dared to enter the arena with the older cocks, in the same manner as occasionally happens with the does of the red deer in Scotland. When two males contend in presence of a single female, the victor, no doubt, commonly gains his desire; but some of these battles are caused by wandering males trying to distract the peace of an already mated pair.[22]

Even with the most pugnacious species it is probable that the pairing does not depend exclusively on the mere strength and courage of the male; for such males are generally decorated with various ornaments, which often become more brilliant during the breeding season, and which are sedulously displayed before the females. The males also endeavor to charm or excite their mates by love-notes, songs, and antics; and the courtship is, in many instances, a prolonged affair. Hence it is not probable that the

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[20] Richardson on *Tetrao umbellus*, "Fauna Bor. Amer.: Birds," 1831, p. 343. L. Lloyd, "Game Birds of Sweden," 1867, pp. 22, 79, on the capercailzie and black-cock. Brehm, however, asserts ("Thierleben," etc., B. iv. s. 352) that in Germany the gray-hens do not generally attend the Balzen of the black-cocks, but this is an exception to the common rule; possibly the hens may lie hidden in the surrounding bushes, as is known to be the case with the gray-hens in Scandinavia, and with other species in North America.

[21] "Ornithological Biography," vol. ii. p. 275.

[22] Brehm, "Thierleben," etc., B. iv., 1867, p. 990. Audubon, "Ornith. Biography" vol. ii. p. 492.

females are indifferent to the charms of the opposite sex, or that they are invariably compelled to yield to the victorious males. It is more probable that the females are excited, either before or after the conflict, by certain males, and thus unconsciously prefer them. In the case of *Tetrao umbellus*, a good observer[23] goes so far as to believe that the battles of the males "are all a sham, performed to show themselves to the greatest advantage before the admiring females who assemble around; for I have never been able to find a maimed hero, and seldom more than a broken feather." I shall have to recur to this subject, but I may here add that with the *Tetrao cupido* of the United States, about a score of males assemble at a particular spot, and, strutting about, make the whole air resound with their extraordinary noises. At the first answer from a female the males begin to fight furiously, and the weaker give way; but then, according to Audubon, both the victors and vanquished search for the female, so that the females must either then exert a choice, or the battle must be renewed. So, again, with one of the field starlings of the United States (*Sturnella ludoviciana*) the males engage in fierce conflicts, "but at the sight of a female they all fly after her as if mad." [24]

Vocal and Instrumental Music.—With birds the voice serves to express various emotions, such as distress, fear, anger, triumph, or mere happiness. It is apparently sometimes used to excite terror, as in the case of the hissing noise made by some nestling-birds. Audubon[25] relates that a night-heron (*Ardea nycticorax*, Linn.) which he kept tame used to hide itself when a cat approached, and then "suddenly start up uttering one of the most frightful cries, apparently enjoying the cat's alarm and flight." The common domestic cock clucks to the hen, and the hen to her chick-

[23] "Land and Water," July 25, 1868, p. 14.

[24] Audubon's "Ornitholog. Biography"; on *Tetrao cupido*, vol. ii. p. 492; on the Sturnus, vol. ii. p. 219.

[25] "Ornithological Biography," vol. v. p. 601.

ens when a dainty morsel is found. The hen, when she has laid an egg, "repeats the same note very often, and concludes with the sixth above, which she holds for a longer time;" [26] and thus she expresses her joy. Some social birds apparently call to each other for aid; and as they flit from tree to tree, the flock is kept together by chirp answering chirp. During the nocturnal migrations of geese and other water-fowl, sonorous clangs from the van may be heard in the darkness overhead, answered by clangs in the rear. Certain cries serve as danger signals, which, as the sportsman knows to his cost, are understood by the same species and by others. The domestic cock crows, and the humming-bird chirps, in triumph over a defeated rival. The true song, however, of most birds and various strange cries are chiefly uttered during the breeding season, and serve as a charm, or merely as a call-note, to the other sex.

Naturalists are much divided with respect to the object of the singing of birds. Few more careful observers ever lived than Montagu, and he maintained that the "males of song-birds and of many others do not in general search for the female, but, on the contrary, their business in the spring is to perch on some conspicuous spot, breathing out their full and amorous notes, which, by instinct, the female knows, and repairs to the spot to choose her mate." [27] Mr. Jenner Weir informs me that this is certainly the case with the nightingale. Bechstein, who kept birds during his whole life, asserts, "that the female canary always chooses the best singer, and that in a state of nature the female finch selects that male out of a hundred whose notes please her most." [28] There can be no doubt that birds closely attend to each other's song. Mr. Weir has told me of the case of a bullfinch which had been taught to pipe a German waltz,

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[26] The Hon. Daines Barrington, "Philosoph. Transact.," 1773, p. 252.

[27] "Ornithological Dictionary," 1833, p. 475.

[28] "Naturgeschichte der Stubenvögel," 1840, s. 4. Mr. Harrison Weir likewise writes to me: "I am informed that the best singing males generally get a mate first, when they are bred in the same room."

and who was so good a performer that he cost ten guineas; when this bird was first introduced into a room where other birds were kept and he began to sing, all the others, consisting of about twenty linnets and canaries, ranged themselves on the nearest side of their cages, and listened with the greatest interest to the new performer. Many naturalists believe that the singing of birds is almost exclusively "the effect of rivalry and emulation," and not for the sake of charming their mates. This was the opinion of Daines Barrington and White of Selborne, who both especially attended to this subject.[29] Barrington, however, admits that "superiority in song gives to birds an amazing ascendency over others, as is well known to bird-catchers."

It is certain that there is an intense degree of rivalry between the males in their singing. Bird-fanciers match their birds to see which will sing longest; and I was told by Mr. Yarrell that a first-rate bird will sometimes sing till he drops down almost dead, or, according to Bechstein,[30] quite dead from rupturing a vessel in the lungs. Whatever the cause may be, male birds, as I hear from Mr. Weir, often die suddenly during the season of song. That the habit of singing is sometimes quite independent of love is clear, for a sterile, hybrid canary-bird has been described[31] as singing while viewing itself in a mirror, and then dashing at its own image; it likewise attacked with fury a female canary when put into the same cage. The jealousy excited by the act of singing is constantly taken advantage of by bird-catchers; a male, in good song, is hidden and protected, while a stuffed bird, surrounded by limed twigs, is exposed to view. In this manner, as Mr. Weir informs me, a man has in the course of a single day caught fifty, and in one instance seventy, male chaffinches. The power and inclination to sing differ so greatly with birds that,

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[29] "Philosophical Transactions," 1773, p. 263. White's "Natural History of Selborne," 1825, vol. i. p. 246.

[30] "Naturgesch. der Stubenvögel," 1840, s. 252.

[31] Mr. Bold, "Zoologist," 1843–1844, p. 659.

although the price of an ordinary male chaffinch is only sixpence, Mr. Weir saw one bird for which the bird-catcher asked three pounds; the test of a really good singer being that it will continue to sing while the cage is swung round the owner's head.

That male birds should sing from emulation as well as for charming the female, is not at all incompatible; and it might have been expected that these two habits would have concurred, like those of display and pugnacity. Some authors, however, argue that the song of the male cannot serve to charm the female, because the females of some few species, such as of the canary, robin, lark, and bullfinch, especially when in a state of widowhood, as Bechstein remarks, pour forth fairly melodious strains. In some of these cases the habit of singing may be in part attributed to the females having been highly fed and confined,[32] for this disturbs all the usual functions connected with the reproduction of the species. Many instances have already been given of the partial transference of secondary masculine characters to the female, so that it is not at all surprising that the females of some species should possess the power of song. It has also been argued that the song of the male cannot serve as a charm, because the males of certain species, for instance, of the robin, sing during the autumn.[33] But nothing is more common than for animals to take pleasure in practicing whatever instinct they follow at other times for some real good. How often do we see birds which fly easily, gliding and sailing through the air obviously for pleasure? The cat plays with the captured mouse, and the cormorant with the captured fish. The weaver-bird (Ploceus), when confined in a cage, amuses itself by neatly weaving blades of grass between the wires of its cage. Birds which habitually fight during the breeding season are generally ready to fight at all times; and the

[32] D. Barrington, "Phil. Transact.," 1773, p. 262. Bechstein, "Stubenvögel," 1840, s. 4.

[33] This is likewise the case with the water-ouzel; see Mr. Hepburn in the "Zoologist," 1845–1846, p. 1068.

males of the capercailzie sometimes hold their *Balzen* or *leks* at the usual place of assemblage during the autumn.[34] Hence it is not at all surprising that male birds should continue singing for their own amusement after the season for courtship is over.

As shown in a previous chapter, singing is to a certain extent an art, and is much improved by practice. Birds can be taught various tunes, and even the unmelodious sparrow has learned to sing like a linnet. They acquire the song of their foster parents,[35] and sometimes that of their neighbors.[36] All the common songsters belong to the Order of Insessores, and their vocal organs are much more complex than those of most other birds; yet it is a singular fact that some of the Insessores, such as ravens, crows, and magpies, possess the proper apparatus,[37] though they never sing, and do not naturally modulate their voices to any great extent. Hunter asserts[38] that with the true songsters the muscles of the larynx are stronger in the males than in the females; but with this slight exception there is no difference in the vocal organs of the two sexes, although the males of most species sing so much better and more continuously than the females.

It is remarkable that only small birds properly sing. The Australian genus Menura, however, must be excepted; for the *Menura Alberti*, which is about the size of a half-grown turkey, not only mocks other birds, but "its own whistle is exceedingly beautiful and varied." The males congregate and form "*corroborying* places," where they sing, raising and spreading their tails like peacocks, and drooping their wings.[39] It is also remarkable that birds

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[34] L. Lloyd, "Game Birds of Sweden," 1867, p. 25.

[35] Barrington, ibid., p. 264. Bechstein, ibid., s. 5.

[36] Dureau de la Malle gives a curious instance ("Annales des Sc. Nat.," 3d series, Zoolog., tom. x. p. 118) of some wild blackbirds in his garden in Paris which naturally learned a republican air from a caged bird.

[37] Bishop, in "Todd's Cyclop. of Anat. and Phys." vol. iv. p. 1496.

[38] As stated by Barrington in "Philosoph. Transact.," 1773, p. 262.

[39] Gould, "Handbook to the Birds of Australia," vol. i., 1865, pp. 308–310. See also Mr. T. W. Wood in the "Student," April, 1870, p. 125.

which sing well are rarely decorated with brilliant colors or other ornaments. Of our British birds, excepting the bullfinch and goldfinch, the best songsters are plain-colored. The kingfisher, bee-eater, roller, hoopoe, wood-

FIG. 39.—Tetrao cupido: male (T. W. Wood)

peckers, etc., utter harsh cries; and the brilliant birds of the tropics are hardly ever songsters.[40] Hence bright colors and the power of song seem to replace each other. We can perceive that if the plumage did not vary in brightness, or

[40] See remarks to this effect in Gould's "Introduction to the Trochilidæ," 1861, p. 22.

if bright colors were dangerous to the species, other means would be employed to charm the females; and melody of voice offers one such means.

In some birds the vocal organs differ greatly in the two sexes. In the *Tetrao cupido* (Fig. 39) the male has two bare, orange-colored sacs, one on each side of the neck; and these are largely inflated when the male, during the breeding season, makes his curious hollow sound, audible at a great distance. Audubon proved that the sound was intimately connected with this apparatus (which reminds us of the air-sacs on each side of the mouth of certain male frogs), for he found that the sound was much diminished when one of the sacs of a tame bird was pricked, and when both were pricked it was altogether stopped. The female has "a somewhat similar, though smaller, naked space of skin on the neck; but this is not capable of inflation." [41] The male of another kind of grouse (*Tetrao urophasianus*), while courting the female, has his "bare yellow œsophagus inflated to a prodigious size, fully half as large as the body"; and he then utters various grating, deep, hollow tones. With his neck-feathers erect, his wings lowered, and buzzing on the ground, and his long pointed tail spread out like a fan, he displays a variety of grotesque attitudes. The œsophagus of the female is not in any way remarkable.[42]

It seems now well made out that the great throat-pouch of the European male bustard (*Otis tarda*), and of at least four other species, does not, as was formerly supposed, serve to hold water, but is connected with the utterance during the breeding season of a peculiar sound resembling "ock." [43] A crow-like bird inhabiting South America

[41] "The Sportsman and Naturalist in Canada," by Major W. Ross King, 1866, pp. 144–146. Mr. T. W. Wood gives in the "Student" (April, 1870, p. 116) an excellent account of the attitude and habits of this bird during its courtship. He states that the ear-tufts or neck-plumes are erected, so that they meet over the crown of the head. See his drawing, Fig. 39.

[42] Richardson, "Fauna Bor. American: Birds," 1831, p. 359. Audubon, Ibid., vol. iv. p. 507.

[43] The following papers have been lately written on this subject: Prof. A.

(*Cephalopterus ornatus*, Fig. 40) is called the umbrella-bird, from its immense topknot, formed of bare white quills surmounted by dark-blue plumes, which it can elevate into a great dome no less than five inches in diameter, covering

Fig. 40.—The Umbrella-bird or Cephalopterus ornatus (male, from Brehm).

the whole head. This bird has on its neck a long, thin, cylindrical fleshy appendage, which is thickly clothed with scale-like blue feathers. It probably serves in part as an ornament, but likewise as a resounding apparatus; for Mr.

Newton, in the "Ibis," 1862, p. 107; Dr. Cullen, ibid., 1865, p. 145; Mr. Flower, in "Proc. Zool. Soc.," 1865, p. 747; and Dr. Murie, in "Proc. Zool. Soc.," 1868, p. 471. In this latter paper an excellent figure is given of the male Australian Bustard in full display with the sac distended. It is a singular fact that the sac is not developed in all the males of the same species.

Bates found that it is connected "with an unusual development of the trachea and vocal organs." It is dilated when the bird utters its singularly deep, loud, and long-sustained fluty note. The head-crest and neck-appendage are rudimentary in the female.[44]

The vocal organs of various web-footed and wading-birds are extraordinarily complex, and differ to a certain extent in the two sexes. In some cases the trachea is convoluted, like a French horn, and is deeply imbedded in the sternum. In the wild swan (*Cygnus ferus*) it is more deeply imbedded in the adult male than in the adult female or young male. In the male Merganser the enlarged portion of the trachea is furnished with an additional pair of muscles.[45] In one of the ducks, however, namely *Anas punctata*, the bony enlargement is only a little more developed in the male than in the female.[46] But the meaning of these differences in the trachea of the two sexes of the Anatidæ is not understood; for the male is not always the more vociferous; thus with the common duck, the male hisses, while the female utters a loud quack.[47] In both sexes of one of the cranes (*Grus virgo*) the trachea penetrates the sternum, but presents "certain sexual modifications." In the male of the black stork there is also a well-marked sexual difference in the length and curvature of the bronchi.[48] Highly important structures have, therefore, in these cases been modified according to sex.

It is often difficult to conjecture whether the many

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[44] Bates, "The Naturalist on the Amazons," 1863, vol. ii. p. 284; Wallace, in "Proc. Zool. Soc.," 1850, p. 206. A new species, with a still larger neck-appendage (*C. penduliger*), has lately been discovered, see "Ibis," vol. i. p. 457.

[45] Bishop, in "Todd's Cyclop. of Anat. and Phys.," vol. iv. p. 1499.

[46] Prof. Newton, "Proc. Zoolog. Soc.," 1871, p. 651.

[47] The spoonbill (Platalea) has its trachea convoluted into a figure of eight, and yet this bird (Jerdon, "Birds of India," vol. iii. p. 763) is mute; but Mr. Blyth informs me that the convolutions are not constantly present, so that perhaps they are now tending toward abortion.

[48] "Elements of Comp. Anat.," by R. Wagner, Eng. translat., 1845, p. 111. With respect to the swan, as given above, Yarrell's "Hist. of British Birds," 2d edit., 1845, vol. iii. p. 193.

strange cries and notes uttered by male birds during the breeding season serve as a charm or merely as a call to the female. The soft cooing of the turtle-dove and of many pigeons, it may be presumed, pleases the female. When the female of the wild turkey utters her call in the morning, the male answers by a note which differs from the gobbling noise made when, with erected feathers, rustling wings, and distended wattles, he puffs and struts before her.[49] The *spel* of the black-cock certainly serves as a call to the female, for it has been known to bring four or five females from a distance to a male under confinement; but as the black-cock continues his *spel* for hours during successive days, and in the case of the capercailzie "with an agony of passion," we are led to suppose that the females which are present are thus charmed.[50] The voice of the common rook is known to alter during the breeding season, and is therefore in some way sexual.[51] But what shall we say about the harsh screams of, for instance, some kinds of macaws; have these birds as bad taste for musical sounds as they apparently have for color, judging by the inharmonious contrast of their bright yellow and blue plumage? It is, indeed, possible that, without any advantage being thus gained, the loud voices of many male birds may be the result of the inherited effects of the continued use of their vocal organs, when excited by the strong passions of love, jealousy, and rage; but to this point we shall recur when we treat of quadrupeds.

We have as yet spoken only of the voice, but the males of various birds practice, during their courtship, what may be called instrumental music. Peacocks and Birds of Paradise rattle their quills together. Turkey-cocks scrape their wings against the ground, and some kinds of grouse thus produce a buzzing sound. Another

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[49] C. L. Bonaparte, quoted in the "Naturalist Library: Birds," vol. xiv. p. 126.

[50] L. Lloyd, "The Game Birds of Sweden," etc., 1867, pp 22, 81.

[51] Jenner, "Philosoph. Transactions," 1824, p. 20.

North American grouse, the *Tetrao umbellus*, when with his tail erect, his ruffs displayed, "he shows off his finery to the females, who lie hid in the neighborhood," drums by rapidly striking his wings together above his back, according to Mr. R. Haymond, and not, as Audubon thought, by striking them against his sides. The sound thus produced is compared by some to distant thunder, and by others to the quick roll of a drum. The female never drums, "but flies directly to the place where the male is thus engaged." The male of the Kalij-pheasant, in the Himalayas, "often makes a singular drumming noise with his wings, not unlike the sound produced by shaking a stiff piece of cloth." On the west coast of Africa the little black weavers (Ploceus?) congregate in a small party on the bushes round a small open space, and sing and glide through the air with quivering wings, "which make a rapid whirring sound like a child's rattle." One bird after another thus performs for hours together, but only during the courting season. At this season, and at no other time, the males of certain night-jars (Caprimulgus) make a strange booming noise with their wings. The various species of woodpeckers strike a sonorous branch with their beaks, with so rapid a vibratory movement that "the head appears to be in two places at once." The sound thus produced is audible at a considerable distance, but cannot be described; and I feel sure that its source would never be conjectured by any one hearing it for the first time. As this jarring sound is made chiefly during the breeding season, it has been considered as a love-song; but it is perhaps more strictly a love-call. The female, when driven from her nest, has been observed thus to call her mate, who answered in the same manner and soon appeared. Lastly, the male Hoopoe (*Upupa epops*) combines vocal and instrumental music; for during the breeding season this bird, as Mr. Swinhoe observed, first draws in air, and then taps the end of its beak perpendicularly down against a stone or the trunk of a tree, "when the breath being forced down the tubular bill pro-

duces the correct sound." If the beak is not thus struck against some object, the sound is quite different. Air is at the same time swallowed, and the œsophagus thus becomes much swollen; and this probably acts as a resonator, not only with the hoopoe, but with pigeons and other birds.[52]

In the foregoing cases sounds are made by the aid of structures already present and otherwise necessary; but in the following cases certain feathers have been specially modified for the express purpose of producing sounds. The drumming, bleating, neighing, or thundering noise (as expressed by different observers) made by the common snipe (*Scolopax gallinago*) must have surprised every one who has ever heard it. This bird, during the pairing season, flies to "perhaps a thousand feet in height," and

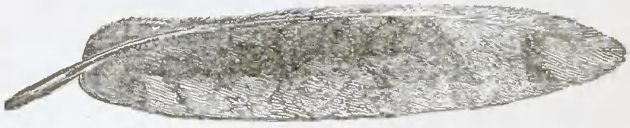

Fig. 41.—Outer tail-feather of Scolopax gallinago (from "Proc. Zool. Soc.," 1858).

after zigzagging about for a time descends to the earth in a curved line, with outspread tail and quivering pinions, and surprising velocity. The sound is emitted only during this rapid descent. No one was able to explain the cause, until M. Meves observed that on each side of the tail the outer feathers are peculiarly formed (Fig. 41), having a stiff sabre-shaped shaft, with the oblique barbs of unusual length, the outer webs being strongly bound together. He found

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[52] For the foregoing facts see, on Birds of Paradise, Brehm, "Thierleben," Band iii. s. 325. On Grouse, Richardson, "Fauna Bor. Americ.: Birds," pp. 343 and 359; Major W. Ross King, "The Sportsman in Canada," 1866, p. 156; Mr. Haymond, in Prof. Cox's "Geol. Survey of Indiana," p. 227; Audubon, "American Ornitholog. Biograph.," vol. i. p. 216. On the Kalij-pheasant, Jerdon, "Birds of India," vol. iii. p. 533. On the Weavers, "Livingstone's Expedition to the Zambesi," 1865, p. 425. On Woodpeckers, Macgillivray, "Hist. of British Birds," vol. iii., 1840, pp. 84, 88, 89, and 95. On the Hoopoe, Mr. Swinhoe, in "Proc. Zoolog. Soc.," June 23, 1863, and 1871, p. 348. On the Night-jar, Audubon, ibid., vol. ii. p. 255, and "American Naturalist," 1873, p. 672. The English Night-jar likewise makes in the spring a curious noise during its rapid flight.

that by blowing on these feathers, or by fastening them to a long, thin stick and waving them rapidly through the air, he could reproduce the drumming noise made by the living bird. Both sexes are furnished with these feathers, but they are generally larger in the male than in the female, and emit a deeper note. In some species, as in *S. frenata* (Fig. 42), four feathers, and in *S. javensis* (Fig. 43), no less than eight on each side of the tail are greatly modified. Different tones are emitted by the feathers of the different species when waved through the air; and the *Scolopax Wilsonii* of the United States makes a switching noise while descending rapidly to the earth.[53]

In the male of the *Chamæpetes unicolor* (a large gallinaceous bird of America) the first primary wing-feather is arched toward the tip and is much more attenuated than in the female. In an allied bird, the *Penelope nigra*, Mr. Salvin observed a male which, while it flew downward "with outstretched wings, gave forth a kind of crashing rushing noise," like the falling of a tree.[54] The male alone of one of the Indian bustards (*Sypheotides auritus*) has its primary wing-feathers greatly acuminated; and the male of an allied species is known to make a humming noise while courting the female.[55] In a widely different group of birds, namely Humming-birds, the males alone of certain kinds have either the shafts of their primary wing-feathers broadly dilated, or the webs abruptly excised toward the extremity. The male, for instance, of *Selasphorus platy-*

FIG. 42.—Outer tail-feather of Scolopax frenata.

FIG. 43.—Outer tail-feather of Scolopax javensis.

[53] See Mr. Meves' interesting paper in "Proc. Zool. Soc.," 1858, p. 199. For the habits of the snipe, Macgillivray, "Hist. British Birds," vol. iv. p. 371. For the American snipe, Capt. Blakiston, "Ibis," vol. v., 1863, p. 131.

[54] Mr. Salvin, in "Proc. Zool. Soc.," 1867, p. 160. I am much indebted to this distinguished ornithologist for sketches of the feathers of the Chamæpetes, and for other information.

[55] Jerdon, "Birds of India," vol. iii. pp. 618, 621.

cercus, when adult, has the first primary wing-feather (Fig. 44) thus excised. While flying from flower to flower he makes "a shrill, almost whistling noise;" [56] but it did not appear to Mr. Salvin that the noise was intentionally made.

Lastly, in several species of a sub-genus of Pipra or Manakin, the males, as described by Mr. Sclater, have their *secondary* wing-feathers modified in a still more remarkable manner. In the brilliantly colored *P. deliciosa* the first three secondaries are thick-stemmed and curved toward the body; in the fourth and fifth (Fig. 45, *a*) the change is greater; and in the sixth and seventh (*b*, *c*) the shaft "is thickened to an extraordinary degree, forming a solid, horny lump." The barbs also are greatly changed in shape, in comparison with the corresponding feathers (*d*, *e*, *f*) in the female. Even the bones of the wing, which support these singular feathers in the male, are said by Mr. Fraser to be much thickened. These little birds make an extraordinary noise, the first "sharp note being not unlike the crack of a whip." [57]

FIG. 44.—Primary wing-feather of a Humming-bird, the *Selasphorus platycerous* (from a sketch by Mr. Salvin). Upper figure, that of male; lower figure, corresponding feather of female.

The diversity of the sounds, both vocal and instrumental, made by the males of many birds during the breeding season, and the diversity of the means for producing such sounds, are highly remarkable. We thus gain a high idea of their importance for sexual purposes, and are reminded of the conclusion arrived at as to insects. It is not difficult to imagine the steps by which the notes of a bird, primarily used as a mere call or for some other purpose, might have been improved into a melodious love song. In the case of the modified feathers, by which the drumming,

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[56] Gould, "Introduction to the Trochilidæ," 1861, p. 49. Salvin, "Proc. Zoolog. Soc.," 1867, p. 160.

[57] Sclater, in "Proc. Zool. Soc.," 1860, p. 90, and in "Ibis," vol. iv., 1862, p. 175. Also Salvin, in "Ibis," 1860, p. 37.

whistling, or roaring noises are produced, we know that some birds during their courtship flutter, shake, or rattle their unmodified feathers together; and if the females were led to select the best performers, the males which possessed

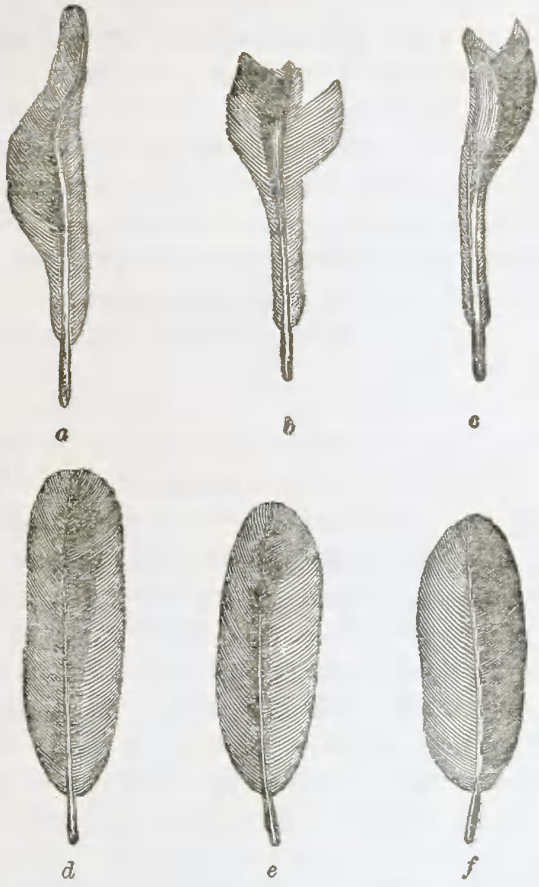

FIG. 45.—Secondary wing-feathers of *Pipra deliciosa* (from Mr. Sclater, in "Proc. Zool Soc.," 1860). The three upper feathers, *a*, *b*, *c*, from the male; the three lower corresponding feathers, *d*, *e*, *f*, from the female. *a* and *d*, fifth secondary wing-feather of male and female, upper surface. *b* and *e*, sixth secondary, upper surface. *c* and *f*, seventh secondary, lower surface.

the strongest or thickest, or most attenuated feathers, situated on any part of the body, would be the most successful; and thus by slow degrees the feathers might be modified to almost any extent. The females, of course, would not notice each slight successive alteration in shape, but only

the sounds thus produced. It is a curious fact that in the same class of animals sounds so different as the drumming of the snipe's tail, the tapping of the woodpecker's beak, the harsh trumpet-like cry of certain water-fowl, the cooing of the turtle-dove, and the song of the nightingale, should all be pleasing to the females of the several species. But we must not judge of the tastes of distinct species by a uniform standard; nor must we judge by the standard of man's taste. Even with man, we should remember what discordant noises, the beating of tom-toms and the shrill notes of reeds, please the ears of savages. Sir S. Baker remarks,[58] that, "as the stomach of the Arab prefers the raw meat and reeking liver taken hot from the animal, so does his ear prefer his equally coarse and discordant music to all other."

Love-Antics and Dances.—The curious love gestures of some birds have already been incidentally noticed, so that little need here be added. In northern America, large numbers of a grouse, the *Tetrao phasianellus*, meet every morning during the breeding season on a selected level spot, and here they run round and round in a circle of about fifteen or twenty feet in diameter, so that the ground is worn quite bare, like a fairy-ring. In these Partridge-dances, as they are called by the hunters, the birds assume the strangest attitudes, and run round, some to the left and some to the right. Audubon describes the males of a heron (*Ardea herodias*) as walking about on their long legs with great dignity before the females, bidding defiance to their rivals. With one of the disgusting carrion-vultures (*Cathartes jota*) the same naturalist states that "the gesticulations and parade of the males at the beginning of the love-season are extremely ludicrous." Certain birds perform their love-antics on the wing, as we have seen with the black African weaver, instead of on the ground. During the spring our

[58] "The Nile Tributaries of Abyssinia," 1867. p. 203.

little white-throat (*Sylvia cinerea*) often rises a few feet or yards in the air above some bush, and "flutters with a fitful and fantastic motion, singing all the while, and then drops to its perch." The great English bustard throws himself into indescribably odd attitudes while courting the female, as has been figured by Wolf. An allied Indian bustard (*Otis bengalensis*) at such times "rises perpendicularly into the air with a hurried flapping of his wings, raising his crest and puffing out the feathers of his neck and breast, and then drops to the ground"; he repeats this manœuvre several times, at the same time humming in a peculiar tone. Such females as happen to be near "obey this saltatory summons," and when they approach he trails his wings and spreads his tail like a turkey-cock.[59]

But the most curious case is afforded by three allied genera of Australian birds, the famous Bower-birds—no doubt the co-descendants of some ancient species which first acquired the strange instinct of constructing bowers for performing their love-antics. The bowers (Fig. 46), which, as we shall hereafter see, are decorated with feathers, shells, bones, and leaves, are built on the ground for the sole purpose of courtship, for their nests are formed in trees. Both sexes assist in the erection of the bowers, but the male is the principal workman. So strong is this instinct that it is practiced under confinement, and Mr. Strange has described[60] the habits of some Satin Bower-birds which he kept in an aviary in New South Wales. "At times the male will chase the female all over the aviary, then go to the bower, pick up a gay feather or a large leaf, utter a curious kind of note, set all his feathers

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[59] For *Tetrao phasianellus*, see Richardson, "Fauna Bor. America," p. 361, and for further particulars Capt. Blakiston, "Ibis," 1863, p. 125. For the Cathartes and Ardea, Audubon, "Ornith. Biography," vol. ii. p. 51, and vol. iii. p. 59. On the White-throat, Macgillivray, "Hist. British Birds," vol. ii. p. 354. On the Indian Bustard, Jerdon, "Birds of India," vol. iii. p. 618.

[60] Gould, "Handbook to the Birds of Australia," vol. i. pp. 444, 449, 455. The bower of the Satin Bower-bird may be seen in the Zoological Society's Gardens, Regent's Park.

erect, run round the bower and become so excited that his eyes appear ready to start from his head; he continues

Fig. 46.—Bower-bird, Chlamydera maculata, with bower (from Brehm).

opening first one wing then the other, uttering a low, whistling note, and, like the domestic cock, seems to be picking up something from the ground, until at last the

female goes gently toward him." Captain Stokes has described the habits and "play-houses" of another species, the Great Bower-bird, which was seen "amusing itself by flying backward and forward, taking a shell alternately from each side, and carrying it through the archway in its mouth." These curious structures, formed solely as halls of assemblage, where both sexes amuse themselves and pay their court, must cost the birds much labor. The bower, for instance, of the Fawn-breasted species is nearly four feet in length, eighteen inches in height, and is raised on a thick platform of sticks.

Decoration.—I will first discuss the cases in which the males are ornamented either exclusively or in a much higher degree than the females, and in a succeeding chapter those in which both sexes are equally ornamented, and finally the rare cases in which the female is somewhat more brightly colored than the male. As with the artificial ornaments used by savage and civilized men, so with the natural ornaments of birds, the head is the chief seat of decoration.[61] The ornaments, as mentioned at the commencement of this chapter, are wonderfully diversified. The plumes on the front or back of the head consist of variously shaped feathers, sometimes capable of erection or expansion, by which their beautiful colors are fully displayed. Elegant ear-tufts (see Fig. 39, ante) are occasionally present. The head is sometimes covered with velvety down, as with the pheasant, or is naked and vividly colored. The throat, also, is sometimes ornamented with a beard, wattles, or caruncles. Such appendages are generally brightly colored, and no doubt serve as ornaments, though not always ornamental in our eyes; for while the male is in the act of courting the female, they often swell and assume vivid tints, as in the male turkey. At such

[61] See remarks to this effect, on the "Feeling of Beauty Among Animals," by Mr. J. Shaw, in the "Athenæum," Nov. 24, 1866, p. 681.

times the fleshy appendages about the head of the male Tragopan pheasant (*Ceriornis Temminckii*) swell into a large lappet on the throat and into two horns, one on each side of the splendid topknot; and these are then colored of the most intense blue which I have ever beheld.[62] The African hornbill (*Bucorax abyssinicus*) inflates the scarlet bladder-like wattle on its neck, and with its wings drooping and tail expanded "makes quite a grand appearance."[63] Even the iris of the eye is sometimes more brightly colored in the male than in the female; and this is frequently the case with the beak, for instance, in our common blackbird. In *Buceros corrugatus*, the whole beak and immense casque are colored more conspicuously in the male than in the female; and "the oblique grooves upon the sides of the lower mandible are peculiar to the male sex."[64]

The head, again, often supports fleshy appendages, filaments, and solid protuberances. These, if not common to both sexes, are always confined to the males. The solid protuberances have been described in detail by Dr. W. Marshall,[65] who shows that they are formed either of cancellated bone coated with skin, or of dermal and other tissues. With mammals true horns are always supported on the frontal bones, but with birds various bones have been modified for this purpose; and in species of the same group the protuberances may have cores of bone, or be quite destitute of them, with intermediate gradations connecting these two extremes. Hence, as Dr. Marshall justly remarks, variations of the most different kinds have served for the development through sexual selection of these ornamental appendages. Elongated feathers or plumes spring from almost every part of the body. The feathers on the throat and breast are sometimes developed into beau-

[62] See Dr. Murie's account with colored figures in "Proc. Zoolog. Soc.," 1872, p. 730.

[63] Monteiro, "Ibis," vol. iv., 1862, p. 339.

[64] "Land and Water," 1868, p. 217.

[65] "Ueber die Schädelhocker," etc., "Niederländischen Archiv für Zoologie," B. I. Heft 2, 1872.

tiful ruffs and collars. The tail-feathers are frequently increased in length; as we see in the tail-coverts of the peacock, and in the tail itself of the Argus pheasant. With the peacock even the bones of the tail have been modified to support the heavy tail-coverts.[66] The body of the Argus is not larger than that of a fowl; yet the length from the end of the beak to the extremity of the tail is no less than five feet three inches,[67] and that of the beautifully ocellated secondary wing-feathers nearly three feet. In a small African night-jar (*Cosmetornis vexillarius*) one of the primary wing-feathers, during the breeding season, attains a length of twenty-six inches, while the bird itself is only ten inches in length. In another closely allied genus of night-jars, the shafts of the elongated wing-feathers are naked, except at the extremity, where there is a disk.[68] Again, in another genus of night-jars, the tail-feathers are even still more prodigiously developed. In general the feathers of the tail are more often elongated than those of the wings, as any great elongation of the latter impedes flight. We thus see that in closely allied birds ornaments of the same kind have been gained by the males through the development of widely different feathers.

It is a curious fact that the feathers of species belonging to very distinct groups have been modified in almost exactly the same peculiar manner. Thus the wing-feathers in one of the above-mentioned night-jars are bare along the shaft, and terminate in a disk; or are, as they are sometimes called, spoon or racket-shaped. Feathers of this kind occur in the tail of a motmot (*Eumomota superciliaris*), of a kingfisher, finch, humming-bird, parrot, several Indian drongos (Dicrurus and Edolius, in one of which the disk stands vertically), and in the tail of certain birds of paradise. In these latter birds, similar feathers, beautifully

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[66] Dr. W. Marshall, "Ueber den Vogelschwanz," ibid., B. I. Heft 2, 1872.

[67] Jardine's "Naturalist Library: Birds," vol. xiv. p. 166.

[68] Sclater, in the "Ibis," vol. vi., 1864, p. 114. Livingstone, "Expedition to the Zambesi," 1865, p. 66.

ocellated, ornament the head, as is likewise the case with some gallinaceous birds. In an Indian bustard (*Sypheotides auritus*) the feathers forming the ear-tufts, which are about four inches in length, also terminate in disks.[69] It is a most singular fact that the motmots, as Mr. Salvin has clearly shown,[70] give to their tail-feathers the racket-shape by biting off the barbs, and, further, that this continued mutilation has produced a certain amount of inherited effect.

Again, the barbs of the feathers in various widely distinct birds are filamentous or plumose, as with some herons, ibises, birds of paradise, and Gallinaceæ. In other cases the barbs disappear, leaving the shafts bare from end to end; and these in the tail of the *Paradisea apoda* attain a length of thirty-four inches;[71] in *P. Papuana* (Fig. 47) they are much shorter and thin. Smaller feathers when thus denuded appear like bristles, as on the breast of the turkey-cock. As any fleeting fashion in dress comes to be admired by man, so with birds a change of almost any kind in the structure or coloring of the feathers in the male appears to have been admired by the female. The fact of the feathers in widely distinct groups having been modified in an analogous manner, no doubt depends primarily on all the feathers having nearly the same structure and manner of development, and consequently tending to vary in the same manner. We often see a tendency to analogous variability in the plumage of our domestic breeds belonging to distinct species. Thus topknots have appeared in several species. In an extinct variety of the turkey, the topknot consisted of bare quills surmounted with plumes of down, so that they somewhat resembled the racket-shaped feathers above described. In certain breeds of the pigeon and fowl the feathers are plumose, with some tendency in the shafts to be naked. In the Sebastopol goose the scapular feathers

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[69] Jerdon, "Birds of India," vol. iii. p. 620.

[70] "Proc. Zoolog. Soc.," 1873, p. 422

[71] Wallace, in "Annals and Mag. of Nat. Hist.," vol. xx., 1857, p. 416; and in his "Malay Archipelago," vol. ii., 1869, p. 390.

are greatly elongated, curled, or even spirally twisted, with the margins plumose.[72]

FIG. 47.—Paradisea Papuana (T. W. Wood).

In regard to color hardly anything need here be said, for every one knows how splendid are the tints of many birds,

[72] See my work on "The Variation of Animals and Plants Under Domestication," vol. i. pp. 289, 293.

and how harmoniously they are combined. The colors are often metallic and iridescent. Circular spots are sometimes surrounded by one or more differently shaded zones, and are thus converted into ocelli. Nor need much be said on the wonderful difference between the sexes of many birds. The common peacock offers a striking instance. Female birds of paradise are obscurely colored and destitute of all ornaments, while the males are probably the most highly decorated of all birds, and in so many different ways, that they must be seen to be appreciated. The elongated and golden orange plumes which spring from beneath the wings of the *Paradisea apoda*, when vertically erected and made to vibrate, are described as forming a sort of halo, in the centre of which the head "looks like a little emerald sun with its rays formed by the two plumes." [73] In another most beautiful species the head is bald, "and of a rich cobalt blue, crossed by several lines of black velvety feathers." [74]

Male humming-birds (Figs. 48 and 49) almost vie with birds of paradise in their beauty, as every one will admit who has seen Mr. Gould's splendid volumes, or his rich collection. It is very remarkable in how many different ways these birds are ornamented. Almost every part of their plumage has been taken advantage of, and modified; and the modifications have been carried, as Mr. Gould showed me, to a wonderful extreme in some species belonging to nearly every sub-group. Such cases are curiously like those which we see in our fancy breeds, reared by man for the sake of ornament: certain individuals originally varied in one character, and other individuals of the same species in other characters; and these have been seized on by man and much augmented—as shown by the tail of the fan-tail pigeon, the hood of the jacobin, the beak and wattle of the carrier, and so forth. The sole difference be-

[73] Quoted from M. de Lafresnaye, in "Annals and Magazine of Natural History, ' vol. xiii., 1854, p. 157; see also Mr Wallace's much fuller account in vol. xx., 1857, p. 412, and in his "Malay Archipelago."

[74] Wallace, "The Malay Archipelago," vol. ii., 1869, p. 405.

tween the cases is that in the one the result is due to man's selection, while in the other, as with humming-birds, birds

FIG. 48.—Lophornis ornatus, male and female (from Brehm).

of paradise, etc., it is due to the selection by the females of the more beautiful males.

I will mention only one other bird, remarkable from the extreme contrast in color between the sexes, namely, the famous bell-bird (*Chasmorhynchus niveus*) of South America,

the note of which can be distinguished at the distance of nearly three miles, and astonishes every one when first hearing it. The male is pure white, while the female is

Fig. 49.—Spathura underwoodi, male and female (from Brehm).

dusky-green; and white is a very rare color in terrestrial species of moderate size and inoffensive habits. The male also, as described by Waterton, has a spiral tube, nearly

three inches in length, which rises from the base of the beak. It is jet black, dotted over with minute downy feathers. This tube can be inflated with air, through a communication with the palate; and when not inflated hangs down on one side. The genus consists of four species, the males of which are very distinct, while the females, as described by Mr. Sclater in a very interesting paper, closely resemble each other, thus offering an excellent instance of the common rule that within the same group the males differ much more from each other than do the females. In a second species (*C. nudicollis*) the male is likewise snow-white, with the exception of a large space of naked skin on the throat and round the eyes, which during the breeding season is of a fine green color. In a third species (*C. tricarunculatus*) the head and neck alone of the male are white, the rest of the body being chestnut-brown, and the male of this species is provided with three filamentous projections half as long as the body—one rising from the base of the beak, and the other two from the corners of the mouth.[75]

The colored plumage and certain other ornaments of the adult males are either retained for life or are periodically renewed during the summer and breeding season. At this same season the beak and naked skin about the head frequently change color, as with some herons, ibises, gulls, one of the bell-birds just noticed, etc. In the white ibis, the cheeks, the inflatable skin of the throat, and the basal portion of the beak then become crimson.[76] In one of the rails, *Gallicrex cristatus*, a large red caruncle is developed during this period on the head of the male. So it is with a thin horny crest on the beak of one of the pelicans, *P. erythrorhynchus;* for after the breeding season these horny crests are shed, like horns from the heads of stags, and the

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[75] Mr. Sclater, "Intellectual Observer," January, 1867. "Waterton's Wanderings," p. 118. See also Mr. Salvin's interesting paper, with a plate, in the "Ibis," 1865, p. 90.

[76] "Land and Water," 1867, p. 394.

shore of an island in a lake in Nevada was found covered with these curious exuviæ.[77]

Changes of color in the plumage according to the season depend, first, on a double annual moult; secondly, on an actual change of color in the feathers themselves; and, thirdly, on their dull-colored margins being periodically shed, or on these three processes more or less combined. The shedding of the deciduary margins may be compared with the shedding of their down by very young birds; for the down in most cases arises from the summits of the first true feathers.[78]

With respect to the birds which annually undergo a double moult, there are, first, some kinds, for instance, snipes, swallow-plovers (Glareolæ), and curlews, in which the two sexes resemble each other, and do not change color at any season. I do not know whether the winter plumage is thicker and warmer than the summer plumage, but warmth seems the most probable end attained of a double moult, when there is no change of color. Secondly, there are birds, for instance, certain species of Totanus and other Grallatores, the sexes of which resemble each other, but in which the summer and winter plumage differ slightly in color. The difference, however, in these cases is so small that it can hardly be an advantage to them; and it may, perhaps, be attributed to the direct action of the different conditions to which the birds are exposed during the two seasons. Thirdly, there are many other birds the sexes of which are alike, but which are widely different in their summer and winter plumage. Fourthly, there are birds the sexes of which differ from each other in color; but the females, though moulting twice, retain the same colors throughout the year, while the males undergo a change of color, sometimes a great one, as with certain bustards. Fifthly and lastly, there are birds the sexes of which differ from each other in

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[77] Mr. D. G. Elliott, in "Proc. Zool. Soc.," 1869, p. 589.

[78] Nitusch's "Pterylography," edited by P. L. Sclater. Ray Soc., 1867, p. 14

both their summer and winter plumage; but the male undergoes a greater amount of change at each recurrent season than the female—of which the ruff (*Machetes pugnax*) offers a good instance.

With respect to the cause or purpose of the differences in color between the summer and winter plumage, this may in some instances, as with the ptarmigan,[79] serve during both seasons as a protection. When the difference between the two plumages is slight, it may perhaps be attributed, as already remarked, to the direct action of the conditions of life. But with many birds there can hardly be a doubt that the summer plumage is ornamental, even when both sexes are alike. We may conclude that this is the case with many herons, egrets, etc., for they acquire their beautiful plumes only during the breeding season. Moreover, such plumes, topknots, etc., though possessed by both sexes, are occasionally a little more developed in the male than in the female; and they resemble the plumes and ornaments possessed by the males alone of other birds. It is also known that confinement, by affecting the reproductive system of male birds, frequently checks the development of their secondary sexual characters, but has no immediate influence on any other characters; and I am informed by Mr. Bartlett that eight or nine specimens of the Knot (*Tringa canutus*) retained their unadorned winter plumage in the Zoological Gardens throughout the year, from which fact we may infer that the summer plumage, though common to both sexes, partakes of the nature of the exclusively masculine plumage of many other birds.[80]

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[79] The brown mottled summer plumage of the ptarmigan is of as much importance to it, as a protection, as the white winter plumage; for in Scandinavia, during the spring, when the snow has disappeared, this bird is known to suffer greatly from birds of prey, before it has acquired its summer dress: see Wilhelm von Wright, in Lloyd, "Game Birds of Sweden," 1867, p. 125.

[80] In regard to the previous statements on moulting, see, on snipes, etc., Macgillivray, "Hist. Brit. Birds," vol. iv. p. 371; on Glareolæ, curlews, and bustards, Jerdon, "Birds of India," vol. iii. pp. 615, 630, 683; on Totanus, ibid., p. 700; on the plumes of herons, ibid., p. 738, and Macgillivray, vol. iv. pp. 435 and 444, and Mr. Stafford Allen, in the "Ibis," vol. v., 1863, p. 33.

From the foregoing facts, more especially from neither sex of certain birds changing color during either annual moult, or changing so slightly that the change can hardly be of any service to them, and from the females of other species moulting twice yet retaining the same colors throughout the year, we may conclude that the habit of annually moulting twice has not been acquired in order that the male should assume an ornamental character during the breeding season; but that the double moult, having been originally acquired for some distinct purpose, has subsequently been taken advantage of in certain cases for gaining a nuptial plumage.

It appears at first sight a surprising circumstance that some closely allied species should regularly undergo a double annual moult, and others only a single one. The ptarmigan, for instance, moults twice or even thrice in the year, and the black-cock only once; some of the splendidly colored honey-suckers (Nectariniæ) of India and some subgenera of obscurely colored pipits (Anthus) have a double, while others have only a single annual moult.[81] But the gradations in the manner of moulting, which are known to occur with various birds, show us how species or whole groups might have originally acquired their double annual moult, or, having once gained the habit, have again lost it. With certain bustards and plovers the vernal moult is far from complete, some feathers being renewed, and some changed in color. There is also reason to believe that with certain bustards and rail-like birds, which properly undergo a double moult, some of the older males retain their nuptial plumage throughout the year. A few highly modified feathers may merely be added during the spring to the plumage, as occurs with the disk-formed tail feathers of certain drongos (*Bhringa*) in India, and with the elongated feathers on the back, neck, and crest of certain

[81] On the moulting of the ptarmigan, see Gould's "Birds of Great Britain." On the honey-suckers, Jerdon, "Birds of India," vol. i. pp. 359, 365, 369. On the moulting of Anthus, see Blyth, in "Ibis," 1867, p. 32.

herons. By such steps as these, the vernal moult might be rendered more and more complete, until a perfect double moult was acquired. Some of the birds of paradise retain their nuptial feathers throughout the year, and thus have only a single moult; others cast them directly after the breeding season, and thus have a double moult; and others again cast them at this season during the first year, but not afterward; so that these latter species are intermediate in their manner of moulting. There is also a great difference with many birds in the length of time during which the two annual plumages are retained; so that the one might come to be retained for the whole year, and the other completely lost. Thus in the spring *Machetes pugnax* retains his ruff for barely two months. In Natal the male widow-bird (*Chera progne*) acquires his fine plumage and long tail-feathers in December or January, and loses them in March; so that they are retained only for about three months. Most species which undergo a double moult keep their ornamental feathers for about six months. The male, however, of the wild *Gallus bankiva* retains his neck-hackles for nine or ten months; and when these are cast off, the underlying black feathers on the neck are fully exposed to view. But with the domesticated descendant of this species, the neck-hackles of the male are immediately replaced by new ones; so that we here see, as to part of the plumage, a double moult changed under domestication into a single moult.[82]

The common drake (*Anas boschas*) after the breeding season is well known to lose his male plumage for a period of three months, during which time he assumes that of the

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[82] For the foregoing statements in regard to partial moults, and on old males retaining their nuptial plumage, see Jerdon, on bustards and plovers, in "Birds of India," vol. iii. pp. 617, 637, 709, 711. Also Blyth in "Land and Water," 1867, p. 84. On the moulting of Paradisea, see an interesting article by Dr. W. Marshall, "Archives Neerlandaises," tom. vi., 1871. On the Vidua, "Ibis," vol. iii., 1861, p. 133. On the Drongo-shrikes, Jerdon, ibid., vol. i. p. 435. On the vernal moult of the *Herodias bubulcus*, Mr. S. S. Allen, in "Ibis," 1863, p. 33. On *Gallus bankiva*, Blyth, in "Annals and Mag. of Nat. Hist.," vol. i., 1848, p. 455; see, also, on this subject, my "Variation of Animals under Domestication," vol. i. p. 236.

female. The male pintail-duck (*Anas acuta*) loses his plumage for the shorter period of six weeks or two months; and Montagu remarks that "this double moult within so short a time is a most extraordinary circumstance, that seems to bid defiance to all human reasoning." But the believer in the gradual modification of species will be far from feeling surprise at finding gradations of all kinds. If the male pintail were to acquire his new plumage within a still shorter period, the new male feathers would almost necessarily be mingled with the old, and both with some proper to the female; and this apparently is the case with the male of a not distantly allied bird, namely the *Merganser serrator*, for the males are said to "undergo a change of plumage, which assimilates them in some measure to the female." By a little further acceleration in the process, the double moult would be completely lost.[83]

Some male birds, as before stated, become more brightly colored in the spring, not by a vernal mount, but either by an actual change of color in the feathers or by their obscurely colored deciduary margins being shed. Changes of color thus caused may last for a longer or shorter time. In the *Pelecanus onocrotalus* a beautiful rosy tint, with lemon-colored marks on the breast, overspreads the whole plumage in the spring; but these tints, as Mr. Sclater states, "do not last long, disappearing generally in about six weeks or two months after they have been attained." Certain finches shed the margins of their feathers in the spring, and then become brighter colored, while other finches undergo no such change. Thus the *Fringilla tristis* of the United States (as well as many other American species) exhibits its bright colors only when the winter is past, while our goldfinch, which exactly represents this bird in habits, and our siskin, which represents it still more closely in structure, undergo no such annual change. But a difference of this kind in

[83] See Macgillivray, "Hist. British Birds" (vol. v. pp. 34, 70 and 223), on the moulting of the Anatidæ, with quotations from Waterton and Montagu. Also Yarrell, "Hist. of British Birds," vol. iii. p. 243.

the plumage of allied species is not surprising, for with the common linnet, which belongs to the same family, the crimson forehead and breast are displayed only during the summer in England, while in Madeira these colors are retained throughout the year.[84]

Display by Male Birds of their Plumage.—Ornaments of all kinds, whether permanently or temporarily gained, are sedulously displayed by the males, and apparently serve to excite, attract, or fascinate the females. But the males will sometimes display their ornaments when not in the presence of the females, as occasionally occurs with grouse at their balz-places, and as may be noticed with the peacock; this latter bird, however, evidently wishes for a spectator of some kind, and, as I have often seen, will show off his finery before poultry, or even pigs.[85] All naturalists who have closely attended to the habits of birds, whether in a state of nature or under confinement, are unanimously of opinion that the males take delight in displaying their beauty. Audubon frequently speaks of the male as endeavoring in various ways to charm the female. Mr. Gould, after describing some peculiarities in a male humming-bird, says he has no doubt that it has the power of displaying them to the greatest advantage before the female. Dr. Jerdon[86] insists that the beautiful plumage of the male serves "to fascinate and attract the female." Mr. Bartlett, at the Zoological Gardens, expressed himself to me in the strongest terms to the same effect.

It must be a grand sight in the forests of India "to come suddenly on twenty or thirty peafowl, the males displaying their gorgeous trains, and strutting about in all the pomp of

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[84] On the pelican, see Sclater, in "Proc. Zoolog. Soc.," 1868, p. 265. On the American finches, see Audubon, "Ornith. Biography," vol. i. pp. 174, 221, and Jerdon, "Birds of India," vol. ii. p. 383. On the *Fringilla cannabina* of Madeira, Mr. E. Vernon Harcourt, "Ibis," vol. v., 1863, p. 230.

[85] See also "Ornamental Poultry," by Rev. E. S. Dixon, 1848, p. 8.

[86] "Birds of India," introduct. vol. i. p. 24; on the peacock, vol. iii. p. 507. See Gould's "Introduction to the Trochilidæ," 1861, pp. 15 and 111.

pride before the gratified females." The wild turkey-cock erects his glittering plumage, expands his finely zoned tail and barred wing-feathers, and altogether, with his crimson and blue wattles, makes a superb, though to our eyes grotesque, appearance. Similar facts have already been given with respect to grouse of various kinds. Turning to another

FIG. 50.—Rupicola crocea, male (T. W. Wood).

Order. The male *Rupicola crocea* (Fig. 50) is one of the most beautiful birds in the world, being of a splendid orange, with some of the feathers curiously truncated and plumose. The female is brownish green, shaded with red, and has a much smaller crest. Sir R. Schomburgk has described their courtship; he found one of their meeting-places where ten males and two females were present. The space was from four to

five feet in diameter, and appeared to have been cleared of every blade of grass and smoothed as if by human hands. A male "was capering, to the apparent delight of several others. Now spreading its wings, throwing up its head, or opening its tail like a fan; now strutting about with a hopping gait until tired, when it gabbled some kind of note and was relieved by another. Thus three of them successively took the field, and then, with self-approbation, withdrew to rest." The Indians, in order to obtain their skins, wait at one of the meeting-places till the birds are eagerly engaged in dancing, and then are able to kill with their poisoned arrows four or five males, one after the other.[87] With birds of paradise a dozen or more full-plumaged males congregate in a tree to hold a dancing-party, as it is called by the natives; and here they fly about, raise their wings, elevate their exquisite plumes, and make them vibrate, and the whole tree seems, as Mr. Wallace remarks, to be filled with waving plumes. When thus engaged, they become so absorbed that a skilful archer may shoot nearly the whole party. These birds, when kept in confinement in the Malay Archipelago, are said to take much care in keeping their feathers clean; often spreading them out, examining them, and removing every speck of dirt. One observer, who kept several pairs alive, did not doubt that the display of the male was intended to please the female.[88]

The Gold and Amherst pheasants during their courtship not only expand and raise their splendid frills, but twist them, as I have myself seen, obliquely toward the female on whichever side she may be standing, obviously in order that a large surface may be displayed before her.[89] They

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[87] See the "Journal of the Royal Geographical Society," vol. x., 1840, p. 236.

[88] "Annals and Mag. of Nat. Hist.," vol. xiii., 1854, p. 157; also Wallace, ibid., vol. xx., 1857, p. 412, and "The Malay Archipelago," vol. ii., 1869, p. 252. Also Dr. Bennett, as quoted by Brehm, "Thierleben," B. iii. s. 326.

[89] Mr. T. W. Wood has given ("The Student," April, 1870, p. 115) a full account of this manner of display, by the Gold pheasant and by the Japanese pheasant, *Ph. versicolor;* and he calls it the lateral or one-sided display.

likewise turn their beautiful tails and tail-coverts a little toward the same side. Mr. Bartlett has observed a male Polyplectron (Fig. 51) in the act of courtship, and has

Fig. 51.—Polyplectron chinquis, male (T. W. Wood).

shown me a specimen stuffed in the attitude then assumed. The tail and wing-feathers of this bird are ornamented with beautiful ocelli, like those on the peacock's train. Now,

when the peacock displays himself, he expands and erects his tail transversely to his body, for he stands in front of the female, and has to show off, at the same time, his rich blue throat and breast. But the breast of the Polyplectron is obscurely colored, and the ocelli are not confined to the tail-feathers. Consequently the Polyplectron does not stand in front of the female; but he erects and expands his tail-feathers a little obliquely, lowering the expanded wing on the same side, and raising that on the opposite side. In this attitude the ocelli over the whole body are exposed at the same time before the eyes of the admiring female in one grand bespangled expanse. To whichever side she may turn, the expanded wings and the obliquely held tail are turned toward her. The male Tragopan pheasant acts in nearly the same manner, for he raises the feathers of the body, though not the wing itself, on the side which is opposite to the female, and which would otherwise be concealed, so that nearly all the beautifully spotted feathers are exhibited at the same time.

The Argus pheasant affords a much more remarkable case. The immensely developed secondary wing-feathers are confined to the male; and each is ornamented with a row of from twenty to twenty-three ocelli, above an inch in diameter. These feathers are also elegantly marked with oblique stripes and rows of spots of a dark color, like those on the skin of a tiger and leopard combined. These beautiful ornaments are hidden until the male shows himself off before the female. He then erects his tail, and expands his wing-feathers into a great, almost upright, circular fan or shield, which is carried in front of the body. The neck and head are held on one side, so that they are concealed by the fan; but the bird, in order to see the female before whom he is displaying himself, sometimes pushes his head between two of the long wing-feathers (as Mr. Bartlett has seen), and then presents a grotesque appearance. This must be a frequent habit with the bird in a state of nature, for Mr. Bartlett and his son, on examining some

perfect skins sent from the East, found a place between two of the feathers which was much frayed, as if the head

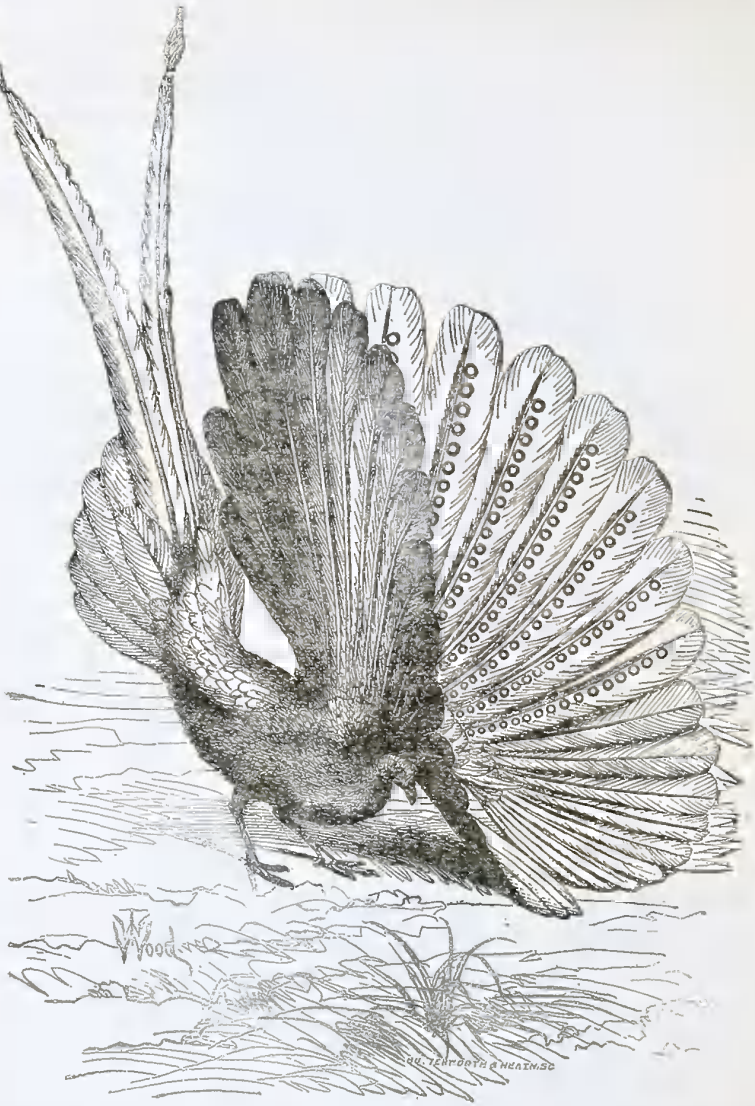

FIG. 52.—Side view of male Argus pheasant, while displaying before the female. Observed and sketched from nature by Mr. T. W. Wood

had here frequently been pushed through. Mr. Wood thinks that the male can also peep at the female on one side, beyond the margin of the fan.

The ocelli on the wing-feathers are wonderful objects; for they are so shaded that, as the Duke of Argyll remarks,[90] they stand out like balls lying loosely within sockets. When I looked at the specimen in the British Museum, which is mounted with the wings expanded and trailing downward, I was, however, greatly disappointed, for the ocelli appeared flat, or even concave. But Mr. Gould soon made the case clear to me, for he held the feathers erect, in the position in which they would naturally be displayed, and now, from the light shining on them from above, each ocellus at once resembled the ornament called a ball and socket. These feathers have been shown to several artists, and all have expressed their admiration at the perfect shading. It may well be asked, could such artistically shaded ornaments have been formed by means of sexual selection? But it will be convenient to defer giving an answer to this question until we treat in the next chapter of the principle of gradation.

The foregoing remarks relate to the secondary wing-feathers, but the primary wing-feathers, which in most gallinaceous birds are uniformly colored, are in the Argus pheasant equally wonderful. They are of a soft brown tint with numerous dark spots, each of which consists of two or three black dots with a surrounding dark zone. But the chief ornament is a space parallel to the dark blue shaft, which in outline forms a perfect second feather lying within the true feather. This inner part is colored of a lighter chestnut, and is thickly dotted with minute white points. I have shown this feather to several persons, and many have admired it even more than the ball and socket feathers, and have declared that it was more like a work of art than of nature. Now these feathers are quite hidden on all ordinary occasions, but are fully displayed, together with the long secondary feathers, when they are all expanded together so as to form the great fan or shield.

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[90] "The Reign of Law," 1867, p. 203.

The case of the male Argus pheasant is eminently interesting, because it affords good evidence that the most refined beauty may serve as a sexual charm, and for no other purpose. We must conclude that this is the case, as the secondary and primary wing-feathers are not at all displayed, and the ball and socket ornaments are not exhibited in full perfection, until the male assumes the attitude of courtship. The Argus pheasant does not possess brilliant colors, so that his success in love appears to depend on the great size of his plumes, and on the elaboration of the most elegant patterns. Many will declare that it is utterly incredible that a female bird should be able to appreciate fine shading and exquisite patterns. It is undoubtedly a marvellous fact that she should possess this almost human degree of taste. He who thinks that he can safely gauge the discrimination and taste of the lower animals may deny that the female Argus pheasant can appreciate such refined beauty; but he will then be compelled to admit that the extraordinary attitudes assumed by the male during the act of courtship, by which the wonderful beauty of his plumage is fully displayed, are purposeless; and this is a conclusion which I for one will never admit.

Although so many pheasants and allied gallinaceous birds carefully display their plumage before the females, it is remarkable, as Mr. Bartlett informs me, that this is not the case with the dull-colored Eared and Cheer pheasants (*Crossoptilon auritum* and *Phasianus wallichii*); so that these birds seem conscious that they have little beauty to display. Mr. Bartlett has never seen the males of either of these species fighting together, though he has not had such good opportunities for observing the Cheer as the Eared pheasant. Mr. Jenner Weir, also, finds that all male birds with rich or strongly characterized plumage are more quarrelsome than the dull-colored species belonging to the same groups. The goldfinch, for instance, is far more pugnacious than the linnet, and the blackbird than the thrush. Those birds which undergo a seasonal change of plumage likewise

become much more pugnacious at the period when they are most gayly ornamented. No doubt the males of some obscurely colored birds fight desperately together, but it appears that when sexual selection has been highly influential, and has given bright colors to the males of any species, it has also very often given a strong tendency to pugnacity. We shall meet with nearly analogous cases when we treat of mammals. On the other hand, with birds the power of song and brilliant colors have rarely been both acquired by the males of the same species; but in this case the advantage gained would have been the same, namely, success in charming the female. Nevertheless it must be owned that the males of several brilliantly colored birds have had their feathers specially modified for the sake of producing instrumental music, though the beauty of this cannot be compared, at least according to our taste, with that of the vocal music of many songsters.

We will now turn to male birds which are not ornamented in any high degree, but which nevertheless display during their courtship whatever attractions they may possess. These cases are in some respects more curious than the foregoing, and have been but little noticed. I owe the following facts to Mr. Weir, who has long kept confined birds of many kinds, including all the British Fringillidæ and Emberizidæ. The facts have been selected from a large body of valuable notes kindly sent me by him. The bullfinch makes his advances in front of the female, and then puffs out his breast, so that many more of the crimson feathers are seen at once than otherwise would be the case. At the same time he twists and bows his black tail from side to side in a ludicrous manner. The male chaffinch also stands in front of the female, thus showing his red breast and "blue bell," as the fanciers call his head; the wings at the same time being slightly expanded, with the pure white bands on the shoulders thus rendered conspicuous. The common linnet distends his rosy breast, slightly expands his brown wings and tail, so as to make the best of them

by exhibiting their white edgings. We must, however, be cautious in concluding that the wings are spread out solely for display, as some birds do so whose wings are not beautiful. This is the case with the domestic cock, but it is always the wing on the side opposite to the female which is expanded, and at the same time scraped on the ground. The male goldfinch behaves differently from all other finches: his wings are beautiful, the shoulders being black, with the dark-tipped wing-feathers spotted with white and edged with golden yellow. When he courts the female, he sways his body from side to side, and quickly turns his slightly expanded wings first to one side, then to the other, with a golden flashing effect. Mr. Weir informs me that no other British finch turns thus from side to side during his courtship, not even the closely allied male siskin, for he would not thus add to his beauty.

Most of the British Buntings are plain colored birds; but in the spring the feathers on the head of the male reed-bunting (*Emberiza schœniculus*) acquire a fine black color by the abrasion of the dusky tips; and these are erected during the act of courtship. Mr. Weir has kept two species of Amadina from Australia: the *A. castanotis* is a very small and chastely colored finch, with a dark tail, white rump, and jet-black upper tail-coverts, each of the latter being marked with three large conspicuous oval spots of white.[91] This species, when courting the female, slightly spreads out and vibrates these party-colored tail-coverts in a very peculiar manner. The male *Amadina Lathami* behaves very differently, exhibiting before the female his brilliantly spotted breast, scarlet rump, and scarlet upper tail-coverts. I may here add from Dr. Jerdon that the Indian bulbul (*Pycnonotus hæmorrhous*) has its under tail-coverts of a crimson color, and these, it might be thought, could never be well exhibited; but the bird "when excited often spreads them out laterally, so that they can be seen

[91] For the description of these birds, see Gould's "Handbook to the Birds of Australia," vol. i., 1865, p. 417.

even from above."[92] The crimson under tail-coverts of some other birds, as with one of the woodpeckers, *Picus major*, can be seen without any such display. The common pigeon has iridescent feathers on the breast, and every one must have seen how the male inflates his breast while courting the female, thus showing them off to the best advantage. One of the beautiful bronze-winged pigeons of Australia (*Ocyphaps lophotes*) behaves, as described to me by Mr. Weir, very differently: the male, while standing before the female, lowers his head almost to the ground, spreads out and raises his tail, and half expands his wings. He then alternately and slowly raises and depresses his body, so that the iridescent metallic feathers are all seen at once, and glitter in the sun.

Sufficient facts have now been given to show with what care male birds display their various charms, and this they do with the utmost skill. While preening their feathers, they have frequent opportunities for admiring themselves, and of studying how best to exhibit their beauty. But as all the males of the same species display themselves in exactly the same manner, it appears that actions, at first perhaps intentional, have become instinctive. If so, we ought not to accuse birds of conscious vanity; yet when we see a peacock strutting about, with expanded and quivering tail-feathers, he seems the very emblem of pride and vanity.

The various ornaments possessed by the males are certainly of the highest importance to them, for in some cases they have been acquired at the expense of greatly impeded powers of flight or of running. The African night-jar (Cosmetornis), which during the pairing season has one of its primary wing-feathers developed into a streamer of very great length, is thereby much retarded in its flight, although at other times remarkable for its swiftness. The "unwieldy size" of the secondary wing-feathers of the male Argus

[92] "Birds of India," vol. ii. p. 96.

pheasant are said "almost entirely to deprive the bird of flight." The fine plumes of male birds of paradise trouble them during a high wind. The extremely long tail-feathers of the male widow-birds (Vidua) of southern Africa render "their flight heavy"; but as soon as these are cast off they fly as well as the females. As birds always breed when food is abundant, the males probably do not suffer much inconvenience in searching for food from their impeded powers of movement; but there can hardly be a doubt that they must be much more liable to be struck down by birds of prey. Nor can we doubt that the long train of the peacock and the long tail and wing-feathers of the Argus pheasant must render them an easier prey to any prowling tiger-cat than would otherwise be the case. Even the bright colors of many male birds cannot fail to make them conspicuous to their enemies of all kinds. Hence, as Mr. Gould has remarked, it probably is that such birds are generally of a shy disposition, as if conscious that their beauty was a source of danger, and are much more difficult to discover or approach than the sombre-colored and comparatively tame females, or than the young and as yet unadorned males.[93]

It is a more curious fact that the males of some birds which are provided with special weapons for battle, and which in a state of nature are so pugnacious that they often kill each other, suffer from possessing certain ornaments. Cock-fighters trim the hackles and cut off the combs and gills of their cocks; and the birds are then said to be dubbed. An undubbed bird, as Mr. Tegetmeièr insists, "is at a fearful disadvantage; the comb and gills offer an easy hold to his adversary's beak, and as a cock always strikes where he holds, when once he has seized his foe,

[93] On the Cosmetornis, see Livingstone's "Expedition to the Zambesi," 1865, p. 66. On the Argus pheasant, Jardine's "Nat. Hist. Lib.: Birds," vol. xiv. p. 167. On Birds of Paradise, Lesson, quoted by Brehm, "Thierleben," B. iii. s. 325. On the widow-bird, Barrow's "Travels in Africa," vol. i. p. 243, and "Ibis," vol. iii., 1861, p. 133. Mr. Gould, on the shyness of male birds, "Handbook to Birds of Australia," vol. i., 1865, pp. 210, 457.

he has him entirely in his power. Even supposing that the bird is not killed, the loss of blood suffered by an undubbed cock is much greater than that sustained by one that has been trimmed."[94] Young turkey-cocks in fighting always seize hold of each other's wattles; and I presume that the old birds fight in the same manner. It may perhaps be objected that the comb and wattles are not ornamental, and cannot be of service to the birds in this way; but even to our eyes the beauty of the glossy black Spanish cock is much enhanced by his white face and crimson comb; and no one who has ever seen the splendid blue wattles of the male Tragopan pheasant distended in courtship can for a moment doubt that beauty is the object gained. From the foregoing facts we clearly see that the plumes and other ornaments of the males must be of the highest importance to them; and we further see that beauty is even sometimes more important than success in battle.

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[94] Tegetmeier, "The Poultry Book," 1866, p. 139.

CHAPTER XIV

BIRDS—*continued*

Choice exerted by the female—Length of courtship—Unpaired birds—Mental qualities and taste for the beautiful—Preference or antipathy shown by the female for particular males—Variability of birds—Variations sometimes abrupt—Laws of variation—Formation of ocelli—Gradations of character—Case of Peacock, Argus pheasant, and Urosticte

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 vigor, 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 balzing 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 capercailzie 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,[1] follow nearly the same habits. The fowlers discover the hillocks where the ruffs congregate by the grass being trampled bare, and this shows 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

[1] 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*.

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 large rats," puffing out their feathers, flapping their wings, and uttering the strangest cries.[2]

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, *corroborying 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[3] by a traveller, who heard in a valley beneath him, thickly covered with scrub, "a din which completely astonished" him; on crawling onward 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

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[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.

[3] Quoted by Mr. T. W. Wood in the "Student," April, 1870, p. 125.

the favors 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.[4]

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.

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[4] Gould, "Handbook to the Birds of Australia," vol. i. pp. 300, 308, 448, 451. On the ptarmigan, above alluded to, see Lloyd, ibid., p. 129.

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.[5] 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 while 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 while 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.

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 afterward to find the survivor rematched. Mr. Fox, Mr. F. Bond, and others have shot one of a pair of carrion-crows (*Corvus corone*), but

[5] On magpies, Jenner, in "Phil. Transact.," 1824, p. 21. Macgillivray, "Hist. British Birds," vol. i. p. 570. Thompson, in "Annals and Mag. of Nat. Hist.," vol. viii., 1842, p. 494.

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 while 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 chrysaëtos*), 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 (*Phœnicura ruticilla*), 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 neighborhood. 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.[6]

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, showing that they have either lost or never gained a mate. Death from accident or dis-

[6] 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," edit. of 1825, vol. i. p. 139. On the Phœnicura, 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.

ease 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.[7] Such contingencies as these probably explain most of the foregoing cases.[8] 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 toward particular males.

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[7] 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 Rev. L. Jenyns, "Observations in Nat. Hist.," 1846, p. 87.

[8] The following case has been given ("The Times," Aug. 6, 1868) by the Rev. F. O. 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 succor the orphan. These two he killed, and then left the nest. On returning afterward 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[9] 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 afterward uttering a plaintive call; and Mr. St. John gives various facts proving the attachment of mated birds.[10] Mr. Bennett relates[11] 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 recognized 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

[9] 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."

[10] "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."

[11] "Wanderings in New South Wales," vol. ii., 1834, p. 62.

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 afterward matched with other birds, the two, when brought together again, rarely, if ever, recognize each other.

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 shown 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 frostbitten 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." [12] They have good memories, for in the Zoological Gardens they have plainly recognized their former masters after an interval of some months.

Birds possess acute powers of observation. Every mated bird, of course, recognizes its fellow. Audubon states that a certain number of mocking-thrushes (*Mimus polyglottus*) remain all the year round in Louisiana, while others migrate to the Eastern States; these latter, on their return, are instantly recognized, 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 show, without any apparent cause, toward certain individuals. I have heard of numerous instances with jays, partridges, canaries, and especially

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

bullfinches. Mr. Hussey has described in how extraordinary a manner a tamed partridge recognized everybody; and its likes and dislikes were very strong. This bird seemed "fond of gay colors, and no new gown or cap could be put on without catching his attention." [13] 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 afterward 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 recognized each other as old friends.[14]

Mr. Jenner Weir is convinced that birds pay particular attention to the colors of other birds, sometimes out of jealousy, and sometimes as a sign of kinship. Thus he turned a reed-bunting (*Emberiza schœniculus*), which had acquired its black headdress, into his aviary, and the new-comer 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 color; and though generally peaceable, it attacked *S. ciris*,

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[13] "The Zoologist," 1847–1848, p. 1602.

[14] Hewitt on wild-ducks, "Journal of Horticulture," Jan. 13, 1863, p. 39. Audubon on the wild turkey, "Ornith. Biography," vol. i. p. 14. On the mocking-thrush, ibid., vol. i. p. 110.

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 crossbill, and nearly killed a goldfinch. On the other hand, he has observed that some birds, when first introduced, fly toward the species which resemble them most in color, 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,[15] attracts the ruff toward any bright object, so that, in the Ionian Islands, "it will dart down to a bright-colored 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?

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

[15] The "Ibis," vol. ii., 1860, p. 344.

beautiful is afforded by the three genera of Australian bower-birds already mentioned. Their bowers (see Fig. 46, p. 494), 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 gayly-colored articles, such as the blue tail-feathers of paroquets, 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 rearranged and carried about by the birds while 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 colors, 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 color, the whole showing 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.[16]

Preference for Particular Males by the Females.—Having made these preliminary remarks on the discrimination and

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[16] On the ornamented nests of Humming-birds, Gould, "Introduction to the Trochilidæ," 1861, p. 19. On the bower-birds, Gould, "Handbook to the Birds of Australia," 1865, vol. i. pp. 444–461. Ramsay in the "Ibis," 1867, p. 456.

taste of birds, I will give all the facts known to me, which bear on the preference shown by the females 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.[17] Several years ago eighteen cases had been recorded of the occurrence in Great Britain of hybrids between the black grouse and pheasant;[18] 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[19] 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 widgeon (*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

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[17] "Hist. of British Birds," vol. ii. p. 92.

[18] "Zoologist," 1853–1854, p. 3946.

[19] Waterton, "Essays on Nat. Hist.," 2d series, pp. 42 and 117. For the following statements, see on the widgeon, 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, "Stubenvögel," 1840, s. 230. Mr. J. Jenner Weir has lately given me an analogous case with ducks of two species.

and rear young with individuals of a race (species) apparently the most alien to themselves, as with their own stock."

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 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. Color, 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. Vitiated 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 shown for one." The female of the red-winged starling (*Agelæus phœniceus*) 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." [20] Many similar statements with respect to other birds could be cited from this same observer.

Turning now to domesticated and confined birds, I will commence by giving what little I have learned 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 game cock, 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 ac-

[20] Audubon, "Ornitholog. Biography," vol. i. pp. 191, 349; vol. ii. pp. 42, 275; vol. iii. p. 2.

tually 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.[21]

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.[22] Mr. Harrison Weir has lately heard from a trustworthy observer, who keeps blue pigeons, that these drive away all other colored 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, color 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.

Female pigeons occasionally feel a strong antipathy toward certain males, without any assignable cause. Thus MM. Boitard and Corbié, whose experience extended over forty-five years, state: "Quand une femelle éprouve de l'antipa-

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[21] "Rare and Prize Poultry," 1854, p. 27.

[22] "The Variation of Animals and Plants under Domestication," vol. ii. p. 103.

thie pour un mâle avec lequel on veut l'accoupler, malgré tous les feux de l'amour, malgré l'alpiste et le chènevis dont on la nourrit pour augmenter son ardeur, malgré un emprisonnement de six mois et même d'un an, elle refuse constamment ses caresses; les avances empressées, les agaceries, les tournoiemens, les tendres roucoulemens, rien ne peut lui plaire ni l'émouvoir; gonflée, boudeuse, blottie dans un coin de sa prison, elle n'en sort que pour boire et manger, ou pour repousser avec une espèce de rage des caresses devenues trop pressantes."[23] 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,[24] 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.

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.[25]

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 peacock. 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 trellis-walls of his prison, and would not

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[23] Boitard and Corbié, "Les Pigeons," etc., 1824, p. 12. Prosper Lucas ("Traité de l'Héréd. Nat.," tom. ii., 1850, p. 296) has himself observed nearly similar facts with pigeons.

[24] "Die Taubenzucht," 1824, s. 86.

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

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."[26] This rival was a japanned or black-winged peacock, to our eyes a more beautiful bird than the common kind.

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.[27] Here is an analogous case: Dr. Jaeger,[28] 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 afterward held the flock.

It is a remarkable fact, as showing how important color 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.[29] 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 colored comrades.

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[26] "Proc. Zool. Soc.," 1835, p. 54. The japanned peacock is considered by Mr. Sclater as a distinct species, and has been named *Pavo nigripennis*; but the evidence seems to me to show that it is only a variety.

[27] Rudolphi, "Beyträge zur Anthropologie," 1812, s. 184.

[28] "Die Darwin'sche Theorie, und ihre Stellung zu Moral und Religion," 1869, s. 59.

[29] 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 while he is parading at one of the places of assemblage, and solicit his attention.[30] 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 the 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-colored 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 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 showing 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

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[30] 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 capercailzie, Lloyd, "Game Birds of Sweden," 1867, p. 23.

convinced that the pheasant invariably prefers the older birds. He does not appear to be in the least influenced by their color, but "is most capricious in his attachments;"[31] from some inexplicable cause he shows 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. Ekström, "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.[32]

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 color 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 color 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

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[31] Mr. Hewitt, quoted in "Tegetmeier's Poultry Book," 1866, p. 165.
[32] Quoted in Lloyd's "Game Birds of Sweden," p. 345.

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 probable that 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 color; 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.[33] 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,[34] who shows that in

[33] 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 shows 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.

[34] "Mammals and Birds of East Florida," also an "Ornithological Reconnoissance of Kansas," etc. Notwithstanding the influence of climate on the colors of 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 colored 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 colored species are common. I have

the United States many species of birds gradually become more strongly colored in proceeding southward, and more lightly colored 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 colors 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.

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.[35] Nevertheless it may be worth while to give the few cases which I have been able to collect, relating chiefly to color—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[36] that near Bogota certain humming-birds belonging to the genus Cynanthus are divided into two or three races or varieties, which differ from each other

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sometimes speculated whether the prevailing dull tints of the scenery in the above named countries may not have affected the appreciation of bright colors by the birds inhabiting them.

[35] "Origin of Species," fifth edit., 1869, p. 104. I had always perceived 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.

[36] "Introduct. to the Trochilidæ," p. 102.

in the coloring 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 paroquets "the thighs in some are scarlet, in others grass green." In another paroquet 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." [37] 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;" [38] but this variation seems to be somewhat rare, so that its preservation through sexual selection would follow only under unusually favorable 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." [39]

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 clamor by the other ravens of the island was the chief cause which led Brünnich to conclude that they were specifically distinct; but this is now known to be an error.[40] This case seems analogous

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[37] Gould, "Handbook to Birds of Australia," vol. ii. pp. 32 and 38.

[38] Audubon, "Ornitholog. Biography," 1838, vol. iv. p. 389.

[39] Jerdon, "Birds of India," vol. i. p. 108; and Mr. Blyth, in "Land and Water," 1868, p. 381.

[40] Graba, "Tagebuch, Reise nach Färo," 1830, s. 51–54. Macgillivray, "Hist. British Birds," vol. iii. p. 745. "Ibis," vol. v., 1863, p. 469.

to that lately given of albino birds not pairing from being rejected by their comrades.

In various parts of the northern seas a remarkable variety of the common Guillemot (*Uria troile*) is found; and in Feroe, one out of every five birds, according to Graba's estimation, presents this variation. It is characterized[41] 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 shown,[42] transmitted either unaltered or not at all. We thus see that two distinct forms of the same species may coexist 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.

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.[43] 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

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[41] Graba, ibid., s. 54. Macgillivray, ibid., vol. v. p. 327.

[42] "Variation of Animals and Plants under Domestication," vol. ii. p. 92.

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

are highly favorable 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.

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 colors 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 color in the two sexes?[44] In some cases the eyes differ conspicuously; thus with the storks of the genus *Xenorhynchus*, those of the male are blackish hazel, while those of the females are gamboge-yellow; with many hornbills (Buceros), as I hear from Mr. Blyth,[45] 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 color of the eyes have been preserved or augmented through sexual selection in the males? This is very doubtful; for Mr. Bartlett showed me in the Zoological Gardens that the inside of the mouth of this Buceros is black in the male and flesh colored in the female; and their external appearance or beauty would not be thus affected. I observed in Chile[46] 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,

[44] See, for instance, on the irides of a Podica and Gallicrex in "Ibis," vol. ii., 1860, p. 206; and vol. v., 1863, p. 426.

[45] See also Jerdon, "Birds of India," vol. i. pp. 243–245.

[46] "Zoology of the Voyage of H.M.S. Beagle," 1841, p. 6.

leaden-colored, fleshy crest or comb. The comb of many gallinaceous birds is highly ornamental, and assumes vivid colors during the act of courtship; but what are we to think of the dull-colored 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.

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 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 topknot, 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; while those on the head of the female are of the ordinary shape. The color also of the hackles forming the topknot 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 Crève-cœur breeds. In some natural species we may observe exactly the same correlation in the colors 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 coloring 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 colored 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 colored 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 toward 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 colored 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 colored 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 colored 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.[47]

Formation and Variability of the Ocelli or Eyelike 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 color, 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 South African moth (*Gyanonis 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 coloration are so unstable in the Lepidoptera as the ocelli, both in number and size." Mr. Wallace, who first called my attention to this subject, showed 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 South African butterfly (*Cyllo leda*, Linn.), belonging to the same family, the ocelli are even still more variable.

[47] Bechstein, "Naturgeschichte Deutschlands," B. iv., 1795, s. 31, on a sub-variety of the Monck pigeon.

In some specimens (A, Fig. 53) large spaces on the upper surface of the wings are colored black, and include irregular white marks; and from this state a complete gradation can be traced into a tolerably perfect ocellus (A^1), and this results from the contraction of the irregular blotches of color. 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 symmet-

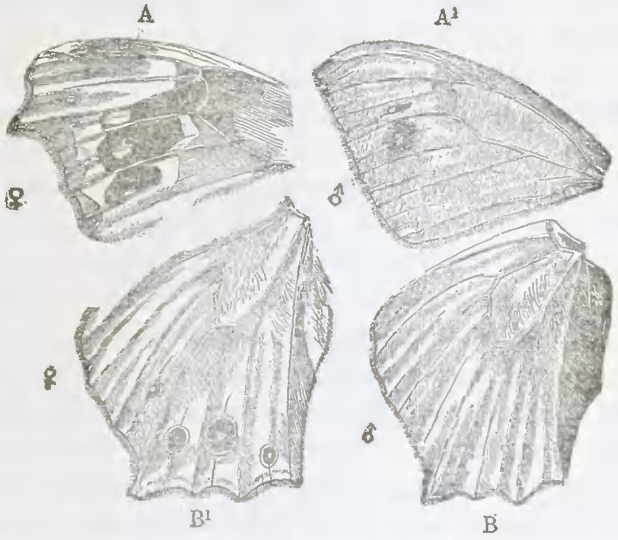

FIG. 53.—Cyllo leda, Linn., from a drawing by Mr. Trimen, showing the extreme range of variation in the ocelli.

A. Specimen, from Mauritius, upper surface of fore-wing.
A1. Specimen, from Natal, ditto.
B. Specimen, from Java, upper surface of hind-wing.
B1. Specimen, from Mauritius, ditto.

rical and large ocelli (B^1).[48] In cases like these, the development of a perfect ocellus does not require a long course of variation and selection.

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.

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[48] 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 of this butterfly, in his "Rhopalocera Africæ Australis," p. 186.

In the Tragopan pheasant faint white lines in the female represent the beautiful white spots in the male;[49] and something of the same kind may be observed in the two sexes of the Argus pheasant. However this may be, appearances strongly favor the belief that, on the one hand, a dark spot is often formed by the coloring matter being drawn toward 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 color 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 coloring 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 color, have been generated, I will not pretend to say. But the zoned feathers of the mongrels from differently colored 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.

Gradation of Secondary Sexual Characters.—Cases of gradation are important, as showing 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 colors or

[49] Jerdon, "Birds of India," vol. iii. p. 517.

other ornaments, we ought to behold the long line of his extinct progenitors; but this is obviously impossible. We may, however, generally gain a clew 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 toward the extremity of the shaft forming the oval disk 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 disk 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 disk is surrounded by an almost transparent zone, which gives it a highly finished aspect. But I have elsewhere described [50] 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 surround-

[50] "Variation of Animals and Plants under Domestication," vol. i. p. 254.

ing zones likewise show traces, as may be seen in the drawing (Fig. 54), of indentations, or rather breaks. These indentations are common to the Indian and Java peacocks (*Pavo cristatus* and *P. muticus*), and they seemed to deserve particular attention, as probably connected with the development of the ocellus; but for a long time I could not conjecture their meaning.

If we admit the principle of gradual evolution, there

Fig. 54.—Feather of Peacock, about two-thirds of natural size, drawn by Mr. Ford. The transparent zone is represented by the outermost white zone, confined to the upper end of the disk.

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 colored spots on other birds; and so with all the other characters of the

peacock. Let us look to the allied Gallinaceæ 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-colored 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 (Fig. 51, p. 514) 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 the species the ocelli on the wings and tail are either circular or oval, and consist of a beautiful, iridescent, greenish blue or greenish purple disk, with a black border. This border in *P. chinquis* shades into brown, edged with cream-color, 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 (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* (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 colored zones are likewise indented. A single ocellus is thus formed on each tail-covert, though

Fig. 55.—Part of a tail-covert of Polyplectron chinquis, with the two ocelli of natural size.

Fig. 56.—Part of a tail-covert of Polyplectron malaccense, with the two ocelli partially confluent, of natural size.

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 toward 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 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 showed 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-colored 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 color, 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 disk and of the surrounding zones of the ocellus, in both species of peacock, speaks plainly in favor 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 of 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 concourse of atoms of coloring 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 clew 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 (Fig. 57) or with rows of dark spots (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.

FIG. 57.—Part of secondary wing-feather of Argus pheasant, showing two perfect ocelli, *a* and *b*. A, B, C, D, etc., are dark stripes running obliquely down, each to an ocellus. [Much of the web on both sides, especially to the left of the shaft, has been cut off.]

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 inclosed ball; it is also sometimes broken toward the base on the right hand. These little breaks have an important meaning. The ring is always much thickened, with the edges ill-defined toward 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 downward into a pale leaden hue, and this into yellowish and brown tints, which insensibly become darker and darker toward the lower part of the ball. It is this shading which gives so admirably the effect of light shining on a convex surface.

Fig. 58.—Basal part of the secondary wing-feather nearest to the body.

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 color, which cannot, of course, be shown in a 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 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 (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 shown in the accompanying figure (Fig. 59). We here see several oblique rows, A, B, C, D, etc. (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 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, the lowest mark (*b*) is thicker and considerably longer than the upper spots, and has its left extremity pointed and curved upward. 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 toward 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 (Fig. 58), but is more highly developed and more brightly colored. Above and to the right of this spot (*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 downward 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

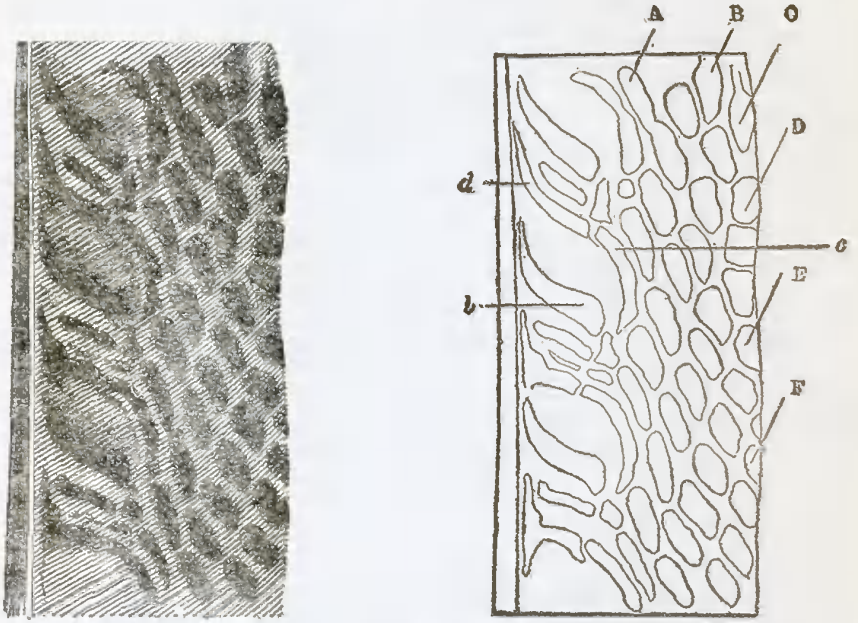

FIG. 59.—Portion of one of the secondary wing-feathers near to the body, showing the so-called elliptic ornaments. The right-hand figure is given merely as a diagram for the sake of the letters of reference.

A, B, C, D, etc. Rows of spots running down to and forming the elliptic ornaments.
b. Lowest spot or mark in row B.
c. The next succeeding spot or mark in the same row.
d. Apparently a broken prolongation of the spot *c* in the same row B.

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 shown.

FIG. 60.—An ocellus in an intermediate condition between the elliptic ornament and the perfect ball-and-socket ocellus.

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 (*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 (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 (*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 colored than in a perfect ball-and-socket ocellus. Even in the most perfect ocelli, traces of the junction of three or four elon-

gated black marks, by which the ring has been formed, may often be detected. The irregular sub-triangular or narrow mark (*d*, Fig. 59), manifestly forms, by its contraction and equalization, 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 (*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 black ring 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 zig-zag 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 leaden 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 toward 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-colored shades of the elliptic ornaments. Thus almost every minute detail in the shape and coloring of the ball-and-socket ocelli can be shown 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 (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 (Fig. 61). The oblique longitudinal stripes suddenly cease upward 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 furthest 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 show less tendency

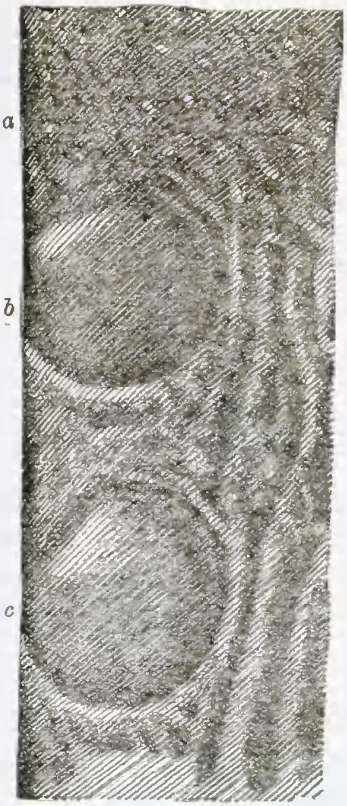

FIG. 61.—Portion near summit of one of the secondary wing-feathers, bearing perfect ball-and-socket ocelli. *a* Ornamented upper part. *b*. Uppermost, imperfect ball-and-socket ocellus. (The shading above the white mark on the summit of the ocellus is here a little too dark.) *c*. Perfect ocellus.

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,[51] 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 upward; and the bird while 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 toward 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.[52]

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[51] The "Field," May 28, 1870.

[52] "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 show us the steps passed through by the extinct progenitors of the species; but they probably give us the clew 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 color, into one of the so-called elliptic ornaments. These latter ornaments have been shown 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 colors 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 *Urosticte 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, while the female has the six exterior feathers ornamented with white tips. What makes the case more curious is that, although the coloring of the tail differs remarkably in both sexes of many kinds of humming-birds, Mr. Gould does not know a single species, besides the Urosticte, in which the male has the four central feathers tipped with white.

The Duke of Argyll, in commenting on this case,[53] 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

[53] "The Reign of Law," 1867, p. 247.

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 splendor of these feathers. We have, moreover, good evidence that humming-birds take especial pains in displaying their tail-feathers; Mr. Belt,[54] 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 show 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. While 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."[55] 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.

[54] "The Naturalist in Nicaragua," 1874, p. 112.
[55] "Introduction to the Trochilidæ," 1861, p. 110.

CHAPTER XV

BIRDS—*continued*

Discussion as to why the males alone of some species, and both sexes of others, are brightly colored—On sexually limited inheritance, as applied to various structures and to brightly colored plumage—Nidification in relation to color—Loss of nuptial plumage during the winter

WE HAVE in this chapter to consider why the females of many birds have not acquired the same ornaments as the male; and why, on the other hand, both sexes of many other birds are equally, or almost equally, ornamented? In the following chapter we shall consider the few cases in which the female is more conspicuously colored than the male.

In my "Origin of Species"[1] I briefly suggested that the long tail of the peacock would be inconvenient, and the conspicuous black color of the male capercailzie dangerous, to the female during the period of incubation; and consequently that the transmission of these characters from the male to the female offspring had been checked through natural selection. I still think that this may have occurred in some few instances; but, after mature reflection on all the facts which I have been able to collect, I am now inclined to believe that when the sexes differ, the successive variations have generally been from the first limited in their transmission to the same sex in which they first arose. Since my remarks appeared, the subject of sexual coloration has been discussed in some very interesting papers by

[1] Fourth edition, 1866, p. 241.

Mr. Wallace,[2] who believes that in almost all cases the successive variations tended at first to be transmitted equally to both sexes; but that the female was saved, through natural selection, from acquiring the conspicuous colors of the male, owing to the danger which she would thus have incurred during incubation.

This view necessitates a tedious discussion on a difficult point, namely, whether the transmission of a character which is at first inherited by both sexes can be subsequently limited in its transmission to one sex alone by means of natural selection. We must bear in mind, as shown in the preliminary chapter on sexual selection, that characters which are limited in their development to one sex are always latent in the other. An imaginary illustration will best aid us in seeing the difficulty of the case. We may suppose that a fancier wished to make a breed of pigeons in which the males alone should be colored of a pale blue, while the females retained their former slaty tint. As with pigeons characters of all kinds are usually transmitted to both sexes equally, the fancier would have to try to convert this latter form of inheritance into sexually limited transmission. All that he could do would be to persevere in selecting every male pigeon which was in the least degree of a paler blue; and the natural result of this process, if steadily carried on for a long time, and if the pale variations were strongly inherited or often recurred, would be to make his whole stock of a lighter blue. But our fancier would be compelled to match, generation after generation, his pale-blue males with slaty females, for he wishes to keep the latter of this color. The result would generally be the production either of a mongrel piebald lot, or more probably the speedy and complete loss of the pale-blue tint; for the primordial slaty color would be transmitted with prepotent force. Supposing, however, that some pale blue males and slaty females

[2] "Westminster Review," July, 1867. "Journal of Travel," vol. i., 1868, p. 73.

were produced during each successive generation, and were always crossed together; then the slaty females would have, if I may use the expression, much blue blood in their veins, for their fathers, grandfathers, etc., will all have been blue birds. Under these circumstances it is conceivable (though I know of no distinct facts rendering it probable) that the slaty females might acquire so strong a latent tendency to pale-blueness, that they would not destroy this color in their male offspring, their female offspring still inheriting the slaty tint. If so, the desired end of making a breed with the two sexes permanently different in color might be gained.

The extreme importance, or rather necessity, in the above case of the desired character, namely, pale-blueness, being present though in a latent state in the female, so that the male offspring should not be deteriorated, will be best appreciated as follows: The male of Scœmmerring's pheasant has a tail thirty-seven inches in length, while that of the female is only eight inches; the tail of the male common pheasant is about twenty inches, and that of the female twelve inches long. Now if the female Scœmmerring pheasant with her *short* tail were crossed with the male common pheasant, there can be no doubt that the male hybrid offspring would have a much *longer* tail than that of the pure offspring of the common pheasant. On the other hand, if the female common pheasant, with a tail much longer than that of the female Scœmmerring pheasant, were crossed with the male of the latter, the male hybrid offspring would have a much *shorter* tail than that of the pure offspring of Scœmmerring's pheasant.[8]

Our fancier, in order to make his new breed with the males of a pale-blue tint, and the females unchanged, would have to continue selecting the males during many

[8] Temminck says that the tail of the female *Phasianus Scœmmerringii* is only six inches long. "Planches coloriées," vol. v., 1838, pp. 487 and 488: the measurements above given were made for me by Mr. Sclater. For the common pheasant, see Macgillivray, "Hist. Brit. Birds," vol. i. pp. 118-121.

generations; and each stage of paleness would have to be fixed in the males, and rendered latent in the females. The task would be an extremely difficult one, and has never been tried, but might possibly be successfully carried out. The chief obstacle would be the early and complete loss of the pale-blue tint, from the necessity of reiterated crosses with the slaty female, the latter not having at first any *latent* tendency to produce pale-blue offspring.

On the other hand, if one or two males were to vary ever so slightly in paleness, and the variations were from the first limited in their transmission to the male sex, the task of making a new breed of the desired kind would be easy, for such males would simply have to be selected and matched with ordinary females. An analogous case has actually occurred, for there are breeds of the pigeon in Belgium[4] in which the males alone are marked with black striæ. So again Mr. Tegetmeier has recently shown[5] that dragons not rarely produce silver-colored birds, which are almost always hens; and he himself has bred ten such females. It is, on the other hand, a very unusual event when a silver male is produced; so that nothing would be easier, if desired, than to make a breed of dragons with blue males and silver females. This tendency is, indeed, so strong that when Mr. Tegetmeier at last got a silver male and matched him with one of the silver females, he expected to get a breed with both sexes thus colored; he was, however, disappointed, for the young male reverted to the blue color of his grandfather, the young female alone being silver. No doubt, with patience this tendency to reversion in the males, reared from an occasional silver male matched with a silver hen, might be eliminated, and then both sexes would be colored alike; and this very process has been followed with success by Mr. Esquilant in the case of silver turbits.

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[4] Dr. Chapuis, "Le Pigeon Voyageur Belge," 1865, p. 87.
[5] The "Field," Sept. 1872.

With fowls, variations of color, limited in their transmission to the male sex, habitually occur. When this form of inheritance prevails, it might well happen that some of the successive variations would be transferred to the female, who would then slightly resemble the male, as actually occurs in some breeds. Or again, the greater number, but not all, of the successive steps might be transferred to both sexes, and the female would then closely resemble the male. There can hardly be a doubt that this is the cause of the male pouter pigeon having a somewhat larger crop, and of the male carrier pigeon having somewhat larger wattles than their respective females; for fanciers have not selected one sex more than the other, and have had no wish that these characters should be more strongly displayed in the male than in the female, yet this is the case with both breeds.

The same process would have to be followed, and the same difficulties encountered, if it were desired to make a breed with the females alone of some new color.

Lastly, our fancier might wish to make a breed with the two sexes differing from each other, and both from the parent species. Here the difficulty would be extreme, unless the successive variations were from the first sexually limited on both sides, and then there would be no difficulty. We see this with the fowl; thus the two sexes of the pencilled Hamburghs differ greatly from each other, and from the two sexes of the aboriginal *Gallus bankiva;* and both are now kept constant to their standard of excellence by continued selection, which would be impossible unless the distinctive characters of both were limited in their transmission. The Spanish fowl offers a more curious case; the male has an immense comb, but some of the successive variations, by the accumulation of which it was acquired, appear to have been transferred to the female; for she has a comb many times larger than that of the females of the parent species. But the comb of the female differs in one respect from that of the male, for it is apt to lop over; and within a recent period it has been ordered by

the fancy that this should always be the case, and success has quickly followed the order. Now the lopping of the comb must be sexually limited in its transmission, otherwise it would prevent the comb of the male from being perfectly upright, which would be abhorrent to every fancier. On the other hand, the uprightness of the comb in the male must likewise be a sexually limited character, otherwise it would prevent the comb of the female from lopping over.

From the foregoing illustrations, we see that, even with almost unlimited time at command, it would be an extremely difficult and complex, perhaps an impossible, process to change one form of transmission into the other through selection. Therefore, without distinct evidence in each case, I am unwilling to admit that this has been effected in natural species. On the other hand, by means of successive variations, which were from the first sexually limited in their transmission, there would not be the least difficulty in rendering a male bird widely different in color or in any other character from the female; the latter being left unaltered, or slightly altered, or specially modified for the sake of protection.

As bright colors are of service to the males in their rivalry with other males, such colors would be selected, whether or not they were transmitted exclusively to the same sex. Consequently the females might be expected often to partake of the brightness of the males to a greater or less degree; and this occurs with a host of species. If all the successive variations were transmitted equally to both sexes, the females would be indistinguishable from the males; and this likewise occurs with many birds. If, however, dull colors were of high importance for the safety of the female during incubation, as with many ground birds, the females which varied in brightness, or which received through inheritance from the males any marked accession of brightness, would sooner or later be destroyed. But the tendency in the males to continue for an indefinite period

transmitting to their female offspring their own brightness, would have to be eliminated by a change in the form of inheritance; and this, as shown by our previous illustration, would be extremely difficult. The more probable result of the long-continued destruction of the more brightly colored females, supposing the equal form of transmission to prevail, would be the lessening or annihilation of the bright colors of the males, owing to their continual crossing with the duller females. It would be tedious to follow out all the other possible results; but I may remind the reader that if sexually limited variations in brightness occurred in the females, even if they were not in the least injurious to them, and consequently were not eliminated, yet they would not be favored or selected, for the male usually accepts any female, and does not select the more attractive individuals; consequently these variations would be liable to be lost, and would have little influence on the character of the race; and this will aid in accounting for the females being commonly duller colored than the males.

In the eighth chapter instances were given, to which many might here be added, of variations occurring at various ages, and inherited at the corresponding age. It was also shown that variations which occur late in life are commonly transmitted to the same sex in which they first appear; while variations occurring early in life are apt to be transmitted to both sexes; not that all the cases of sexually limited transmission can thus be accounted for. It was further shown that if a male bird varied by becoming brighter while young, such variations would be of no service until the age for reproduction had arrived, and there was competition between rival males. But in the case of birds living on the ground and commonly in need of the protection of dull colors, bright tints would be far more dangerous to the young and inexperienced than to the adult males. Consequently the males which varied in brightness while young would suffer much destruction and be eliminated through natural selection; on the other hand, the males which varied

in this manner when nearly mature, notwithstanding that they were exposed to some additional danger, might survive, and, from being favored through sexual selection, would procreate their kind. As a relation often exists between the period of variation and the form of transmission, if the bright colored young males were destroyed and the mature ones were successful in their courtship, the males alone would acquire brilliant colors and would transmit them exclusively to their male offspring. But I by no means wish to maintain that the influence of age on the form of transmission is the sole cause of the great difference in brilliancy between the sexes of many birds.

When the sexes of birds differ in color, it is interesting to determine whether the males alone have been modified by sexual selection, the females having been left unchanged, or only partially and indirectly thus changed; or whether the females have been specially modified through natural selection for the sake of protection. I will, therefore, discuss this question at some length, even more fully than its intrinsic importance deserves; for various curious collateral points may thus be conveniently considered.

Before we enter on the subject of color, more especially in reference to Mr. Wallace's conclusions, it may be useful to discuss some other sexual differences under a similar point of view. A breed of fowls formerly existed in Germany,[6] in which the hens were furnished with spurs; they were good layers, but they so greatly disturbed their nests with their spurs that they could not be allowed to sit on their own eggs. Hence, at one time it appeared to me probable that with the females of the wild Gallinaceæ the development of spurs had been checked through natural selection from the injury thus caused to their nests. This seemed all the more probable, as wing-spurs, which would not be injurious during incubation, are often as well developed in the female as in the male; though in not a few

[6] Bechstein, "Naturgesch. Deutschlands," 1793, B. iii. s. 339.

cases they are rather larger in the male. When the male is furnished with leg spurs the female almost always exhibits rudiments of them—the rudiment sometimes consisting of a mere scale, as in Gallus. Hence, it might be argued that the females had aboriginally been furnished with well-developed spurs, but that these had subsequently been lost through disuse or natural selection. But if this view be admitted, it would have to be extended to innumerable other cases; and it implies that the female progenitors of the existing spur-bearing species were once encumbered with an injurious appendage.

In some few genera and species, as in Galloperdix, Acomus, and the Javan peacock (*Pavo muticus*), the females, as well as the males, possess well-developed leg spurs. Are we to infer from this fact that they construct a different sort of nest from that made by their nearest allies, and not liable to be injured by their spurs; so that the spurs have not been removed? Or are we to suppose that the females of these several species especially require spurs for their defence? It is a more probable conclusion that both the presence and absence of spurs in the females result from different laws of inheritance having prevailed, independently of natural selection. With the many females in which spurs appear as rudiments, we may conclude that some few of the successive variations through which they were developed in the males occurred very early in life, and were consequently transferred to the females. In the other and much rarer cases, in which the females possess fully developed spurs, we may conclude that all the successive variations were transferred to them; and that they gradually acquired and inherited the habit of not disturbing their nests.

The vocal organs and the feathers variously modified for producing sound, as well as the proper instincts for using them, often differ in the two sexes, but are sometimes the same in both. Can such differences be accounted for by the males having acquired these organs and instincts, while the females have been saved from inheriting them, on ac-

count of the danger to which they would have been exposed by attracting the attention of birds or beasts of prey? This does not seem to me probable, when we think of the multitude of birds which with impunity gladden the country with their voices during the spring.[7] It is a safer conclusion that, as vocal and instrumental organs are of special service only to the males during their courtship, these organs were developed through sexual selection and their constant use in that sex alone—the successive variations and the effects of use having been from the first more or less limited in transmission to the male offspring.

Many analogous cases could be adduced; those, for instance, of the plumes on the head being generally longer in the male than in the female, sometimes of equal length in both sexes, and occasionally absent in the female—these several cases occurring in the same group of birds. It would be difficult to account for such a difference between the sexes by the female having been benefited by possessing a slightly shorter crest than the male, and its consequent diminution or complete suppression through natural selection. But I will take a more favorable case, namely, the length of the tail. The long train of the peacock would have been not only inconvenient but dangerous to the peahen during the period of incubation and while accompanying her young. Hence there is not the least *à priori* improbability in the development of her tail having been checked through natural selection. But the females of various pheasants, which apparently are exposed on their open nests to as much danger as the peahen, have tails of considerable length. The females as well as the males of the *Menura superba* have long tails, and they build a domed nest, which is a great anomaly in so large a bird. Naturalists have wondered how the female Menura could

[7] Daines Barrington, however, thought it probable ("Phil. Transact.," 1773, p. 164) that few female birds sing, because the talent would have been dangerous to them during incubation. He adds, that a similar view may possibly account for the inferiority of the female to the male in plumage.

manage her tail during incubation; but it is now known[8] that she "enters the nest head first, and then turns round with her tail sometimes over her back, but more often bent round by her side. Thus in time the tail becomes quite askew, and is a tolerable guide to the length of time the bird has been sitting." Both sexes of an Australian kingfisher (*Tanysiptera sylvia*) have the middle tail-feathers greatly lengthened, and the female makes her nest in a hole; and, as I am informed by Mr. R. B. Sharpe, these feathers become much crumpled during incubation.

In these two latter cases the great length of the tail-feathers must be in some degree inconvenient to the female; and, as in both species the tail-feathers of the female are somewhat shorter than those of the male, it might be argued that their full development had been prevented through natural selection. But if the development of the tail of the peahen had been checked only when it became inconveniently or dangerously great, she would have retained a much longer tail than she actually possesses; for her tail is not nearly so long, relatively to the size of her body, as that of many female pheasants, nor longer than that of the female turkey. It must also be borne in mind that, in accordance with this view, as soon as the tail of the peahen became dangerously long, and its development was consequently checked, she would have continually reacted on her male progeny, and thus have prevented the peacock from acquiring his present magnificent train. We may therefore infer that the length of the tail in the peacock and its shortness in the peahen are the result of the requisite variations in the male having been from the first transmitted to the male offspring alone.

We are led to a nearly similar conclusion with respect to the length of the tail in the various species of pheasants. In the Eared pheasant (*Crossoptilon auritum*) the tail is of equal length in both sexes, namely, sixteen or seventeen

[8] Mr. Ramsay, in "Proc. Zoolog. Soc.," 1868, p. 50.

inches; in the common pheasant it is about twenty inches long in the male and twelve in the female; in Sœmmerring's pheasant, thirty-seven inches in the male and only eight in the female; and lastly, in Reeve's pheasant it is sometimes actually seventy-two inches long in the male and sixteen in the female. Thus in the several species, the tail of the female differs much in length, irrespectively of that of the male; and this can be accounted for, as it seems to me, with much more probability, by the laws of inheritance—that is, by the successive variations having been from the first more or less closely limited in their transmission to the male sex—than by the agency of natural selection, resulting from the length of tail being more or less injurious to the females of these several allied species.

We may now consider Mr. Wallace's arguments in regard to the sexual coloration of birds. He believes that the bright tints originally acquired through sexual selection by the males would in all, or almost all, cases have been transmitted to the females, unless the transference had been checked through natural selection. I may here remind the reader that various facts opposed to this view have already been given under reptiles, amphibians, fishes, and lepidoptera. Mr. Wallace rests his belief chiefly, but not exclusively, as we shall see in the next chapter, on the following statement,[9] that when both sexes are colored in a very conspicuous manner, the nest is of such a nature as to conceal the sitting bird; but when there is a marked contrast of color between the sexes, the male being gay and the female dull colored, the nest is open and exposes the sitting bird to view. This coincidence, as far as it goes, certainly seems to favor the belief that the females which sit on open nests have been specially modified for the sake of protection; but we shall presently see that there is another and more probable explanation, namely, that conspic-

[9] "Journal of Travel," edited by A. Murray, vol. i., 1868, p. 78.

uous females have acquired the instinct of building domed nests oftener than dull-colored birds. Mr. Wallace admits that there are, as might have been expected, some exceptions to his two rules, but it is a question whether the exceptions are not so numerous as seriously to invalidate them.

There is in the first place much truth in the Duke of Argyll's remark[10] that a large domed nest is more conspicuous to an enemy, especially to all tree-haunting carnivorous animals, than a smaller open nest. Nor must we forget that with many birds which build open nests the male sits on the eggs and aids the female in feeding the young: this is the case, for instance, with *Pyranga æstiva*,[11] one of the most splendid birds in the United States, the male being vermilion, and the female light brownish green. Now if brilliant colors had been extremely dangerous to birds while sitting on their open nests, the males in these cases would have suffered greatly. It might, however, be of such paramount importance to the male to be brilliantly colored, in order to beat his rivals, that this may have more than compensated some additional danger.

Mr. Wallace admits that with the King-crows (Dicrurus), Orioles, and Pittidæ, the females are conspicuously colored, yet build open nests; but he urges that the birds of the first group are highly pugnacious and could defend themselves; that those of the second group take extreme care in concealing their open nests, but this does not invariably hold good;[12] and that with the birds of the third group the females are brightly colored chiefly on the under surface. Besides these cases, pigeons, which are sometimes brightly and almost always conspicuously colored, and which are notoriously liable to the attacks of birds of prey, offer a serious exception to the rule, for they almost always build

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[10] "Journal of Travel," edited by A. Murray, vol. i., 1868, p. 281.

[11] Audubon, "Ornithological Biography," vol. i. p. 233.

[12] Jerdon, "Birds of India," vol. ii. p. 108. Gould's "Handbook of the Birds of Australia," vol. i. p. 463.

open and exposed nests. In another large family, that of the humming-birds, all the species build open nests, yet with some of the most gorgeous species the sexes are alike; and in the majority, the females, though less brilliant than the males, are brightly colored. Nor can it be maintained that all female humming-birds, which are brightly colored, escape detection by their tints being green, for some display on their upper surfaces red, blue, and other colors.[13]

In regard to birds which build in holes or construct domed nests, other advantages, as Mr. Wallace remarks, besides concealment are gained, such as shelter from the rain, greater warmth, and in hot countries protection from the sun;[14] so that it is no valid objection to his view that many birds having both sexes obscurely colored build concealed nests.[15] The female Horn-bill (*Buceros*), for instance, of India and Africa is protected during incubation with extraordinary care, for she plasters up with her own excrement the orifice of the hole in which she sits on her eggs, leaving only a small orifice through which the male feeds her; she is thus kept a close prisoner during the whole period of incubation;[16] yet female horn-bills are not more conspicuously colored than many other birds of equal size which build open nests. It is a more serious objection to Mr. Wallace's view, as is admitted by him, that in some few groups the males are brilliantly colored and the females obscure, and yet the latter hatch their eggs in domed nests.

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[13] For instance, the female *Eupetomena macroura* has the head and tail dark blue with reddish loins; the female *Lampornis porphyrurus* is blackish green on the upper surface, with the lores and sides of the throat crimson; the female *Eulampis jugularis* has the top of the head and back green, but the loins and the tail are crimson. Many other instances of highly conspicuous females could be given. See Mr. Gould's magnificent work on this family.

[14] Mr. Salvin noticed in Guatemala ("Ibis," 1864, p. 375) that humming-birds were much more unwilling to leave their nests during very hot weather, when the sun was shining brightly, as if their eggs would be thus injured, than during cool, cloudy, or rainy weather.

[15] I may specify, as instances of dull-colored birds building concealed nests, the species belonging to eight Australian genera, described in Gould's "Handbook of the Birds of Australia," vol. i. pp. 340, 362, 365, 383, 387, 389, 391, 414.

[16] Mr. C. Horne, "Proc. Zoolog. Soc.," 1869, p. 243.

This is the case with the Grallinæ of Australia, the Superb Warblers (Maluridæ) of the same country, the Sun-birds (Nectariniæ), and with several of the Australian Honey-suckers or Meliphagidæ.[17]

If we look to the birds of England we shall see that there is no close and general relation between the colors of the female and the nature of the nest which is constructed. About forty of our British birds (excluding those of large size which could defend themselves) build in holes in banks, rocks or trees, or construct domed nests. If we take the colors of the female goldfinch, bullfinch, or blackbird, as a standard of the degree of conspicuousness, which is not highly dangerous to the sitting female, then out of the above forty birds the females of only twelve can be considered as conspicuous to a dangerous degree, the remaining twenty-eight being inconspicuous.[18] Nor is there any close relation within the same genus between a well pronounced difference in color between the sexes and the nature of the nest constructed. Thus the male house-sparrow (*Passer domesticus*) differs much from the female, the male tree-sparrow (*P. montanus*) hardly at all, and yet both build well concealed nests. The two sexes of the common fly-catcher (*Muscicapa grisola*) can hardly be distinguished, while the sexes of the pied fly-catcher (*M. luctuosa*) differ considerably, and both species build in holes or conceal their nests. The female blackbird (*Turdus*

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[17] On the nidification and colors of these latter species, see Gould's "Handbook," etc., vol. i. pp. 504, 527.

[18] I have consulted, on this subject, Macgillivray's "British Birds," and though doubts may be entertained in some cases in regard to the degree of concealment of the nest, and to the degree of conspicuousness of the female, yet the following birds, which all lay their eggs in holes or in domed nests, can hardly be considered, by the above standard, as conspicuous: Passer, 2 species; Sturnus, of which the female is considerably less brilliant than the male; Cinclus; Motacilla boarula (?); Erithacus (?); Fruticola, 2 sp.; Saxicola; Ruticilla, 2 sp.; Sylvia, 3 sp.; Parus, 3 sp.; Mecistura; Anorthura; Certhia; Sitta; Yunx; Muscicapa, 2 sp.; Hirundo, 3 sp.; and Cypselus. The females of the following 12 birds may be considered as conspicuous, according to the same standard, viz., Pastor, Motacilla alba, Parus major and P. cæruleus, Upupa, Picus, 4 sp.; Coracias, Alcedo, and Merops.

merula) differs much, the female ring-ouzel (*T. torquatus*) differs less, and the female common thrush (*T. musicus*) hardly at all from their respective males; yet all build open nests. On the other hand, the not very distantly allied water-ouzel (*Cinclus aquaticus*) builds a domed nest, and the sexes differ about as much as in the ring-ouzel. The black and red grouse (*Tetrao tetrix* and *T. scoticus*) build open nests in equally well concealed spots, but in the one species the sexes differ greatly, and in the other very little.

Notwithstanding the foregoing objections, I cannot doubt, after reading Mr. Wallace's excellent essay, that, looking to the birds of the world, a large majority of the species in which the females are conspicuously colored (and in this case the males with rare exceptions are equally conspicuous) build concealed nests for the sake of protection. Mr. Wallace enumerates[19] a long series of groups in which this rule holds good; but it will suffice here to give, as instances, the more familiar groups of kingfishers, toucans, trogons, puff-birds (Capitonidæ), plantain-eaters (Musophagæ), woodpeckers and parrots. Mr. Wallace believes that in these groups, as the males gradually acquired through sexual selection their brilliant colors, these were transferred to the females and were not eliminated by natural selection, owing to the protection which they already enjoyed from their manner of nidification. According to this view, their present manner of nesting was acquired before their present colors. But it seems to me much more probable that in most cases, as the females were gradually rendered more and more brilliant from partaking of the colors of the male, they were gradually led to change their instincts (supposing that they originally built open nests), and to seek protection by building domed or concealed nests. No one who studies, for instance, Audubon's account of the differences in the nests of the same species in the Northern and Southern

[19] "Journal of Travel," edited by A. Murray, vol. i. p. 78.

United States,[20] will feel any great difficulty in admitting that birds, either by a change (in the strict sense of the word) of their habits, or through the natural selection of so-called spontaneous variations of instinct, might readily be led to modify their manner of nesting.

This way of viewing the relation, as far as it holds good, between the bright colors of female birds and their manner of nesting, receives some support from certain cases occurring in the Sahara Desert. Here, as in most other deserts, various birds and many other animals have had their colors adapted in a wonderful manner to the tints of the surrounding surface. Nevertheless there are, as I am informed by the Rev. Mr. Tristram, some curious exceptions to the rule; thus the male of the *Monticola cyanea* is conspicuous from his bright blue color, and the female almost equally conspicuous from her mottled brown and white plumage; both sexes of two species of Dromolæa are of a lustrous black; so that these three species are far from receiving protection from their colors, yet they are able to survive, for they have acquired the habit of taking refuge from danger in holes or crevices in the rocks.

With respect to the above groups in which the females are conspicuously colored and build concealed nests, it is not necessary to suppose that each separate species had its nidifying instinct specially modified; but only that the early progenitors of each group were gradually led to build domed or concealed nests, and afterward transmitted this instinct, together with their bright colors, to their modified descendants. As far as it can be trusted, the conclusion is interesting, that sexual selection, together with equal or nearly equal inheritance by both sexes, have indirectly determined the manner of nidification of whole groups of birds.

According to Mr. Wallace, even in the groups in which the females, from being protected in domed nests during in-

[20] See many statements in the "Ornithological Biography." See, also, some curious observations on the nests of Italian birds by Eugenio Bettoni, in the "Atti della Società Italiana," vol. xi., 1869, p. 487.

cubation, have not had their bright colors eliminated through natural selection, the males often differ in a slight, and occasionally in a considerable, degree from the females. This is a significant fact, for such differences in color must be accounted for by some of the variations in the males having been from the first limited in transmission to the same sex; as it can hardly be maintained that these differences, especially when very slight, serve as a protection to the female. Thus all the species in the splendid group of the Trogons build in holes; and Mr. Gould gives figures[21] of both sexes of twenty-five species, in all of which, with one partial exception, the sexes differ sometimes slightly, sometimes conspicuously, in color—the males being always finer than the females, though the latter are likewise beautiful. All the species of kingfishers build in holes, and with most of the species the sexes are equally brilliant, and thus far Mr. Wallace's rule holds good; but in some of the Australian species the colors of the females are rather less vivid than those of the male; and in one splendidly colored species, the sexes differ so much that they were at first thought to be specifically distinct.[22] Mr. R. B. Sharpe, who has especially studied this group, has shown me some American species (Ceryle) in which the breast of the male is belted with black. Again, in Carcineutes, the difference between the sexes is conspicuous: in the male the upper surface is dull blue banded with black, the lower surface being partly fawn-colored, and there is much red about the head; in the female the upper surface is reddish brown banded with black, and the lower surface white with black markings. It is an interesting fact, as showing how the same peculiar style of sexual coloring often characterizes allied forms, that in three species of Dacelo the male differs from the female only in the tail being dull blue banded with black, while that of the female is brown with blackish bars; so that

[21] See his "Monograph of the Trogonidæ," first edition.

[22] Namely, Cyanalcyon. Gould's "Handbook to the Birds of Australia," vol. i. p. 133; see, also, pp. 130, 136.

here the tail differs in color in the two sexes in exactly the same manner as the whole upper surface in the two sexes of Carcineutes.

With parrots, which likewise build in holes, we find analogous cases; in most of the species both sexes are brilliantly colored and indistinguishable, but in not a few species the males are colored rather more vividly than the females, or even very differently from them. Thus, besides other strongly marked differences, the whole under surface of the male King Lory (*Aprosmictus scapulatus*) is scarlet, while the throat and chest of the female is green tinged with red; in the *Euphema splendida* there is a similar difference, the face and wing-coverts moreover of the female being of a paler blue than in the male.[23] In the family of the tits (*Parinæ*) which build concealed nests, the female of our common blue tomtit (*Parus cæruleus*) is "much less brightly colored" than the male; and in the magnificent Sultan yellow tit of India the difference is greater.[24]

Again, in the great group of the woodpeckers[25] the sexes are generally nearly alike, but in the *Megapicus validas* all those parts of the head, neck, and breast which are crimson in the male are pale brown in the female. As in several woodpeckers the head of the male is bright crimson, while that of the female is plain, it occurred to me that this color might possibly make the female dangerously conspicuous, whenever she put her head out of the hole containing her nest, and consequently that this color, in accordance with Mr. Wallace's belief, had been eliminated. This view is strengthened by what Malherbe states with respect to *Indopicus carlotta;* namely, that the young females, like the young males, have some crimson about their heads, but that this color disappears in the adult female, while it is

[23] Every gradation of difference between the sexes may be followed in the parrots of Australia. See Gould's "Handbook," etc., vol. ii. pp. 14–102.

[24] Macgillivray's "British Birds," vol. ii. p. 433. Jerdon, "Birds of India," vol. ii. p. 282.

[25] All the following facts are taken from M. Malherbe's magnificent "Monographie des Picidées," 1861.

intensified in the adult male. Nevertheless the following considerations render this view extremely doubtful; the male takes a fair share in incubation,[26] and would be thus almost equally exposed to danger; both sexes of many species have their heads of an equally bright crimson; in other species the difference between the sexes in the amount of scarlet is so slight that it can hardly make any appreciable difference in the danger incurred; and lastly, the coloring of the head in the two sexes often differs slightly in other ways.

The cases, as yet given, of slight and graduated differences in color between the males and females in the groups in which, as a general rule, the sexes resemble each other, all relate to species which build domed or concealed nests. But similar gradations may likewise be observed in groups in which the sexes as a general rule resemble each other, but which build open nests. As I have before instanced the Australian parrots, so I may here instance, without giving any details, the Australian pigeons.[27] It deserves especial notice that in all these cases the slight differences in plumage between the sexes are of the same general nature as the occasionally greater differences. A good illustration of this fact has already been afforded by those kingfishers in which either the tail alone or the whole upper surface of the plumage differs in the same manner in the two sexes. Similar cases may be observed with parrots and pigeons. The differences in color between the sexes of the same species are also of the same general nature as the differences in color between the distinct species of the same group. For when, in a group in which the sexes are usually alike, the male differs considerably from the female, he is not colored in a quite new style. Hence we may infer that within the same group the special colors of both sexes, when they are alike,

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[26] Audubon's "Ornithological Biography," vol. ii. p. 75; see, also, the "Ibis," vol. i. p. 268.

[27] Gould's "Handbook to the Birds of Australia," vol. ii. pp. 109–149.

and the colors of the male, when he differs slightly or even considerably from the female, have been in most cases determined by the same general cause; this being sexual selection.

It is not probable, as has already been remarked, that differences in color between the sexes, when very slight, can be of service to the female as a protection. Assuming, however, that they are of service, they might be thought to be cases of transition; but we have no reason to believe that many species at any one time are undergoing change. Therefore we can hardly admit that the numerous females which differ very slightly in color from their males are now all commencing to become obscure for the sake of protection. Even if we consider somewhat more marked sexual differences, is it probable, for instance, that the head of the female chaffinch—the crimson on the breast of the female bullfinch—the green of the female greenfinch—the crest of the female golden-crested wren, have all been rendered less bright by the slow process of selection for the sake of protection? I cannot think so; and still less with the slight differences between the sexes of those birds which build concealed nests. On the other hand, the differences in color between the sexes, whether great or small, may to a large extent be explained on the principle of the successive variations acquired by the males through sexual selection having been from the first more or less limited in their transmission to the females. That the degree of limitation should differ in different species of the same group will not surprise any one who has studied the laws of inheritance, for they are so complex that they appear to us in our ignorance to be capricious in their action.[28]

As far as I can discover, there are few large groups of birds in which all the species have both sexes alike and brilliantly colored, but I hear from Mr Sclater that this

[28] See remarks to this effect in my work on "Variation under Domestication," vol. ii. chap. xii.

appears to be the case with the Musophagæ or plantain eaters. Nor do I believe that any large group exists in which the sexes of all the species are widely dissimilar in color: Mr. Wallace informs me that the chatterers of South America (*Cotingidæ*) offer one of the best instances; but with some of the species, in which the male has a splendid red breast, the female exhibits some red on her breast; and the females of other species show traces of the green and other colors of the males. Nevertheless we have a near approach to close sexual similarity or dissimilarity throughout several groups; and this, from what has just been said of the fluctuating nature of inheritance, is a somewhat surprising circumstance. But that the same laws should largely prevail with allied animals is not surprising. The domestic fowl has produced a great number of breeds and sub-breeds, and in these the sexes generally differ in plumage; so that it has been noticed as an unusual circumstance when in certain sub-breeds they resemble each other. On the other hand, the domestic pigeon has likewise produced a vast number of distinct breeds and sub-breeds, and in these, with rare exceptions, the two sexes are identically alike. Therefore if other species of Gallus and Columba were domesticated and varied, it would not be rash to predict that similar rules of sexual similarity and dissimilarity, depending on the form of transmission, would hold good in both cases. In like manner the same form of transmission has generally prevailed under nature throughout the same groups, although marked exceptions to this rule occur. Thus within the same family, or even genus, the sexes may be identically alike or very different in color. Instances have already been given in the same genus, as with sparrows, fly-catchers, thrushes, and grouse. In the family of pheasants the sexes of almost all the species are wonderfully dissimilar, but are quite alike in the eared pheasant or *Crossoptilon auritum*. In two species of Chloephaga, a genus of geese, the male cannot be distinguished from the females, except by size; while in two others, the

sexes are so unlike that they might easily be mistaken for distinct species.[29]

The laws of inheritance can alone account for the following cases, in which the female acquires, late in life, certain characters proper to the male, and ultimately comes to resemble him more or less completely. Here protection can hardly have come into play. Mr. Blyth informs me that the females of *Oriolus melanocephalus* and of some allied species, when sufficiently mature to breed, differ considerably in plumage from the adult males; but after the second or third moults they differ only in their beaks having a slight greenish tinge. In the dwarf bitterns (Ardetta), according to the same authority, "the male acquires his final livery at the first moult, the female not before the third or fourth moult; in the meanwhile she presents an intermediate garb, which is ultimately exchanged for the same livery as that of the male." So again the female *Falco peregrinus* acquires her blue plumage more slowly than the male. Mr. Swinhoe states that with one of the Drongo shrikes (*Dicrurus macrocercus*), the male, while almost a nestling, moults his soft brown plumage and becomes of a uniform glossy greenish black; but the female retains for a long time the white striæ and spots on the axillary feathers; and does not completely assume the uniform black color of the male for three years. The same excellent observer remarks that in the spring of the second year the female spoonbill (Platalea) of China resembles the male of the first year, and that apparently it is not until the third spring that she acquires the same adult plumage as that possessed by the male at a much earlier age. The female *Bombycilla carolinensis* differs very little from the male, but the appendages, which like beads of red sealing-wax ornament the wing-feathers,[30] are not developed in her so early in

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[29] The "Ibis," vol. vi., 1864, p. 122.

[30] When the male courts the female, these ornaments are vibrated, and "are shown off to great advantage," on the outstretched wings; A. Leith Adams, "Field and Forest Rambles," 1873, p. 153.

life as in the male. In the male of an Indian paroquet (*Palæornis javanicus*) the upper mandible is coral red from his earliest youth, but in the female, as Mr. Blyth has observed with caged and wild birds, it is at first black and does not become red until the bird is at least a year old, at which age the sexes resemble each other in all respects. Both sexes of the wild turkey are ultimately furnished with a tuft of bristles on the breast, but in two-year-old birds the tuft is about four inches long in the male and hardly apparent in the female; when, however, the latter has reached her fourth year, it is from four to five inches in length.[31]

These cases must not be confounded with those where diseased or old females abnormally assume masculine characters, nor with those where fertile females, while young, acquire the characters of the male, through variation or some unknown cause.[32] But all these cases have so much in common that they depend, according to the hypothesis of pangenesis, on gemmules derived from each part of the male being present, though latent, in the female; their development following on some slight change in the elective affinities of her constituent tissues.

A few words must be added on changes of plumage in relation to the season of the year. From reasons formerly assigned there can be little doubt that the elegant plumes, long pendent feathers, crests, etc., of egrets, herons, and

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[31] On Ardetta, Translation of Cuvier's "Règne Animal," by Mr. Blyth, footnote, p. 159. On the Peregrine Falcon, Mr. Blyth, in Charlesworth's "Mag. of Nat. Hist.," vol. i., 1837, p. 304. On Dicrurus, "Ibis," 1863, p. 44. On the Platalea, "Ibis," vol. vi., 1864, p. 366. On the Bombycilla, Audubon's "Ornithol. Biography," vol. i. p. 229. On the Palæornis, see also Jerdon, "Birds of India," vol. i. p. 263. On the wild turkey, Audubon, ibid., vol. i. p. 15; but I hear from Judge Caton that in Illinois the female very rarely acquires a tuft. Analogous cases with the females of Petrocossyphus are given by Mr. R. B. Sharpe, "Proc. Zoolog. Soc.," 1872, p. 496.

[32] Of these latter cases Mr. Blyth has recorded (Translation of Cuvier's "Règne Animal," p. 158) various instances with Lanius, Ruticilla, Linaria, and Anas. Audubon has also recorded a similar case ("Ornith. Biog.," vol. v. p. 519) with *Lyranga æstiva*.

many other birds, which are developed and retained only during the summer, serve for ornamental and nuptial purposes, though common to both sexes. The female is thus rendered more conspicuous during the period of incubation than during the winter; but such birds as herons and egrets would be able to defend themselves. As, however, plumes would probably be inconvenient, and certainly of no use during the winter, it is possible that the habit of moulting twice in the year may have been gradually acquired through natural selection for the sake of casting off inconvenient ornaments during the winter. But this view cannot be extended to the many waders, whose summer and winter plumages differ very little in color. With defenceless species, in which both sexes, or the males alone, become extremely conspicuous during the breeding season—or when the males acquire at this season such long wing or tail-feathers as to impede their flight, as with Cosmetornis and Vidua—it certainly at first appears highly probable that the second moult has been gained for the special purpose of throwing off these ornaments. We must, however, remember that many birds, such as some of the Birds of Paradise, the Argus pheasant and peacock, do not cast their plumes during the winter; and it can hardly be maintained that the constitution of these birds, at least of the Gallinaceæ, renders a double moult impossible, for the ptarmigan moults thrice in the year.[33] Hence it must be considered as doubtful whether the many species which moult their ornamental plumes or lose their bright colors during the winter, have acquired this habit on account of the inconvenience or danger which they would otherwise have suffered.

I conclude, therefore, that the habit of moulting twice in the year was in most or all cases first acquired for some distinct purpose, perhaps for gaining a warmer winter covering; and that variations in the plumage occurring during the summer were accumulated through sexual selection and

[33] See Gould's "Birds of Great Britain."

transmitted to the offspring at the same season of the year; that such variations were inherited either by both sexes or by the males alone, according to the form of inheritance which prevailed. This appears more probable than that the species in all cases originally tended to retain their ornamental plumage during the winter; but were saved from this through natural selection, resulting from the inconvenience or danger thus caused.

I have endeavored in this chapter to show that the arguments are not trustworthy in favor of the view that weapons, bright colors and various ornaments are now confined to the males owing to the conversion, by natural selection, of the equal transmission of characters to both sexes, into transmission to the male sex alone. It is also doubtful whether the colors of many female birds are due to the preservation, for the sake of protection, of variations which were from the first limited in their transmission to the female sex. But it will be convenient to defer any further discussion on this subject until I treat, in the following chapter, of the differences in plumage between the young and old.

CHAPTER XVI

BIRDS — *concluded*

The immature plumage in relation to the character of the plumage in both sexes when adult—Six classes of cases—Sexual differences between the males of closely allied or representative species—The female assuming the characters of the male—Plumage of the young in relation to the summer and winter plumage of the adults—On the increase of beauty in the birds of the world—Protective coloring—Conspicuously colored birds—Novelty appreciated—Summary of the four chapters on birds

WE MUST now consider the transmission of characters, as limited by age, in reference to sexual selection. The truth and importance of the principle of inheritance at corresponding ages need not here be discussed, as enough has already been said on the subject. Before giving the several rather complex rules or classes of cases, under which the differences in plumage between the young and the old, as far as known to me, may be included, it will be well to make a few preliminary remarks.

With animals of all kinds when the adults differ in color from the young, and the colors of the latter are not, as far as we can see, of any special service, they may generally be attributed, like various embryological structures, to the retention of a former character. But this view can be maintained with confidence only when the young of several species resemble each other closely, and likewise resemble other adult species belonging to the same group; for the latter are the living proofs that such a state of things was formerly possible. Young lions and pumas are marked with feeble stripes or rows of spots, and as many allied species both young and old are similarly marked, no be-

liever in evolution will doubt that the progenitor of the lion and puma was a striped animal, and that the young have retained vestiges of the stripes, like the kittens of black cats, which are not in the least striped when grown up. Many species of deer which when mature are not spotted are while young covered with white spots, as are likewise some few species in the adult state. So again the young in the whole family of pigs (Suidæ), and in certain rather distantly allied animals, such as the tapir, are marked with dark, longitudinal stripes; but here we have a character apparently derived from an extinct progenitor, and now preserved by the young alone. In all such cases the old have had their colors changed in the course of time, while the young have remained but little altered, and this has been effected through the principle of inheritance at corresponding ages.

This same principle applies to many birds belonging to various groups, in which the young closely resemble each other, and differ much from their respective adult parents. The young of almost all the Gallinaceæ, and of some distantly allied birds, such as ostriches, are covered with longitudinally striped down; but this character points back to a state of things so remote that it hardly concerns us. Young cross-bills (Loxia) have at first straight beaks like those of other finches, and in their immature striated plumage they resemble the mature redpole and female siskin, as well as the young of the goldfinch, greenfinch and some other allied species. The young of many kinds of buntings (Emberiza) resemble one another, and likewise the adult state of the common bunting, *E. miliaria*. In almost the whole large group of thrushes the young have their breasts spotted—a character which is retained throughout life by many species, but is quite lost by others, as by the *Turdus migratorius*. So again with many thrushes, the feathers on the back are mottled before they are moulted for the first time, and this character is retained for life by certain eastern species. The young of many species of shrikes (Lanius), of some woodpeckers,

and of an Indian pigeon (*Chalcophaps indicus*), are transversely striped on the under surface; and certain allied species or whole genera are similarly marked when adult. In some closely allied and resplendent Indian cuckoos (Chrysococcyx), the mature species differ considerably from one another in color, but the young cannot be distinguished. The young of an Indian goose (*Sarkidiornis melanonotus*) closely resemble in plumage an allied genus, Dendrocygna, when mature.[1] Similar facts will hereafter be given in regard to certain herons. Young black grouse (*Tetrao tetrix*) resemble the young as well as the old of certain other species, for instance, the red grouse or *T. scoticus*. Finally, as Mr. Blyth, who has attended closely to this subject, has well remarked, the natural affinities of many species are best exhibited in their immature plumage; and as the true affinities of all organic beings depend on their descent from a common progenitor, this remark strongly confirms the belief that the immature plumage approximately shows us the former or ancestral condition of the species.

Although many young birds, belonging to various families, thus give us a glimpse of the plumage of their remote progenitors, yet there are many other birds, both dull colored and bright colored, in which the young closely resemble their parents. In such cases the young of the different species cannot resemble each other more closely than do the parents; nor can they strikingly resemble allied forms when adult. They give us but little insight into the plumage of their progenitors, excepting in so far that, when the young and the old are colored in the same general manner throughout a whole group of species, it is probable that their progenitors were similarly colored.

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[1] In regard to thrushes, shrikes, and woodpeckers, see Mr. Blyth, in Charlesworth's "Mag. of Nat. Hist.," vol. i., 1837, p. 304; also footnote to his translation of Cuvier's "Règne Animal," p. 159. I give the case of Loxia on Mr. Blyth's information. On thrushes, see, also, Audubon, "Ornith. Biography," vol. ii. p. 195. On Chrysococcyx and Chalcophaps, Blyth, as quoted in Jerdon's "Birds of India," vol. iii. p. 485. On Sarkidiornis, Blyth, in "Ibis," 1867, p. 175.

We may now consider the classes of cases under which the differences and resemblances between the plumage of the young and the old, in both sexes, or in one sex alone, may be grouped. Rules of this kind were first enounced by Cuvier; but with the progress of knowledge they require some modification and amplification. This I have attempted to do, as far as the extreme complexity of the subject permits, from information derived from various sources; but a full essay on this subject by some competent ornithologist is much needed. In order to ascertain to what extent each rule prevails, I have tabulated the facts given in four great works, namely, by Macgillivray on the birds of Britain, Audubon on those of North America, Jerdon on those of India, and Gould on those of Australia. I may here premise, first, that the several cases or rules graduate into each other; and, secondly, that when the young are said to resemble their parents, it is not meant that they are identically alike, for their colors are almost always less vivid, and the feathers are softer and often of a different shape.

RULES OR CLASSES OF CASES

I. When the adult male is more beautiful or conspicuous than the adult female, the young of both sexes in their first plumage closely resemble the adult female, as with the common fowl and peacock; or, as occasionally occurs, they resemble her much more closely than they do the adult male.

II. When the adult female is more conspicuous than the adult male, as sometimes though rarely occurs, the young of both sexes in their first plumage resemble the adult male.

III. When the adult male resembles the adult female, the young of both sexes have a peculiar first plumage of their own, as with the robin.

IV. When the adult male resembles the adult female, the young of both sexes in their first plumage resemble the adults, as with the kingfisher, many parrots, crows, hedge-warblers.

V. When the adults of both sexes have a distinct winter and summer plumage, whether or not the male differs from the female, the young resemble the adults of both sexes in their winter dress, or much more rarely in their summer dress, or they resemble the females alone. Or the young may have an intermediate character; or, again, they may differ greatly from the adults in both their seasonal plumages.

VI. In some few cases the young in their first plumage differ from each other according to sex, the young males resembling more or less closely the adult males, and the young females more or less closely the adult females.

Class I.—In this class, the young of both sexes more or less closely resemble the adult female, while the adult male differs from the adult female, often in the most conspicuous manner. Innumerable instances in all Orders could be given; it will suffice to call to mind the common pheasant, duck, and house-sparrow. The cases under this class graduate into others. Thus the two sexes when adult may differ so slightly, and the young so slightly from the adults, that it is doubtful whether such cases ought to come under the present, or under the third or fourth classes. So, again, the young of the two sexes, instead of being quite alike, may differ in a slight degree from each other, as in our sixth class. These transitional cases, however, are few, or at least are not strongly pronounced, in comparison with those which come strictly under the present class.

The force of the present law is well shown in those groups in which, as a general rule, the two sexes and the young are all alike; for when in these groups the male does differ from the female, as with certain parrots, kingfishers, pigeons, etc., the young of both sexes resemble the adult female.[2] We see the same fact exhibited still more

[2] See, for instance, Mr. Gould's account ("Handbook to the Birds of Australia," vol. i. p. 133) of Cyanalcyon (one of the Kingfishers), in which, however, the young male, though resembling the adult female, is less brilliantly

clearly in certain anomalous cases; thus the male of *Heliothrix auriculata* (one of the humming-birds) differs conspicuously from the female in having a splendid gorget and fine ear-tufts, but the female is remarkable from having a much longer tail than that of the male; now the young of both sexes resemble (with the exception of the breast being spotted with bronze) the adult female in all other respects, including the length of her tail, so that the tail of the male actually becomes shorter as he reaches maturity, which is a most unusual circumstance.[3] Again, the plumage of the male goosander (*Mergus merganser*) is more conspicuously colored than that of the female, with the scapular and secondary wing-feathers much longer; but differently from what occurs, as far as I know, in any other bird, the crest of the adult male, though broader than that of the female, is considerably shorter, being only a little above an inch in length; the crest of the female being two and a half inches long. Now the young of both sexes entirely resemble the adult female, so that their crests are actually of greater length, though narrower, than in the adult male.[4]

When the young and the females closely resemble each other, and both differ from the males, the most obvious conclusion is that the males alone have been modified. Even in the anomalous cases of the Heliothrix and Mergus, it is probable that originally both adult sexes were furnished—the one species with a much elongated tail, and the other with a much elongated crest—these characters having since been partially lost by the adult males from some unexplained

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colored. In some species of Dacelo the males have blue tails, and the females brown ones; and Mr. R. B. Sharpe informs me that the tail of the young male of *D. gaudichaudi* is at first brown. Mr. Gould has described (ibid., vol. ii. pp. 14, 20, 37) the sexes and the young of certain black Cockatoos and of the King Lory, with which the same rule prevails. Also Jerdon ("Birds of India," vol. i. p. 260) on the *Palæornis rosa*, in which the young are more like the female than the male. See Audubon ("Ornith. Biography," vol. ii. p. 475) on the two sexes and the young of *Columba passerina*.

[3] I owe this information to Mr. Gould, who showed me the specimens; see, also, his "Introduction to the Trochilidæ," 1861, p. 120.

[4] Macgillivray, "Hist. British Birds," vol. v. pp. 207–214.

cause, and transmitted in their diminished state to their male offspring alone, when arrived at the corresponding age of maturity. The belief that in the present class the male alone has been modified, as far as the differences between the male and the female together with her young are concerned, is strongly supported by some remarkable facts recorded by Mr. Blyth,[5] with respect to closely allied species which represent each other in distinct countries. For with several of these representative species the adult males have undergone a certain amount of change and can be distinguished; the females and the young from the distinct countries being indistinguishable, and therefore absolutely unchanged. This is the case with certain Indian chats (Thamnobia), with certain honey-suckers (Nectarinia), shrikes (Tephrodornis), certain kingfishers (Tanysiptera), Kalij pheasants (Gallophasis), and tree-partridges (Arboricola).

In some analogous cases, namely, with birds having a different summer and winter plumage, but with the two sexes nearly alike, certain closely allied species can easily be distinguished in their summer or nuptial plumage, yet are indistinguishable in their winter as well as in their immature plumage. This is the case with some of the closely allied Indian wagtails or Motacillæ. Mr. Swinhoe[6] informs me that three species of Ardeola, a genus of herons, which represent one another on separate continents, are "most strikingly different" when ornamented with their summer plumes, but are hardly, if at all, distinguishable during the winter. The young also of these three species in their immature plumage closely resemble the adults in their winter dress. This case is all the more interesting, because with two other species of Ardeola both sexes retain, during the

[5] See his admirable paper in the "Journal of the Asiatic Soc. of Bengal," vol. xix., 1850, p. 223; see, also, Jerdon, "Birds of India," vol. i. introduction, p. xxix. In regard to Tanysiptera, Prof. Schlegel told Mr. Blyth that he could distinguish several distinct races, solely by comparing the adult males.

[6] See, also, Mr. Swinhoe, in "Ibis," July, 1863, p. 131; and a previous paper, with an extract from a note by Mr. Blyth, in "Ibis," Jan. 1861, p. 25.

winter and summer, nearly the same plumage as that possessed by the three first species during the winter and in their immature state; and this plumage, which is common to several distinct species at different ages and seasons, probably shows us how the progenitors of the genus were colored. In all these cases the nuptial plumage, which we may assume was originally acquired by the adult males during the breeding season, and transmitted to the adults of both sexes at the corresponding season, has been modified, while the winter and immature plumages have been left unchanged.

The question naturally arises, how is it that in these latter cases the winter plumage of both sexes, and in the former cases the plumage of the adult females, as well as the immature plumage of the young, have not been at all affected? The species which represent each other in distinct countries will almost always have been exposed to somewhat different conditions, but we can hardly attribute to this action the modification of the plumage in the males alone, seeing that the females and the young, though similarly exposed, have not been affected. Hardly any fact shows us more clearly how subordinate in importance is the direct action of the conditions of life, in comparison with the accumulation through selection of indefinite variations, than the surprising difference between the sexes of many birds; for both will have consumed the same food, and have been exposed to the same climate. Nevertheless, we are not precluded from believing that in the course of time new conditions may produce some direct effect either on both sexes, or, from their constitutional differences, chiefly on one sex. We see only that this is subordinate in importance to the accumulated results of selection. Judging, however, from a widespread analogy, when a species migrates into a new country (and this must precede the formation of representative species), the changed conditions to which they will almost always have been exposed will cause them to undergo a certain amount of fluctuating variability. In this case sex-

ual selection, which depends on an element liable to change —the taste or admiration of the female—will have had new shades of color or other differences to act on and accumulate; and as sexual selection is always at work, it would (from what we know of the results on domestic animals of man's unintentional selection) be surprising if animals inhabiting separate districts, which can never cross and thus blend their newly acquired characters, were not, after a sufficient lapse of time, differently modified. These remarks likewise apply to the nuptial or summer plumage, whether confined to the males or common to both sexes.

Although the females of the above closely allied or representative species, together with their young, differ hardly at all from one another, so that the males alone can be distinguished, yet the females of most species within the same genus obviously differ from each other. The differences, however, are rarely as great as between the males. We see this clearly in the whole family of the Gallinaceæ: the females, for instance, of the common and Japan pheasant, and especially of the Gold and Amherst pheasant—of the silver pheasant and the wild fowl—resemble one another very closely in color, while the males differ to an extraordinary degree. So it is with the females of most of the Cotingidæ, Fringillidæ, and many other families. There can indeed be no doubt that, as a general rule, the females have been less modified than the males. Some few birds, however, offer a singular and inexplicable exception; thus the females of *Paradisea apoda* and *P. papuana* differ from each other more than do their respective males;[7] the female of the latter species having the under surface pure white, while the female *P. apoda* is deep brown beneath. So again, as I hear from Prof. Newton, the males of two species of Oxynotus (shrikes), which represent each other in the islands of Mauritius and Bourbon,[8] differ but little in color, while the

[7] Wallace, "The Malay Archipelago," vol. ii., 1869, p. 394.

[8] These species are described with colored figures, by M. F. Pollen, in "Ibis," 1866, p. 275.

females differ much. In the Bourbon species the female appears to have partially retained an immature condition of plumage, for at first sight she "might be taken for the young of the Mauritian species." These differences may be compared with those inexplicable ones which occur independently of man's selection in certain sub-breeds of the game fowl, in which the females are very different, while the males can hardly be distinguished.[9]

As I account so largely by sexual selection for the differences between the males of allied species, how can the differences between the females be accounted for in all ordinary cases? We need not here consider the species which belong to distinct genera; for with these, adaptation to different habits of life, and other agencies, will have come into play. In regard to the differences between the females within the same genus, it appears to me almost certain, after looking through various large groups, that the chief agent has been the greater or less transference to the female of the characters acquired by the males through sexual selection. In the several British finches the two sexes differ either very slightly or considerably; and if we compare the females of the greenfinch, chaffinch, goldfinch, bullfinch, crossbill, sparrow, etc., we shall see that they differ from one another chiefly in the points in which they partially resemble their respective males; and the colors of the males may safely be attributed to sexual selection. With many gallinaceous species the sexes differ to an extreme degree, as with the peacock, pheasant, and fowl, while with other species there has been a partial or even complete transference of character from the male to the female. The females of the several species of Polyplectron exhibit in a dim condition, and chiefly on the tail, the splendid ocelli of their males. The female partridge differs from the male only in the red mark on her breast being smaller; and the female wild turkey only in her colors being much duller. In the guinea-fowl

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[9] "Variation of Animals," etc., i. p. 251.

the two sexes are indistinguishable. There is no improbability in the plain, though peculiarly spotted plumage of this latter bird having been acquired through sexual selection by the males, and then transmitted to both sexes; for it is not essentially different from the much more beautifully spotted plumage, characteristic of the males alone of the Tragopan pheasants.

It should be observed that, in some instances, the transference of characters from the male to the female has been effected apparently at a remote period, the male having subsequently undergone great changes, without transferring to the female any of his later-gained characters. For instance, the female and the young of the black grouse (*Tetrao tetrix*) resemble pretty closely both sexes and the young of the red grouse (*T. scoticus*); and we may consequently infer that the black grouse is descended from some ancient species, of which both sexes were colored in nearly the same manner as the red grouse. As both sexes of this latter species are more distinctly barred during the breeding season than at any other time, and as the male differs slightly from the female in his more strongly pronounced red and brown tints,[10] we may conclude that his plumage has been influenced by sexual selection, at least to a certain extent. If so, we may further infer that the nearly similar plumage of the female black grouse was similarly produced at some former period. But since this period the male black grouse has acquired his fine black plumage, with his forked and outwardly curled tail feathers; but of these characters there has hardly been any transference to the female, excepting that she shows in her tail a trace of the curved fork.

We may therefore conclude that the females of distinct though allied species have often had their plumage rendered more or less different by the transference, in various degrees, of characters acquired by the males through sexual selection, both during former and recent times. But it deserves

[10] Macgillivray, "Hist. British Birds," vol. i. pp. 172–174.

especial attention that brilliant colors have been transferred much more rarely than other tints. For instance, the male of the red-throated bluebreast (*Cyanecula suecica*) has a rich blue breast, including a sub-triangular red mark; now marks of nearly the same shape have been transferred to the female, but the central space is fulvous instead of red, and is surrounded by mottled instead of blue feathers. The Gallinaceæ offer many analogous cases; for none of the species, such as partridges, quails, guinea fowl, etc., in which the colors of the plumage have been largely transferred from the male to the female, is brilliantly colored. This is well exemplified with the pheasants, in which the male is generally so much more brilliant than the female; but with the Eared and Cheer pheasants (*Crossoptilon auritum* and *Phasianus wallichii*) the sexes closely resemble each other and their colors are dull. We may go so far as to believe that if any part of the plumage in the males of these two pheasants had been brilliantly colored, it would not have been transferred to the females. These facts strongly support Mr. Wallace's view that with birds which are exposed to much danger during incubation, the transference of bright colors from the male to the female has been checked through natural selection. We must not, however, forget that another explanation, before given, is possible; namely, that the males which varied and became bright, while they were young and inexperienced, would have been exposed to much danger, and would generally have been destroyed; the older and more cautious males, on the other hand, if they varied in a like manner, would not only have been able to survive, but would have been favored in their rivalry with other males. Now, variations occurring late in life tend to be transmitted exclusively to the same sex, so that in this case extremely bright tints would not have been transmitted to the females. On the other hand, ornaments of a less conspicuous kind, such as those possessed by the Eared and Cheer pheasants, would not have been dangerous, and if they appeared during

early youth, would generally have been transmitted to both sexes.

In addition to the effects of the partial transference of characters from the males to the females, some of the differences between the females of closely allied species may be attributed to the direct or definite action of the conditions of life."[11] With the males any such action would generally have been masked by the brilliant colors gained through sexual selection; but not so with the females. Each of the endless diversities in plumage which we see in our domesticated birds is, of course, the result of some definite cause; and under natural and more uniform conditions some one tint, assuming that it was in no way injurious, would almost certainly sooner or later prevail. The free intercrossing of the many individuals belonging to the same species would ultimately tend to make any change of color, thus induced, uniform in character.

No one doubts that both sexes of many birds have had their colors adapted for the sake of protection; and it is possible that the females alone of some species may have been modified for this end. Although it would be a difficult, perhaps an impossible process, as shown in the last chapter, to convert one form of transmission into another through selection, there would not be the least difficulty in adapting the colors of the female, independently of those of the male, to surrounding objects, through the accumulation of variations which were from the first limited in their transmission to the female sex. If the variations were not thus limited, the bright tints of the male would be deteriorated or destroyed. Whether the females alone of many species have been thus specially modified is at present very doubtful. I wish I could follow Mr. Wallace to the full extent; for the admission would remove some difficulties. Any variations which were of no service to the female as a protection would be at once obliterated, instead of being lost simply

[11] See, on this subject, chap. xxiii. in the "Variation of Animals and Plants under Domestication."

by not being selected, or from free intercrossing, or from being eliminated when transferred to the male and in any way injurious to him. Thus the plumage of the female would be kept constant in character. It would also be a relief if we could admit that the obscure tints of both sexes of many birds had been acquired and preserved for the sake of protection—for example of the hedge-warbler or kitty-wren (*Accentor modularis* and *Troglodytes vulgaris*), with respect to which we have no sufficient evidence of the action of sexual selection. We ought, however, to be cautious in concluding that colors which appear to us dull are not attractive to the females of certain species; we should bear in mind such cases as that of the common house sparrow, in which the male differs much from the female; but does not exhibit any bright tints. No one probably will dispute that many gallinaceous birds which live on the open ground have acquired their present colors, at least in part, for the sake of protection. We know how well they are thus concealed; we know that ptarmigans, while changing from their winter to their summer plumage, both of which are protective, suffer greatly from birds of prey. But can we believe that the very slight differences in tints and markings between, for instance, the female black grouse and red grouse serve as a protection? Are partridges, as they are now colored, better protected than if they had resembled quails? Do the slight differences between the females of the common pheasant, the Japan and gold pheasants, serve as a protection, or might not their plumages have been interchanged with impunity? From what Mr. Wallace has observed of the habits of certain gallinaceous birds in the East he thinks that such slight differences are beneficial. For myself I will only say that I am not convinced.

Formerly when I was inclined to lay much stress on protection as accounting for the duller colors of female birds, it occurred to me that possibly both sexes and the young might aboriginally have been equally bright-colored; but that subsequently the females, from the danger incurred

during incubation, and the young from being inexperienced, had been rendered dull as a protection. But this view is not supported by any evidence and is not probable; for we thus in imagination expose during past times the females and the young to danger, from which it has subsequently been necessary to shield their modified descendants. We have, also, to reduce, through a gradual process of selection, the females and the young to almost exactly the same tints and markings, and to transmit them to the corresponding sex and period of life. On the supposition that the females and the young have partaken during each stage of the process of modification of a tendency to be as brightly colored as the males, it is also a somewhat strange fact that the females have never been rendered dull colored without the young participating in the same change; for there are no instances, as far as I can discover, of species with the females dull and the young bright-colored. A partial exception, however, is offered by the young of certain woodpeckers, for they have "the whole upper part of the head tinged with red," which afterward either decreases into a mere circular red line in the adults of both sexes, or quite disappears in the adult females.[12]

Finally, with respect to our present class of cases, the most probable view appears to be that successive variations in brightness or in other ornamental characters, occurring in the males at a rather late period of life, have alone been preserved; and that most or all of these variations, owing to the late period of life at which they appeared, have been from the first transmitted only to the adult male offspring. Any variations in brightness occurring in the females or in the young would have been of no service to them, and would not have been selected; and, moreover, if dangerous, would have been eliminated. Thus the females and the young will either have been left unmodified, or (as

[12] Audubon, "Ornith. Biography," vol. i. p. 193. Macgillivray, "Hist. British Birds," vol. iii. p. 85. See, also, the case before given of *Indopicus carlotta*.

is much more common) will have been partially modified by receiving through transference from the male some of his successive variations. Both sexes have, perhaps, been directly acted on by the conditions of life to which they have long been exposed; but the females, from not being otherwise much modified, will best exhibit any such effects. These changes and all others will have been kept uniform by the free intercrossing of many individuals. In some cases, especially with ground birds, the females and the young may possibly have been modified, independently of the males, for the sake of protection, so as to have acquired the same dull-colored plumage.

CLASS II. *When the adult female is more conspicuous than the adult male, the young of both sexes in their first plumage resemble the adult male.*—This class is exactly the reverse of the last, for the females are here brighter colored or more conspicuous than the males; and the young, as far as they are known, resemble the adult males instead of the adult females. But the difference between the sexes is never nearly so great as with many birds in the first class, and the cases are comparatively rare. Mr. Wallace, who first called attention to the singular relation which exists between the less bright colors of the males and their performing the duties of incubation, lays great stress on this point,[13] as a crucial test that obscure colors have been acquired for the sake of protection during the period of nesting. A different view seems to me more probable. As the cases are curious and not numerous, I will briefly give all that I have been able to find.

In one section of the genus Turnix, quail-like birds, the female is invariably larger than the male (being nearly twice as large in one of the Australian species), and this is an unusual circumstance with the Gallinaceæ. In most of the species the female is more distinctly colored and brighter

[13] "Westminster Review," July, 1867, and A. Murray, "Journal of Travel," 1868, p. 83.

than the male,[14] but in some few species the sexes are alike. In *Turnix taigoor* of India the male "wants the black on the throat and neck, and the whole tone of the plumage is lighter and less pronounced than that of the female." The female appears to be noisier, and is certainly much more pugnacious than the male; so that the females and not the males are often kept by the natives for fighting, like game-cocks. As male birds are exposed by the English bird-catchers for a decoy near a trap, in order to catch other males by exciting their rivalry, so the females of this Turnix are employed in India. When thus exposed the females soon begin their "loud purring call, which can be heard a long way off, and any females within earshot run rapidly to the spot, and commence fighting with the caged bird." In this way from twelve to twenty birds, all breeding females, may be caught in the course of a single day. The natives assert that the females after laying their eggs associate in flocks, and leave the males to sit on them. There is no reason to doubt the truth of this assertion, which is supported by some observations made in China by Mr. Swinhoe.[15] Mr. Blyth believes that the young of both sexes resemble the adult male.

The females of the three species of Painted Snipes (Rhynchæa, Fig. 62) "are not only larger but much more richly colored than the males." [16] With all other birds in which the trachea differs in structure in the two sexes it is more developed and complex in the male than in the female; but in the *Rhynchæa australis* it is simple in the male, while in the female it makes four distinct convolutions before entering the lungs.[17] The female, therefore, of this species has acquired an eminently masculine character. Mr. Blyth

[14] For the Australian species, see Gould's "Handbook," etc., vol. ii. pp. 178, 180, 186, and 188. In the British Museum specimens of the Australian Plain-wanderer (*Pedionomus torquatus*) may be seen, showing similar sexual differences.

[15] Jerdon, "Birds of India," vol. iii. p. 596. Mr. Swinhoe, in "Ibis," 1865, p. 542; 1866, pp. 131, 405.

[16] Jerdon, "Birds of India," vol. iii. p. 677.

[17] Gould's "Handbook to the Birds of Australia," vol. ii. p. 275.

ascertained, by examining many specimens, that the trachea is not convoluted in either sex of *R. bengalensis*, which species resembles *R. australis* so closely that it can hardly be distinguishd except by its shorter toes. This fact is another striking instance of the law that secondary sexual

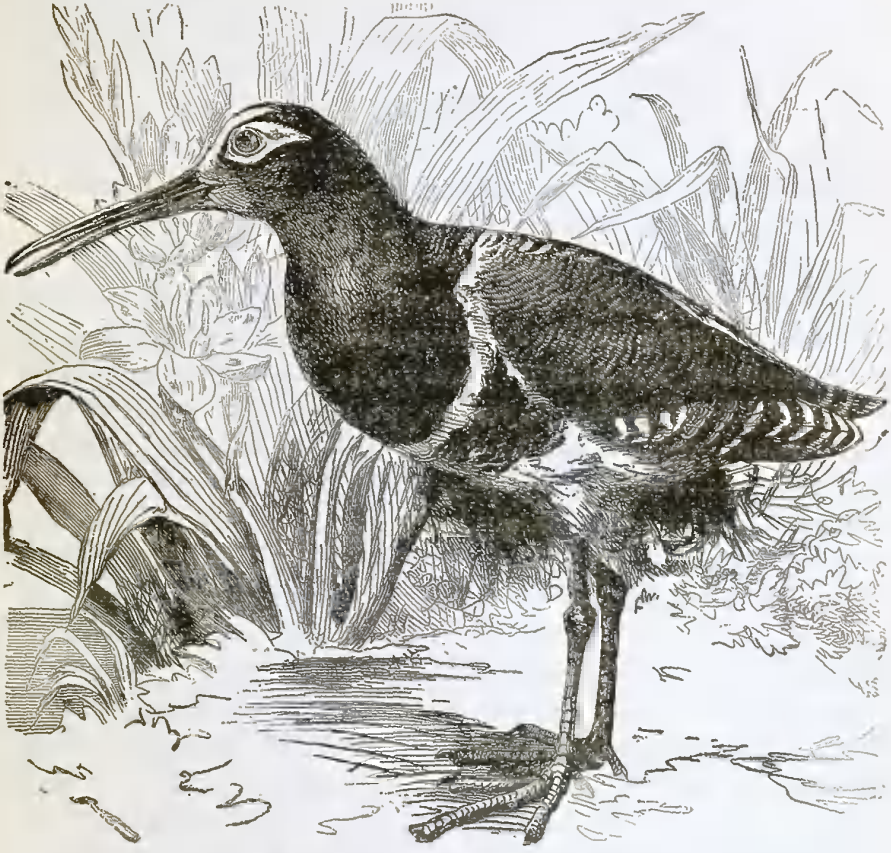

Fig. 62.—Rhynchæa capensis (from Brehm).

characters are often widely different in closely allied forms, though it is a very rare circumstance when such differences relate to the female sex. The young of both sexes of *R. bengalensis* in their first plumage are said to resemble the mature male.[18] There is also reason to believe that the male undertakes the duty of incubation, for

[18] "The Indian Field," Sept. 1858, p. 3.

Mr. Swinhoe [19] found the females before the close of the summer associated in flocks, as occurs with the females of the Turnix.

The females of *Phalaropus fulicarius* and *P. hyperboreus* are larger, and in their summer plumage "more gayly attired than the males." But the difference in color between the sexes is far from conspicuous. According to Prof. Steenstrup, the male alone of *P. fulicarius* undertakes the duty of incubation; this is likewise shown by the state of his breast feathers during the breeding season. The female of the dotterel plover (*Eudromias morinellus*) is larger than the male, and has the red and black tints on the lower surface, the white crescent on the breast, and the stripes over the eyes, more strongly pronounced. The male also takes at least a share in hatching the eggs; but the female likewise attends to the young.[20] I have not been able to discover whether with these species the young resemble the adult males more closely than the adult females; for the comparison is somewhat difficult to make on account of the double moult.

Turning now to the Ostrich order: The male of the common cassowary (*Casuarius galeatus*) would be thought by any one to be the female, from his smaller size and from the appendages and naked skin about his head being much less brightly colored; and I am informed by Mr. Bartlett that in the Zoological Gardens it is certainly the male alone who sits on the eggs and takes care of the young.[21] The

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[19] "Ibis," 1866, p. 298.

[20] For these several statements, see Mr. Gould's "Birds of Great Britain." Prof. Newton informs me that he has long been convinced, from his own observations and from those of others, that the males of the above-named species take either the whole or a large share of the duties of incubation, and that they "show much greater devotion toward their young, when in danger, than do the females." So it is, as he informs me, with *Limosa lapponica* and some few other Waders, in which the females are larger and have more strongly contrasted colors than the males.

[21] The natives of Ceram (Wallace, "Malay Archipelago," vol. ii. p. 150) assert that the male and female sit alternately on the eggs; but this assertion, as Mr. Bartlett thinks, may be accounted for by the female visiting the nest to lay her eggs.

female is said by Mr. T. W. Wood[22] to exhibit during the breeding season a most pugnacious disposition; and her wattles then become enlarged and more brilliantly colored. So, again, the female of one of the emus (*Dromœus irroratus*) is considerably larger than the male, and she possesses a slight topknot, but is otherwise indistinguishable in plumage. She appears, however, "to have greater power, when angry or otherwise excited, of erecting, like a turkey-cock, the feathers of her neck and breast. She is usually the more courageous and pugilistic. She makes a deep, hollow, guttural boom, especially at night, sounding like a small gong. The male has a slenderer frame and is more docile, with no voice beyond a suppressed hiss when angry, or a croak." He not only performs the whole duty of incubation, but has to defend the young from their mother; "for as soon as she catches sight of her progeny she becomes violently agitated, and, notwithstanding the resistance of the father, appears to use her utmost endeavors to destroy them. For months afterward it is unsafe to put the parents together, violent quarrels being the inevitable result, in which the female generally comes off conqueror."[23] So that with this emu we have a complete reversal not only of the parental and incubating instincts, but of the usual moral qualities of the two sexes; the females being savage, quarrelsome and noisy, the males gentle and good. The case is very different with the African ostrich, for the male is somewhat larger than the female and has finer plumes with more strongly contrasted colors; nevertheless, he undertakes the whole duty of incubation.[24]

I will specify the few other cases known to me in which

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[22] "The Student," April, 1870, p. 124.

[23] See the excellent account of the habits of this bird under confinement, by Mr. A. W. Bennett, in "Land and Water," May, 1868, p. 233.

[24] Mr. Sclater, on the incubation of the Struthiones, "Proc. Zool. Soc.," June 9, 1863. So it is with the *Rhea darwinii:* Captain Musters says ("At Home with the Patagonians," 1871, p. 128) that the male is larger, stronger, and swifter than the female, and of slightly darker colors; yet he takes sole charge of the eggs and of the young, just as does the male of the common species of Rhea.

the female is more conspicuously colored than the male, although nothing is known about the manner of incubation. With the carrion-hawk of the Falkland Islands (*Milvago leucurus*) I was much surprised to find by dissection that the individuals which had all their tints strongly pronounced, with the cere and legs orange colored, were the adult females, while those with duller plumage and gray legs were the males or the young. In an Australian tree-creeper (*Climacteris erythrops*) the female differs from the male in "being adorned with beautiful, radiated, rufous markings on the throat, the male having this part quite plain." Lastly, in an Australian night-jar, "the female always exceeds the male in size and in the brilliance of her tints; the males, on the other hand, have two white spots on the primaries more conspicuous than in the female." [25]

We thus see that the cases in which the female birds are more conspicuously colored than the males, with the young in their immature plumage resembling the adult males instead of the adult females, as in the previous class, are not numerous, though they are distributed in various Orders. The amount of difference, also, between the sexes is incomparably less than that which frequently occurs in the last class; so that the cause of the difference, whatever it may have been, has here acted on the females either less ener-

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[25] For the Milvago, see "Zoology of the Voyage of the Beagle": Birds, 1841, p. 16. For the Climacteris and night-jar (Eurostopodos), see Gould's "Handbook to the Birds of Australia," vol. i. pp. 602 and 97. The New Zealand shieldrake (*Tadorna variegata*) offers a quite anomalous case; the head of the female is pure white, and her back is redder than that of the male; the head of the male is of a rich dark bronzed color, and his back is clothed with finely pencilled slate-colored feathers, so that altogether he may be considered as the more beautiful of the two. He is larger and more pugnacious than the female, and does not sit on the eggs. So that in all these respects this species comes under our first class of cases; but Mr. Sclater ("Proc. Zool. Soc.," 1866, p. 150) was much surprised to observe that the young of both sexes, when about three months old, resembled in their dark heads and necks the adult males, instead of the adult females; so that it would appear in this case that the females have been modified, while the males and the young have retained a former state of plumage.

getically or less persistently than on the males in the last class. Mr. Wallace believes that the males have had their colors rendered less conspicuous for the sake of protection during the period of incubation; but the difference between the sexes in hardly any of the foregoing cases appears sufficiently great for this view to be safely accepted. In some of the cases the brighter tints of the female are almost confined to the lower surface, and the males, if thus colored, would not have been exposed to danger while sitting on the eggs. It should also be borne in mind that the males are not only in a slight degree less conspicuously colored than the females, but are smaller and weaker. They have, moreover, not only acquired the maternal instinct of incubation, but are less pugnacious and vociferous than the females, and in one instance have simpler vocal organs. Thus an almost complete transposition of the instincts, habits, disposition, color, size, and of some points of structure, has been effected between the two sexes.

Now if we might assume that the males in the present class have lost some of that ardor which is usual to their sex, so that they no longer search eagerly for the females; or, if we might assume that the females have become much more numerous than the males—and in the case of one Indian Turnix the females are said to be "much more commonly met with than the males"[26]—then it is not improbable that the females would have been led to court the males, instead of being courted by them. This, indeed, is the case to a certain extent with some birds, as we have seen with the peahen, wild turkey, and certain kinds of grouse. Taking as our guide the habits of most male birds, the greater size and strength as well as the extraordinary pugnacity of the females of the Turnix and emu, must mean that they endeavor to drive away rival females, in order to gain possession of the male; and on this view all the facts become clear; for the males would probably be most charmed or excited by

[26] Jerdon, "Birds of India," vol. iii. p. 598.

the females which were the most attractive to them by their bright colors, other ornaments, or vocal powers. Sexual selection would then do its work, steadily adding to the attractions of the females; the males and the young being left not at all, or but little, modified.

Class III. *When the adult male resembles the adult female, the young of both sexes have a peculiar first plumage of their own.*—In this class the sexes when adult resemble each other, and differ from the young. This occurs with many birds of many kinds. The male robin can hardly be distinguished from the female, but the young are widely different, with their mottled dusky-olive and brown plumage. The male and female of the splendid scarlet ibis are alike, while the young are brown; and the scarlet color, though common to both sexes, is apparently a sexual character, for it is not well developed in either sex under confinement; and a loss of color often occurs with brilliant males when they are confined. With many species of herons the young differ greatly from the adults; and the summer plumage of the latter, though common to both sexes, clearly has a nuptial character. Young swans are slate colored, while the mature birds are pure white; but it would be superfluous to give additional instances. These differences between the young and the old apparently depend, as in the last two classes, on the young having retained a former or ancient state of plumage, while the old of both sexes have acquired a new one. When the adults are bright colored, we may conclude, from the remarks just made in relation to the scarlet ibis and to many herons, and from the analogy of the species in the first class, that such colors have been acquired through sexual selection by the nearly mature males; but that, differently from what occurs in the first two classes, the transmission, though limited to the same age, has not been limited to the same sex. Consequently, the sexes when mature resemble each other and differ from the young.

CLASS IV. *When the adult male resembles the adult female, the young of both sexes in their first plumage resemble the adults.*—In this class the young and the adults of both sexes, whether brilliantly or obscurely colored, resemble each other. Such cases are, I think, more common than those in the last class. We have in England instances in the kingfisher, some woodpeckers, the jay, magpie, crow, and many small dull-colored birds, such as the hedge-warbler or kitty-wren. But the similarity in plumage between the young and the old is never complete, and graduates away into dissimilarity. Thus the young of some members of the kingfisher family are not only less vividly colored than the adults, but many of the feathers on the lower surface are edged with brown [27]—a vestige probably of a former state of the plumage. Frequently in the same group of birds, even within the same genus, for instance, in an Australian genus of paroquets (Platycercus), the young of some species closely resemble, while the young of other species differ considerably, from their parents of both sexes, which are alike.[28] Both sexes and the young of the common jay are closely similar; but in the Canada jay (*Perisorcus canadensis*) the young differ so much from their parents that they were formerly described as distinct species.[29]

I may remark before proceeding that, under the present and next two classes of cases, the facts are so complex and the conclusions so doubtful, that any one who feels no especial interest in the subject had better pass them over.

The brilliant or conspicuous colors which characterize many birds in the present class can rarely or never be of service to them as a protection; so that they have probably been gained by the males through sexual selection, and then transferred to the females and the young. It is, how-

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[27] Jerdon, "Birds of India," vol. i. pp. 222, 228. Gould's "Handbook to the Birds of Australia," vol. i. pp. 124, 130.

[28] Gould, ibid., vol. ii. pp. 37, 46, 56.

[29] Audubon, "Ornith. Biography," vol. ii. p. 55.

ever, possible that the males may have selected the more attractive females; and if these transmitted their characters to their offspring of both sexes, the same results would follow as from the selection of the more attractive males by the females. But there is evidence that this contingency has rarely, if ever, occurred in any of those groups of birds in which the sexes are generally alike; for, if even a few of the successive variations had failed to be transmitted to both sexes, the females would have slightly exceeded the males in beauty. Exactly the reverse occurs under nature; for, in almost every large group in which the sexes generally resemble each other, the males of some few species are in a slight degree more brightly colored than the females. It is again possible that the females may have selected the more beautiful males, these males having reciprocally selected the more beautiful females; but it is doubtful whether this double process of selection would be likely to occur, owing to the greater eagerness of one sex than the other, and whether it would be more efficient than selection on one side alone. It is, therefore, the most probable view that sexual selection has acted, in the present class, as far as ornamental characters are concerned, in accordance with the general rule throughout the animal kingdom, that is, on the males; and that these have transmitted their gradually acquired colors, either equally or almost equally, to their offspring of both sexes.

Another point is more doubtful, namely, whether the successive variations first appeared in the males after they had become nearly mature, or while quite young. In either case sexual selection must have acted on the male when he had to compete with rivals for the possession of the female; and in both cases the characters thus acquired have been transmitted to both sexes and all ages. But these characters, if acquired by the males when adult, may have been transmitted at first to the adults alone and at some subsequent period transferred to the young. For it is known that, when the law of inheritance at corresponding ages fails, the offspring often inherit characters at an earlier age than that at which they first appeared in their parents.[30] Cases apparently of this kind have been observed with birds in a state of nature. For instance, Mr. Blyth has seen specimens of *Lanius rufus* and of *Colymbus glaci-*

[30] "Variation of Animals and Plants under Domestication," vol. ii. p. 79.

alis which had assumed while young, in a quite anomalous manner, the adult plumage of their parents.[31] Again, the young of the common swan (*Cygnus olor*) do not cast off their dark feathers and become white until eighteen months or two years old; but Dr. F. Forel has described the case of three vigorous young birds, out of a brood of four, which were born pure white. These young birds were not albinos, as shown by the color of their beaks and legs, which nearly resembled the same parts in the adults.[32]

It may be worth while to illustrate the above three modes by which, in the present class, the two sexes and the young may have come to resemble each other, by the curious case of the genus Passer.[33] In the house-sparrow (*P. domesticus*) the male differs much from the female and from the young. The young and the females are alike, and resemble to a large extent both sexes and the young of the sparrow of Palestine (*P. brachydactylus*), as well as of some allied species. We may, therefore, assume that the female and young of the house-sparrow approximately show us the plumage of the progenitor of the genus. Now with the tree-sparrow (*P. montanus*) both sexes and the young closely resemble the male of the house-sparrow; so that they have all been modified in the same manner, and all depart from the typical coloring of their early progenitor. This may have been effected by a male ancestor of the tree-sparrow having varied, first, when nearly mature; or, secondly, while quite young, and by having in either case transmitted his modified plumage to the females and the young; or, thirdly, he may have varied when adult and transmitted his plumage to both adult sexes, and, owing to the failure of the law of inheritance at corresponding ages, at some subsequent period to his young.

It is impossible to decide which of these three modes has generally prevailed throughout the present class of cases. That the males varied while young, and transmitted their variations to their offspring of both sexes, is the most probable. I may here add that I have, with little

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[31] Charlesworth's "Mag. of Nat. Hist.," vol. i., 1837, pp 305, 306.

[32] "Bulletin de la Soc. Vaudoise des Sc. Nat.," vol. x., 1869, p. 132. The young of the Polish swan *Cygnus immutabilis* of Yarrell are always white; but this species, as Mr. Sclater informs me, is believed to be nothing more than a variety of the domestic swan (*Cygnus olor*).

[33] I am indebted to Mr. Blyth for information in regard to this genus. The sparrow of Palestine belongs to the sub-genus Petronia.

success, endeavored, by consulting various works, to decide how far the period of variation in birds has generally determined the transmission of characters to one sex or to both. The two rules, often referred to (namely, that variations occurring late in life are transmitted to one and the same sex, while those which occur early in life are transmitted to both sexes), apparently hold good in the first,[34] second, and fourth classes of cases; but they fail in the third, often in the fifth,[35] and in the sixth small class. They apply, however, as far as I can judge, to a considerable majority of the species, and we must not forget the striking generalization by Dr. W. Marshall with respect to the protuberances on the heads of birds. Whether or not the two rules generally hold good we may conclude from the facts given in the eighth chapter that the period of variation is one important element in determining the form of transmission.

With birds it is difficult to decide by what standard we ought to judge of the earliness or lateness of the period of variation, whether by the age in reference to the duration of life, or to the power of reproduction, or to the number of moults through which the species passes. The moulting of birds, even within the same family, sometimes differs much without any assignable cause. Some birds moult so early that nearly all the body-feathers are cast off before the first wing-feathers are fully grown; and we cannot believe that this was the primordial state of things. When the period of moulting has been accelerated, the age at which the colors of the adult plumage are first developed will falsely appear to us to be earlier than it really is. This may be illustrated by the practice followed by some bird-fanciers, who pull out a few feathers from the breast of nestling bullfinches, and from the head or neck of young gold pheasants, in order to ascertain their sex; for in the males these feath-

[34] For instance, the males of *Tanagra æstiva* and *Fringilla cyanea* require three years, the male of *Fringilla ciris* four years, to complete their beautiful plumage. (See Audubon, "Ornith. Biography," vol. i. pp. 233, 280, 378.) The Harlequin duck takes three years (ibid., vol. iii. p. 614). The male of the Gold pheasant, as I hear from Mr. Jenner Weir, can be distinguished from the female when about three months old, but he does not acquire his full splendor until the end of the September in the following year.

[35] Thus the *Ibis tantalus* and *Grus americanus* take four years, the Flamingo several years, and the *Ardea ludovicana* two years, before they acquire their perfect plumage. See Audubon, ibid., vol. i. p. 221; vol. iii. pp. 133, 139, 211.

ers are immediately replaced by colored ones.[36] The actual duration of life is known in but few birds, so that we can hardly judge by this standard. And, with reference to the period at which the power of reproduction is gained, it is a remarkable fact that various birds occasionally breed while retaining their immature plumage.[37]

The fact of birds breeding in their immature plumage seems opposed to the belief that sexual selection has played as important a part, as I believe it has, in giving ornamental colors, plumes, etc., to the males, and, by means of equal transmission, to the females of many species. The objection would be a valid one, if the younger and less ornamented males were as successful in winning females and propagating their kind as the older and more beautiful males. But we have no reason to suppose that this is the case. Audubon speaks of the breeding of the immature males of *Ibis tantalus* as a rare event, as does Mr. Swinhoe, in regard to the immature males of Oriolus.[38] If the young of any species in their immature plumage were more successful in winning partners than the adults, the adult plumage would probably soon be lost, as the males would prevail which retained their immature dress for the longest period, and thus the character of the species would ultimately be modified.[39] If, on the other hand, the young

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[36] Mr. Blyth, in Charlesworth's "Mag. of Nat. Hist.," vol. i., 1837, p. 300. Mr. Bartlett has informed me in regard to gold pheasants.

[37] I have noticed the following cases in Audubon's "Ornith. Biography." The redstart of America (*Muscapica ruticilla*, vol. i. p. 203). The *Ibis tantalus* takes four years to come to full maturity, but sometimes breeds in the second year (vol. iii. p. 133). The *Grus americanus* takes the same time, but breeds before acquiring its full plumage (vol. iii. p. 211). The adults of *Ardea cærulea* are blue, and the young white; and white, mottled, and mature blue birds may all be seen breeding together (vol. iv. p. 58): but Mr. Blyth informs me that certain herons apparently are dimorphic, for white and colored individuals of the same age may be observed. The Harlequin duck (*Anas histrionica*, Linn.) takes three years to acquire its full plumage, though many birds breed in the second year (vol. iii. p. 614). The White-headed Eagle (*Falco leucocephalus*, vol. iii. p. 210) is likewise known to breed in its immature state. Some species of Oriolus (according to Mr. Blyth and Mr. Swinhoe, in "Ibis," July, 1863, p. 68) likewise breed before they attain their full plumage.

[38] See the last footnote.

[39] Other animals, belonging to quite distinct classes, are either habitually or occasionally capable of breeding before they have fully acquired their adult characters. This is the case with the young males of the salmon. Several amphibians have been known to breed while retaining their larval structure. Fritz Müller has shown ("Facts and Arguments for Darwin," Eng. trans., 1869, p. 79) that the males of several amphipod crustaceans become sexually mature while young; and I infer that this is a case of premature breeding,

never succeeded in obtaining a female, the habit of early reproduction would perhaps be sooner or later eliminated, from being superfluous and entailing waste of power.

The plumage of certain birds goes on increasing in beauty during many years after they are fully mature; this is the case with the train of the peacock, with some of the birds of paradise, and with the crest of the plumes of certain herons, for instance, the *Ardea ludovicana*.[40] But it is doubtful whether the continued development of such feathers is the result of the selection of successive beneficial variations (though this is the most probable view with birds of paradise) or merely of continuous growth. Most fishes continue increasing in size, as long as they are in good health and have plenty of food; and a somewhat similar law may prevail with the plumes of birds.

CLASS V. *When the adults of both sexes have a distinct winter and summer plumage, whether or not the male differs from the female, the young resemble the adults of both sexes in their winter dress, or much more rarely in their summer dress, or they resemble the females alone. Or the young may have an intermediate character; or, again, they may differ greatly from the adults in both their seasonal plumages.*—The cases in this class are singularly complex; nor is this surprising, as they depend on inheritance, limited in a greater or less degree in three different ways, namely, by sex, age, and the season of the year. In some cases the individuals of the same species pass through at least five distinct states of plumage. With the species, in which the male differs from the female during the summer season alone, or which is rarer, during both seasons,[41] the young generally resemble the females—as with the so-called goldfinch of North America, and apparently with the splendid Maluri of Australia.[42] With those species

because they have not as yet acquired their fully developed claspers. All such facts are highly interesting, as bearing on one means by which species may undergo great modifications of character.

[40] Jerdon, "Birds of India," vol. iii. p. 507, on the peacock. Dr. Marshall thinks that the older and more brilliant males of birds of paradise have an advantage over the younger males; see "Archives Néerlandaises," tom. vi., 1871. On Ardea, Audubon, ibid., vol. iii. p. 139.

[41] For illustrative cases see vol. iv. of Macgillivray's "Hist. Brit. Birds"; on Tringa, etc., pp. 229, 271; on the Machetes, p. 172; on the *Charadrius hiaticula*, p. 118; on the *Charadrius pluvialis*, p. 94.

[42] For the goldfinch of North America, *Fringilla tristis*, Linn., see Audubon, "Ornith. Biography," vol. i. p. 172. For the Maluri, Gould's "Handbook to the Birds of Australia," vol. i. p. 318.

the sexes of which are alike during both the summer and winter, the young may resemble the adults, first, in their winter dress; secondly, and this is of much rarer occurrence, in their summer dress; thirdly, they may be intermediate between these two states; and, fourthly, they may differ greatly from the adults at all seasons. We have an instance of the first of these four cases in one of the egrets of India (*Buphus coromandus*), in which the young and the adults of both sexes are white during the winter, the adults becoming golden-buff during the summer. With the gaper (*Anastomus oscitans*) of India we have a similar case, but the colors are reversed; for the young and the adults of both sexes are gray and black during the winter, the adults becoming white during the summer.[43] As an instance of the second case, the young of the razor-bill (*Alca torda*, Linn.), in an early state of plumage, are colored like the adults during the summer; and the young of the white-crowned sparrow of North America (*Fringilla leucophrys*), as soon as fledged, have elegant white stripes on their heads, which are lost by the young and the old during the winter.[44] With respect to the third case, namely, that of the young having an intermediate character between the summer and winter adult plumages, Yarrell,[45] insists that this occurs with many waders. Lastly, in regard to the young differing greatly from both sexes in their adult summer and winter plumages, this occurs with some herons and egrets of North America and India—the young alone being white.

I will make only a few remarks on these complicated cases. When the young resemble the females in their summer dress, or the adults of both sexes in their winter dress, the cases differ from those given under Classes I. and III. only in the characters originally acquired by the males during the breeding season having been limited in their transmission to the corresponding season. When the adults have a distinct summer and winter plumage, and the young differ from both, the case is more difficult to understand. We may admit as probable that the young have retained an

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[43] I am indebted to Mr. Blyth for information as to the Buphus; see, also, Jerdon, "Birds of India," vol. iii. p. 749. On the Anastomus, see Blyth in "Ibis," 1867, p. 173.

[44] On the Alca, see Macgillivray, "Hist. Brit. Birds," v. 347. On the *Fringilla leucophrys*, Audubon, ibid., ii. p. 89. I shall have hereafter to refer to the young of certain herons and egrets being white.

[45] "History of British Birds," vol. i., 1839, p. 159.

ancient state of plumage; we can account by sexual selection for the summer or nuptial plumage of the adults, but how are we to account for their distinct winter plumage? If we could admit that this plumage serves in all cases as a protection, its acquirement would be a simple affair; but there seems no good reason for this admission. It may be suggested that the widely different conditions of life during the winter and summer have acted in a direct manner on the plumage; this may have had some effect, but I have not much confidence in so great a difference as we sometimes see between the two plumages having been thus caused. A more probable explanation is, that an ancient style of plumage, partially modified through the transference of some characters from the summer plumage, has been retained by the adults during the winter. Finally, all the cases in our present class apparently depend on characters acquired by the adult males having been variously limited in their transmission according to age, season, and sex; but it would not be worth while to attempt to follow out these complex relations.

CLASS VI. *The young in their first plumage differ from each other according to sex; the young males resembling more or less closely the adult males, and the young females more or less closely the adult females.*—The cases in the present class, though occurring in various groups, are not numerous; yet it seems the most natural thing that the young should at first somewhat resemble the adults of the same sex, and gradually become more and more like them. The adult male blackcap (*Sylvia atricapilla*) has a black head, that of the female being reddish brown; and I am informed by Mr. Blyth that the young of both sexes can be distinguished by this character even as nestlings. In the family of thrushes an unusual number of similar cases have been noticed; thus, the male blackbird (*Turdus merula*) can be distinguished in the nest from the female. The two sexes of the mocking-bird (*Turdus polyglottus*, Linn.) differ very little from each other, yet the males can easily be distinguished at a very early age from the females by showing more pure white.[46] The males of a forest-thrush and of a rock-thrush (*Orocetes erythrogastra* and *Petrocincla cyanea*) have much of their plumage of a fine blue, while the females are brown; and

[46] Audubon, "Ornith. Biography," vol. i. p. 113.

the nestling males of both species have their main wing and tail-feathers edged with blue, while those of the female are edged with brown.[47] In the young blackbird the wing-feathers assume their mature character and become black after the others; on the other hand, in the two species just named the wing-feathers become blue before the others. The most probable view with reference to the cases in the present class is that the males, differently from what occurs in Class I., have transmitted their colors to their male offspring at an earlier age than that at which they were first acquired; for, if the males had varied while quite young, their characters would probably have been transmitted to both sexes.[48]

In *Aïthurus polytmus*, a humming-bird, the male is splendidly colored black and green, and two of the tail-feathers are immensely lengthened; the female has an ordinary tail and inconspicuous colors; now the young males, instead of resembling the adult female, in accordance with the common rule, begin from the first to assume the colors proper to their sex, and their tail-feathers soon become elongated. I owe this information to Mr. Gould, who has given me the following more striking and as yet unpublished case. Two humming-birds belonging to the genus Eustephanus, both beautifully colored, inhabit the small island of Juan Fernandez, and have always been ranked as specifically distinct. But it has lately been ascertained that the one, which is of a rich chestnut brown color with a golden-red head, is the male, while the other, which is elegantly variegated with green and white, with a metallic-green head, is the female. Now the young from the first somewhat resemble the adults of the corresponding sex, the resemblance gradually becoming more and more complete.

In considering this last case, if, as before, we take the plumage of the young as our guide, it would appear that

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[47] Mr. C. A. Wright, in "Ibis," vol. vi., 1864, p. 65. Jerdon, "Birds of India," vol. i. p. 515. See, also, on the blackbird, Blyth, in Charlesworth's "Mag. of Nat. History," vol. i., 1837, p. 113.

[48] The following additional cases may be mentioned: the young males of *Tanagra rubra* can be distinguished from the young females (Audubon, "Ornith. Biography," vol. iv. p. 392), and so it is with the nestlings of a blue nuthatch, *Dendrophila frontalis* of India (Jerdon, "Birds of India," vol. i. p. 389). Mr. Blyth also informs me that the sexes of the stonechat, *Saxicola rubicola*, are distinguishable at a very early age. Mr. Salvin gives ("Proc. Zoolog. Soc.," 1870, p. 206) the case of a humming-bird, like the above one of Eustephanus.

both sexes have been rendered beautiful independently; and not that one sex has partially transferred its beauty to the other. The male apparently has acquired his bright colors through sexual selection in the same manner as, for instance, the peacock or pheasant in our first class of cases; and the female in the same manner as the female Rhynchæa or Turnix in our second class of cases. But there is much difficulty in understanding how this could have been effected at the same time with the two sexes of the same species. Mr. Salvin states, as we have seen in the eighth chapter, that with certain humming-birds the males greatly exceed the females in number, while with other species inhabiting the same country the females greatly exceed the males. If, then, we might assume that during some former lengthened period the males of the Juan Fernandez species had greatly exceeded the females in number, but that during another lengthened period the females had far exceeded the males, we could understand how the males at one time, and the females at another, might have been rendered beautiful by the selection of the brighter-colored individuals of either sex; both sexes transmitting their characters to their young at a rather earlier age than usual. Whether this is the true explanation I will not pretend to say; but the case is too remarkable to be passed over without notice.

We have now seen in all six classes that an intimate relation exists between the plumage of the young and the adults, either of one sex or both. These relations are fairly well explained on the principle that one sex—this being in the great majority of cases the male—first acquired through variation and sexual selection bright colors or other ornaments, and transmitted them in various ways, in accordance with the recognized laws of inheritance. Why variations have occurred at different periods of life, even sometimes with species of the same group, we do not know, but with respect to the form of transmission one important determining cause seems to be the age at which the variations first appear.

From the principle of inheritance at corresponding ages, and from any variations in color which occurred in the males at an early age not being then selected—on the con-

trary being often eliminated as dangerous—while similar variations occurring at or near the period of reproduction have been preserved, it follows that the plumage of the young will often have been left unmodified, or but little modified. We thus get some insight into the coloring of the progenitors of our existing species. In a vast number of species, in five out of our six classes of cases, the adults of one sex or of both are bright colored, at least during the breeding season, while the young are invariably less brightly colored than the adults, or are quite dull colored, for no instance is known, as far as I can discover, of the young of dull-colored species displaying bright colors, or of the young of bright-colored species being more brilliant than their parents. In the fourth class, however, in which the young and the old resemble each other, there are many species (though by no means all) of which the young are bright colored, and as these form whole groups we may infer that their early progenitors were likewise bright. With this exception, if we look to the birds of the world, it appears that their beauty has been much increased since that period of which their immature plumage gives us a partial record.

On the Color of the Plumage in relation to Protection.—It will have been seen that I cannot follow Mr. Wallace in the belief that dull colors, when confined to the females, have been in most cases specially gained for the sake of protection. There can, however, be no doubt, as formerly remarked, that both sexes of many birds have had their colors modified, so as to escape the notice of their enemies; or in some instances, so as to approach their prey unobserved, just as owls have had their plumage rendered soft, that their flight may not be overheard. Mr. Wallace remarks[49] that "it is only in the tropics, among forests which never lose their foliage, that we find whole groups of birds, whose chief color is green." It will be admitted

[49] "Westminster Review," July, 1867, p. 5.

by every one who has ever tried, how difficult it is to distinguish parrots in a leaf-covered tree. Nevertheless, we must remember that many parrots are ornamented with crimson, blue, and orange tints, which can hardly be protective. Woodpeckers are eminently arboreal, but besides green species there are many black, and black-and-white kinds—all the species being apparently exposed to nearly the same dangers. It is therefore probable that with tree-haunting birds strongly pronounced colors have been acquired through sexual selection, but that a green tint has been acquired oftener than any other, from the additional advantage of protection.

In regard to birds which live on the ground, every one admits that they are colored so as to imitate the surrounding surface. How difficult it is to see a partridge, snipe, woodcock, certain plovers, larks, and night-jars when crouched on ground. Animals inhabiting deserts offer the most striking cases, for the bare surface affords no concealment, and nearly all the smaller quadrupeds, reptiles and birds depend for safety on their colors. Mr. Tristram has remarked, in regard to the inhabitants of the Sahara, that all are protected by their "isabelline or sand-color."[60] Calling to my recollection the desert-birds of South America, as well as most of the ground-birds of Great Britain, it appeared to me that both sexes in such cases are generally colored nearly alike. Accordingly, I applied to Mr. Tristram with respect to the birds of the Sahara, and he has kindly given me the following information. There are twenty-six species belonging to fifteen genera, which manifestly have their plumage colored in a protective manner; and this coloring is all the more striking, as with most of these birds it differs from that of their congeners. Both sexes of thirteen out of the twenty-six species are colored in the same manner; but these belong to genera in which

[60] "Ibis," 1859, vol. i. p. 429 *et seq.* Dr. Rohlfs, however, remarks to me in a letter that, according to his experience of the Sahara, this statement is too strong.

this rule commonly prevails, so that they tell us nothing about the protective colors being the same in both sexes of desert-birds. Of the other thirteen species, three belong to genera in which the sexes usually differ from each other, yet here they have the sexes alike. In the remaining ten species, the male differs from the female; but the difference is confined chiefly to the under surface of the plumage, which is concealed when the bird crouches on the ground; the head and back being of the same sand-colored hue in the two sexes. So that in these ten species the upper surfaces of both sexes have been acted on and rendered alike, through natural selection, for the sake of protection; while the lower surfaces of the males alone have been diversified, through sexual selection, for the sake of ornament. Here, as both sexes are equally well protected, we clearly see that the females have not been prevented by natural selection from inheriting the colors of their male parents; so that we must look to the law of sexually limited transmission.

In all parts of the world both sexes of many soft-billed birds, especially those which frequent reeds or sedges, are obscurely colored. No doubt if their colors had been brilliant they would have been much more conspicuous to their enemies; but whether their dull tints have been specially gained for the sake of protection seems, as far as I can judge, rather doubtful. It is still more doubtful whether such dull tints can have been gained for the sake of ornament. We must, however, bear in mind that male birds, though dull colored, often differ much from their females (as with the common sparrow), and this leads to the belief that such colors have been gained through sexual selection, from being attractive. Many of the soft-billed birds are songsters; and a discussion in a former chapter should not be forgotten, in which it was shown that the best songsters are rarely ornamented with bright tints. It would appear that female birds, as a general rule, have selected their mates either for their sweet voices or gay colors; but not for both charms combined. Some species, which are

manifestly colored for the sake of protection, such as the jack-snipe, woodcock, and night-jar, are likewise marked and shaded, according to our standard of taste, with extreme elegance. In such cases we may conclude that both natural and sexual selection have acted conjointly for protection and ornament. Whether any bird exists which does not possess some special attraction, by which to charm the opposite sex, may be doubted. When both sexes are so obscurely colored that it would be rash to assume the agency of sexual selection, and when no direct evidence can be advanced showing that such colors serve as a protection, it is best to own complete ignorance of the cause, or, which comes to nearly the same thing, to attribute the result to the direct action of the conditions of life.

Both sexes of many birds are conspicuously though not brilliantly colored, such as the numerous black, white, or piebald species, and these colors are probably the result of sexual selection. With the common blackbird, capercailzie, black-cock, black scoter-duck (Oidemia), and even with one of the birds of paradise (*Lophorina atra*), the males alone are black, while the females are brown or mottled; and there can hardly be a doubt that blackness in these cases has been a sexually selected character. Therefore it is in some degree probable that the complete or partial blackness of both sexes in such birds as crows, certain cockatoos, storks and swans, and many marine birds, is likewise the result of sexual selection, accompanied by equal transmission to both sexes; for blackness can hardly serve in any case as a protection. With several birds in which the male alone is black, and in others in which both sexes are black, the beak or skin about the head is brightly colored, and the contrast thus afforded adds much to their beauty; we see this in the bright yellow beak of the male blackbird, in the crimson skin over the eyes of the black-cock and capercailzie, in the brightly and variously colored beak of the scoter-drake (Oidemia), in the red beak of the chough (*Corvus graculus*, Linn.), of the black swan, and the black

stork. This leads me to remark that it is not incredible that toucans may owe the enormous size of their beaks to sexual selection, for the sake of displaying the diversified and vivid stripes of color with which these organs are ornamented.[51] The naked skin, also, at the base of the beak and round the eyes is likewise often brilliantly colored; and Mr. Gould, in speaking of one species,[52] says that the colors of the beak "are doubtless in the finest and most brilliant state during the time of pairing." There is no greater improbability that toucans should be encumbered with immense beaks, though rendered as light as possible by their cancellated structure, for the display of fine colors (an object falsely appearing to us unimportant), than that the male Argus pheasant and some other birds should be encumbered with plumes so long as to impede their flight.

In the same manner as the males alone of various species are black, the females being dull colored, so in a few cases the males alone are either wholly or partially white, as with the several bell-birds of South America (Chasmorhynchus), the Antarctic goose (*Bernicla antarctica*), the silver-pheasant, etc., while the females are brown or obscurely mottled. Therefore, on the same principle as before, it is probable that both sexes of many birds, such as white cockatoos, several egrets with their beautiful plumes, certain ibises, gulls, terns, etc., have acquired their more or less completely white plumage through sexual selection. In some of these cases the plumage becomes white only at maturity.

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[51] No satisfactory explanation has ever been offered of the immense size, and still less of the bright colors, of the toucan's beak. Mr. Bates ("The Naturalist on the Amazons," vol. ii., 1863, p. 341) states that they use their beaks for reaching fruit at the extreme tips of the branches; and likewise, as stated by other authors, for extracting eggs and young birds from the nests of other birds. But, as Mr. Bates admits, the beak "can scarcely be considered a very perfectly formed instrument for the end to which it is applied." The great bulk of the beak, as shown by its breadth, depth, as well as length, is not intelligible on the view that it serves merely as an organ of prehension. Mr. Belt believes ("The Naturalist in Nicaragua," p. 197) that the principal use of the beak is as a defence against enemies, especially to the female while nesting in a hole in a tree.

[52] Ramphastos carinatus, Gould's "Monograph of Ramphastidæ."

This is the case with certain gannets, tropic-birds, etc., and with the snow-goose (*Anser hyperboreus*). As the latter breeds on the "barren grounds" when not covered with snow, and as it migrates southward during the winter, there is no reason to suppose that its snow-white adult plumage serves as a protection. In the *Anastomus oscitans*, we have still better evidence that the white plumage is a nuptial character, for it is developed only during the summer; the young in their immature state, and the adults in their winter dress, being gray and black. With many kinds of gulls (Larus) the head and neck become pure white during the summer, being gray or mottled during the winter and in the young state. On the other hand, with the smaller gulls, or sea-mews (Gavia), and with some terns (Sterna), exactly the reverse occurs; for the heads of the young birds during the first year, and of the adults during the winter, are either pure white or much paler colored than during the breeding season. These latter cases offer another instance of the capricious manner in which sexual selection appears often to have acted.[53]

That aquatic birds have acquired a white plumage so much oftener than terrestrial birds, probably depends on their large size and strong powers of flight, so that they can easily defend themselves or escape from birds of prey, to which, moreover, they are not much exposed. Consequently, sexual selection has not here been interfered with or guided for the sake of protection. No doubt with birds which roam over the open ocean, the males and females could find each other much more easily when made conspicuous either by being perfectly white or intensely black; so that these colors may possibly serve the same end as the call-notes of many land-birds.[54] A white or black bird

[53] On Larus, Gavia, and Sterna, see Macgillivray, "Hist. Brit. Birds," vol. v. pp. 515, 584, 626. On the Anser hyperboreus, Audubon, "Ornith. Biography," vol. iv. p. 562. On the Anastomus, Mr. Blyth, in "Ibis," 1867, p. 173.

[54] It may be noticed that with vultures, which roam far and wide high in the air, like marine birds over the ocean, three or four species are almost wholly

when it discovers and flies down to a carcass floating on the sea or cast upon the beach, will be seen from a great distance, and will guide other birds of the same and other species to the prey; but as this would be a disadvantage to the first finders, the individuals which were the whitest or blackest would not thus procure more food than the less strongly colored individuals. Hence conspicuous colors cannot have been gradually acquired for this purpose through natural selection.

As sexual selection depends on so fluctuating an element as taste, we can understand how it is that, within the same group of birds having nearly the same habits, there should exist white or nearly white, as well as black or nearly black species—for instance, both white and black cockatoos, storks, ibises, swans, terns, and petrels. Piebald birds likewise sometimes occur in the same groups together with black and white species; for instance, the black-necked swan, certain terns, and the common magpie. That a strong contrast in color is agreeable to birds we may conclude by looking through any large collection, for the sexes often differ from each other in the male having the pale parts of a purer white, and the variously colored dark parts of still darker tints than the female.

It would even appear that mere novelty or slight changes for the sake of change have sometimes acted on female birds as a charm, like changes of fashion with us. Thus the males of some parrots can hardly be said to be more beautiful than the females, at least according to our taste, but they differ in such points as in having a rose-colored collar instead of "a bright emeraldine narrow green collar"; or in the male having a black collar instead of "a yellow demi-collar in front," with a pale roseate instead of a plum-blue head.[55] And so many male birds have elongated tail-

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or largely white, and that many others are black. So that here again conspicuous colors may possibly aid the sexes in finding each other during the breeding season.

[55] See Jerdon on the genus Palæornis, "Birds of India," vol. i. pp. 258–260.

feathers or elongated crests for their chief ornament, the shortened tail, formerly described in the male of a humming-bird, and the shortened crest of the male goosander, seem like one of the many changes of fashion which we admire in our own dresses.

Some members of the heron family offer a still more curious case of novelty in coloring having, as it appears, been appreciated for the sake of novelty. The young of the *Ardea asha* are white, the adults being dark slate-colored; and not only the young, but the adults in their winter plumage, of the allied *Buphus coromandus* are white, this color changing into a rich golden-buff during the breeding season. It is incredible that the young of these two species, as well as of some other members of the same family,[56] should for any special purpose have been rendered pure white and thus made conspicuous to their enemies; or that the adults of one of these two species should have been specially rendered white during the winter in a country which is never covered with snow. On the other hand, we have good reason to believe that whiteness has been gained by many birds as a sexual ornament. We may, therefore, conclude that some early progenitor of the *Ardea asha* and the Buphus acquired a white plumage for nuptial purposes, and transmitted this color to their young; so that the young and the old became white like certain existing egrets; and that the whiteness was afterward retained by the young, while it was exchanged by the adults for more strongly pronounced tints. But if we could look still further back to the still earlier progenitors of these two species, we should probably see the adults dark colored. I infer that this would be the case from the analogy of many other birds, which are dark while

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[56] The young of *Ardea rufescens* and *A. cærulea* of the United States are likewise white, the adults being colored in accordance with their specific names. Audubon ("Ornith. Biography," vol. iii. p. 416; vol. iv. p. 58) seems rather pleased at the thought that this remarkable change of plumage will greatly "disconcert the systematists."

young, and when adult are white; and more especially from the case of the *Ardea gularis*, the colors of which are the reverse of those of *A. asha*, for the young are dark colored and the adults white, the young having retained a former state of plumage. It appears, therefore, that during a long line of descent the adult progenitors of the *Ardea asha*, the Buphus, and of some allies, have undergone the following changes of color: first, a dark shade; secondly, pure white; and thirdly, owing to another change of fashion (if I may so express myself), their present slaty, reddish, or golden-buff tints. These successive changes are intelligible only on the principle of novelty having been admired by birds for its own sake.

Several writers have objected to the whole theory of sexual selection, by assuming that with animals and savages the taste of the female for certain colors or other ornaments would not remain constant for many generations; that first one color and then another would be admired, and consequently that no permanent effect could be produced. We may admit that taste is fluctuating, but it is not quite arbitrary. It depends much on habit, as we see in mankind; and we may infer that this would hold good with birds and other animals. Even in our own dress, the general character lasts long, and the changes are, to a certain extent, graduated. Abundant evidence will be given in two places in a future chapter that savages of many races have admired for many generations the same cicatrices on the skin, the same hideously perforated lips, nostrils, or ears, distorted heads, etc.; and these deformities present some analogy to the natural ornaments of various animals. Nevertheless, with savages such fashions do not endure forever, as we may infer from the differences in this respect between allied tribes on the same continent. So, again, the raisers of fancy animals certainly have admired for many generations, and still admire, the same breeds; they earnestly desire slight changes, which are considered as improvements, but any great or sudden

change is looked at as the greatest blemish. With birds in a state of nature we have no reason to suppose that they would admire an entirely new style of coloration, even if great and sudden variations often occurred, which is far from being the case. We know that dovecot pigeons do not willingly associate with the variously colored fancy breeds; that albino birds do not commonly get partners in marriage; and that the black ravens of the Feroe Islands chase away their piebald brethren. But this dislike of a sudden change would not preclude their appreciating slight changes, any more than it does in the case of man. Hence, with respect to taste, which depends on many elements, but partly on habit and partly on a love of novelty, there seems no improbability in animals admiring for a very long period the same general style of ornamentation or other attractions, and yet appreciating slight changes in colors, form, or sound.

Summary of the Four Chapters on Birds.—Most male birds are highly pugnacious during the breeding season, and some possess weapons adapted for fighting with their rivals. But the most pugnacious and the best armed males rarely or never depend for success solely on their power to drive away or kill their rivals, but have special means for charming the female. With some it is the power of song, or of giving forth strange cries or instrumental music, and the males in consequence differ from the females in their vocal organs, or in the structure of certain feathers. From the curiously diversified means for producing various sounds, we gain a high idea of the importance of this means of courtship. Many birds endeavor to charm the females by love-dances or antics, performed on the ground or in the air, and sometimes at prepared places. But ornaments of many kinds, the most brilliant tints, combs and wattles, beautiful plumes, elongated feathers, topknots, and so forth, are by far the commonest means. In some cases mere novelty appears to have acted as a charm. The ornaments of the males must be highly important to them, for they have been ac-

quired in not a few cases at the cost of increased danger from enemies, and even at some loss of power in fighting with their rivals. The males of very many species do not assume their ornamental dress until they arrive at maturity, or they assume it only during the breeding season, or the tints then become more vivid. Certain ornamental appendages become enlarged, turgid, and brightly colored during the act of courtship. The males display their charms with elaborate care and to the best effect; and this is done in the presence of the females. The courtship is sometimes a prolonged affair, and many males and females congregate at an appointed place. To suppose that the females do not appreciate the beauty of the males, is to admit that their splendid decorations, all their pomp and display, are useless; and this is incredible. Birds have fine powers of discrimination, and in some few instances it can be shown that they have a taste for the beautiful. The females, moreover, are known occasionally to exhibit a marked preference or antipathy for certain individual males.

If it be admitted that the females prefer, or are unconsciously excited by the more beautiful males, then the males would slowly but surely be rendered more and more attractive through sexual selection. That it is this sex which has been chiefly modified we may infer from the fact that, in almost every genus where the sexes differ, the males differ much more from one another than do the females; this is well shown in certain closely allied representative species, in which the females can hardly be distinguished, while the males are quite distinct. Birds in a state of nature offer individual differences which would amply suffice for the work of sexual selection; but we have seen that they occasionally present more strongly marked variations which recur so frequently that they would immediately be fixed, if they served to allure the female. The laws of variation must determine the nature of the initial changes, and will have largely influenced the final

result. The gradations which may be observed between the males of allied species indicate the nature of the steps through which they have passed. They explain also in the most interesting manner how certain characters have originated, such as the indented ocelli on the tail-feathers of the peacock, and the ball-and-socket ocelli on the wing-feathers of the Argus pheasant. It is evident that the brilliant colors, topknots, fine plumes, etc., of many male birds cannot have been acquired as a protection; indeed, they sometimes lead to danger. That they are not due to the direct and definite action of the conditions of life we may feel assured, because the females have been exposed to the same conditions, and yet often differ from the males to an extreme degree. Although it is probable that changed conditions acting during a lengthened period have in some cases produced a definite effect on both sexes, or sometimes on one sex alone, the more important result will have been an increased tendency to vary or to present more strongly marked individual differences; and such differences will have afforded an excellent groundwork for the action of sexual selection.

The laws of inheritance, irrespectively of selection, appear to have determined whether the characters acquired by the males for the sake of ornament, for producing various sounds, and for fighting together, have been transmitted, to the males alone or to both sexes, either permanently or periodically, during certain seasons of the year. Why various characters should have been transmitted, sometimes in one way and sometimes in another, is not in most cases known; but the period of variability seems often to have been the determining cause. When the two sexes have inherited all characters in common they necessarily resemble each other; but as the successive variations may be differently transmitted, every possible gradation may be found, even within the same genus, from the closest similarity to the widest dissimilarity between the sexes. With many closely allied species, following nearly the same habits of life, the males

have come to differ from each other chiefly through the action of sexual selection, while the females have come to differ chiefly from partaking more or less of the characters thus acquired by the males. The effects, moreover, of the definite action of the conditions of life will not have been masked in the females, as in the males, by the accumulation through sexual selection of strongly pronounced colors and other ornaments. The individuals of both sexes, however affected, will have been kept at each successive period nearly uniform by the free intercrossing of many individuals.

With species in which the sexes differ in color it is possible or probable that some of the successive variations often tended to be transmitted equally to both sexes; but that when this occurred the females were prevented from acquiring the bright colors from the males by the destruction which they suffered during incubation. There is no evidence that it is possible by natural selection to convert one form of transmission into another. But there would not be the least difficulty in rendering a female dull colored, the male being still kept bright colored by the selection of successive variations, which were from the first limited in their transmission to the same sex. Whether the females of many species have actually been thus modified must at present remain doubtful. When, through the law of the equal transmission of characters to both sexes, the females were rendered as conspicuously colored as the males, their instincts appear often to have been modified so that they were led to build domed or concealed nests.

In one small and curious class of cases the characters and habits of the two sexes have been completely transposed, for the females are larger, stronger, more vociferous, and brighter colored than the males. They have, also, become so quarrelsome that they often fight together for the possession of the males, like the males of other pugnacious species for the possession of the females. If, as seems probable, such females habitually drive away their rivals, and by the display of their bright colors or other charms endeavor

to attract the males, we can understand how it is that they have gradually been rendered, by sexual selection and sexually limited transmission, more beautiful than the males—the latter being left unmodified or only slightly modified.

Whenever the law of inheritance at corresponding ages prevails, but not that of sexually limited transmission, then if the parents vary late in life—and we know that this constantly occurs with our poultry, and occasionally with other birds—the young will be left unaffected, while the adults of both sexes will be modified. If both these laws of inheritance prevail, and either sex varies late in life, that sex alone will be modified, the other sex and the young being unaffected. When variations in brightness or in other conspicuous characters occur early in life, as no doubt often happens, they will not be acted on through sexual selection until the period of reproduction arrives; consequently, if dangerous to the young, they will be eliminated through natural selection. Thus we can understand how it is that variations arising late in life have so often been preserved for the ornamentation of the males; the females and the young being left almost unaffected, and therefore like each other. With species having a distinct summer and winter plumage, the males of which either resemble or differ from the females during both seasons or during the summer alone, the degrees and kinds of resemblance between the young and the old are exceedingly complex; and this complexity apparently depends on characters, first acquired by the males, being transmitted in various ways and degrees, as limited by age, sex and season.

As the young of so many species have been but little modified in color and in other ornaments, we are enabled to form some judgment with respect to the plumage of their early progenitors; and we may infer that the beauty of our existing species, if we look to the whole class, has been largely increased since that period, of which the immature plumage gives us an indirect record. Many birds, especially those which live much on the ground, have un-

doubtedly been obscurely colored for the sake of protection. In some instances the upper exposed surface of the plumage has been thus colored in both sexes, while the lower surface in the males alone has been variously ornamented through sexual selection. Finally, from the facts given in these four chapters, we may conclude that weapons for battle, organs for producing sound, ornaments of many kinds, bright and conspicuous colors, have generally been acquired by the males through variation and sexual selection, and have been transmitted in various ways according to the several laws of inheritance—the females and the young being left comparatively but little modified.[57]

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[57] I am greatly indebted to the kindness of Mr. Sclater for having looked over these four chapters on birds, and the two following ones on mammals. In this way I have been saved from making mistakes about the names of the species, and from stating anything as a fact which is known to this distinguished naturalist to be erroneous. But of course he is not at all answerable for the accuracy of the statements quoted by me from various authorities.

CHAPTER XVII

SECONDARY SEXUAL CHARACTERS OF MAMMALS

The law of battle—Special weapons, confined to the males—Cause of absence of weapons in the female—Weapons common to both sexes, yet primarily acquired by the male—Other uses of such weapons—Their high importance—Greater size of the male—Means of defence—On the preference shown by either sex in the pairing of quadrupeds

WITH mammals the male appears to win the female much more through the law of battle than through the display of his charms. The most timid animals, not provided with any special weapons for fighting, engage in desperate conflicts during the season of love. Two male hares have been seen to fight together until one was killed; male moles often fight, and sometimes with fatal results; male squirrels engage in frequent contests, "and often wound each other severely"; as do male beavers, so that "hardly a skin is without scars."[1] I observed the same fact with the hides of the guanacos in Patagonia; and on one occasion several were so absorbed in fighting that they fearlessly rushed close by me. Livingstone speaks of the males of the many animals in Southern Africa as almost invariably showing the scars received in former contests.

The law of battle prevails with aquatic as with terrestrial mammals. It is notorious how desperately male seals fight, both with their teeth and claws, during the breeding

[1] See Waterton's account of two hares fighting, "Zoologist," vol. i., 1843, p. 211. On moles, Bell, "Hist. of British Quadrupeds," first edit. p. 100. On squirrels, Audubon and Bachman, "Viviparous Quadrupeds of N. America," 1846, p. 269. On beavers, Mr. A. H. Green, in "Journal of Lin. Soc. Zoolog.," vol. x., 1869, p. 362.

season; and their hides are likewise often covered with scars. Male sperm-whales are very jealous at this season; and in their battles "they often lock their jaws together, and turn on their sides and twist about"; so that their lower jaws often become distorted.[2]

All male animals which are furnished with special weapons for fighting are well known to engage in fierce battles. The courage and the desperate conflicts of stags have often been described; their skeletons have been found in various parts of the world with the horns inextricably locked together, showing how miserably the victor and vanquished had perished.[3] No animal in the world is so dangerous as an elephant in must. Lord Tankerville has given me a graphic description of the battles between the wild bulls in Chillingham Park, the descendants, degenerated in size but not in courage, of the gigantic *Bos primigenius*. In 1861 several contended for mastery; and it was observed that two of the younger bulls attacked in concert the old leader of the herd, overthrew and disabled him, so that he was believed by the keepers to be lying mortally wounded in a neighboring wood. But a few days afterward one of the young bulls approached the wood alone, and then the "monarch of the chase," who had been lashing himself up for vengeance, came out, and in a short time killed his antagonist. He then quietly joined the herd, and long held undisputed sway. Admiral Sir J. B. Sulivan informs me that when he lived in the Falkland Islands, he imported a young English stallion, which frequented the hills near Port William with eight mares. On these hills there were two wild stallions, each with a small troop

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[2] On the battles of seals, see Capt. C. Abbott in "Proc. Zool. Soc.," 1868, p. 191; also Mr. R. Brown, ibid., 1868, p. 436; also L. Lloyd, "Game Birds of Sweden," 1867, p. 412; also Pennant. On the sperm-whale, see Mr. J. H. Thompson, in "Proc. Zool. Soc.," 1867, p. 246.

[3] See Scrope ("Art of Deer-stalking," p. 17) on the locking of the horns with the Cervus elaphus. Richardson, in "Fauna Bor. Americana," 1829, p. 252, says that the wapiti, moose, and reindeer have been found thus locked together. Sir A. Smith found at the Cape of Good Hope the skeletons of two gnus in the same condition.

of mares; "and it is certain that these stallions would never have approached each other without fighting. Both had tried singly to fight the English horse and drive away his mares, but had failed. One day they came in *together* and attacked him. This was seen by the capitan who had charge of the horses, and who, on riding to the spot, found one of the two stallions engaged with the English horse, while the other was driving away the mares, and had already separated four from the rest. The capitan settled the matter by driving the whole party into the corral, for the wild stallions would not leave the mares."

Male animals which are provided with efficient cutting or tearing teeth for the ordinary purposes of life, such as the carnivora, insectivora, and rodents, are seldom furnished with weapons especially adapted for fighting with their rivals. The case is very different with the males of many other animals. We see this in the horns of stags and of certain kinds of antelopes in which the females are hornless. With many animals the canine teeth in the upper or lower jaw, or in both, are much larger in the males than in the females, or are absent in the latter, with the exception sometimes of a hidden rudiment. Certain antelopes, the musk-deer, camel, horse, boar, various apes, seals, and the walrus, offer instances. In the females of the walrus the tusks are sometimes quite absent.[4] In the male elephant of India and in the male dugong[5] the upper incisors form offensive weapons. In the male narwhal the left canine alone is developed into the well-known, spirally twisted, so-called horn, which is sometimes from nine to ten feet in length. It is believed that the males use these horns for fighting together; for "an unbroken one can rarely be got, and occasionally one may be found with the

[4] Mr. Lamont ("Seasons with the Sea-Horses," 1861, p. 143) says that a good tusk of the male walrus weighs 4 pounds, and is longer than that of the female, which weighs about 3 pounds. The males are described as fighting ferociously. On the occasional absence of the tusks in the female, see Mr. R. Brown, "Proc. Zool. Soc.," 1868, p. 429.

[5] Owen, "Anatomy of Vertebrates," vol. iii. p. 283.

point of another jammed into the broken place."[6] The tooth on the opposite side of the head in the male consists of a rudiment about ten inches in length, which is imbedded in the jaw; but sometimes, though rarely, both are equally developed on the two sides. In the female both are always rudimentary. The male cachalot has a larger head than that of the female, and it no doubt aids him in his aquatic battles. Lastly, the adult male ornithorhynchus is provided with a remarkable apparatus, namely, a spur on the foreleg, closely resembling the poison fang of a venomous snake; but according to Harting, the secretion from the gland is not poisonous; and on the leg of the female there is a hollow, apparently for the reception of the spur.[7]

When the males are provided with weapons which in the females are absent, there can hardly be a doubt that these serve for fighting with other males; and that they were acquired through sexual selection, and were transmitted to the male sex alone. It is not probable, at least in most cases, that the females have been prevented from acquiring such weapons on account of their being useless, superfluous, or in some way injurious. On the contrary, as they are often used by the males for various purposes, more especially as a defence against their enemies, it is a surprising fact that they are so poorly developed, or quite absent, in the females of so many animals. With female deer the development during each recurrent season of great branching horns, and with female elephants the development of immense tusks, would be a great waste of vital power, supposing that they were of no use to the females. Consequently, they would have tended to be eliminated in the

[6] Mr. R. Brown, in "Proc. Zool. Soc.," 1869, p. 553. See Prof. Turner, in "Journal of Anat. and Phys.," 1872, p. 76, on the homological nature of these tusks. Also Mr. J. W. Clarke on two tusks being developed in the males, in "Proc. Zoolog. Soc.," 1871, p. 42.

[7] Owen on the cachalot and Ornithorhynchus, ibid., vol. iii. pp. 638, 641. Harting is quoted by Dr. Zouteveen in the Dutch translat. of this work, vol. ii. p. 292.

female through natural selection; that is, if the successive variations were limited in their transmission to the female sex, for otherwise the weapons of the males would have been injuriously affected, and this would have been a greater evil. On the whole, and from the consideration of the following facts, it seems probable that when the various weapons differ in the two sexes, this has generally depended on the kind of transmission which has prevailed.

As the reindeer is the one species in the whole family of Deer in which the female is furnished with horns, though they are somewhat smaller, thinner, and less branched than in the male, it might naturally be thought that, at least in this case, they must be of some special service to her. The female retains her horns from the time when they are fully developed, namely, in September, throughout the winter until April or May, when she brings forth her young. Mr. Crotch made particular inquiries for me in Norway, and it appears that the females at this season conceal themselves for about a fortnight in order to bring forth their young, and then reappear, generally hornless. In Nova Scotia, however, as I hear from Mr. H. Reeks, the female sometimes retains her horns longer. The male, on the other hand, casts his horns much earlier, toward the end of November. As both sexes have the same requirements and follow the same habits of life, and as the male is destitute of horns during the winter, it is improbable that they can be of any special service to the female during this season, which includes the larger part of the time during which she is horned. Nor is it probable that she can have inherited horns from some ancient progenitor of the family of deer, for, from the fact of the females of so many species in all quarters of the globe not having horns, we may conclude that this was the primordial character of the group.[8]

[8] On the structure and shedding of the horns of the reindeer, Hoffberg, "Amœnitates Acad.," vol. iv., 1788, p. 149. See Richardson, "Fauna Bor. Americana," p. 241, in regard to the American variety or species; also Major W. Ross King, "The Sportsman in Canada," 1866, p. 80.

The horns of the reindeer are developed at a most unusually early age; but what the cause of this may be is not known. The effect has apparently been the transference of the horns to both sexes. We should bear in mind that horns are always transmitted through the female, and that she has a latent capacity for their development, as we see in old or diseased females.[9] Moreover, the females of some other species of deer exhibit, either normally or occasionally, rudiments of horns; thus the female of *Cervulus moschatus* has "bristly tufts, ending in a knob, instead of a horn"; and "in most specimens of the female wapiti (*Cervus canadensis*) there is a sharp, bony protuberance in the place of the horn."[10] From these several considerations we may conclude that the possession of fairly well-developed horns by the female reindeer is due to the males having first acquired them as weapons for fighting with other males; and, secondarily, to their development from some unknown cause at an unusually early age in the males, and their consequent transference to both sexes.

Turning to the sheath-horned ruminants: with antelopes a graduated series can be formed, beginning with species the females of which are completely destitute of horns—passing on to those which have horns so small as to be almost rudimentary (as with the *Antilocapra americana*, in which species they are present in only one out of four or five females[11])—to those which have fairly developed horns, but manifestly smaller and thinner than in the male and sometimes of a different shape[12]—and ending with those

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[9] Isidore Geoffroy St.-Hilaire, "Essais de Zoolog. Générale," 1841, p. 513. Other masculine characters, besides the horns, are sometimes similarly transferred to the female; thus Mr. Boner, in speaking of an old female chamois ("Chamois Hunting in the Mountains of Bavaria," 1860, 2d edit., p. 363), says, "not only was the head very male-looking, but along the back there was a ridge of long hair, usually to be found only in bucks."

[10] On the Cervulus, Dr. Gray, "Catalogue of Mammalia in the British Museum," part. iii. p. 220. On the *Cervus canadensis* or wapiti, see Hon. J. D. Caton, "Ottawa Acad. of Nat. Sciences," May, 1868, p. 9.

[11] I am indebted to Dr. Canfield for this information; see, also, his paper in "Proc. Zoolog. Soc.," 1866, p. 105.

[12] For instance the horns of the female *Antilocapra euchore* resemble those

in which both sexes have horns of equal size. As with the reindeer, so with antelopes there exists, as previously shown, a relation between the period of the development of the horns and their transmission to one or both sexes; it is therefore probable that their presence or absence in the females of some species, and their more or less perfect condition in the females of other species, depends, not on their being of any special use, but simply in inheritance. It accords with this view that even in the same restricted genus both sexes of some species, and the males alone of others, are thus provided. It is also a remarkable fact that, although the females of *Antilope bezoartica* are normally destitute of horns, Mr. Blyth has seen no less than three females thus furnished; and there was no reason to suppose that they were old or diseased.

In all the wild species of goats and sheep the horns are larger in the male than in the female, and are sometimes quite absent in the latter.[13] In several domestic breeds of these two animals, the males alone are furnished with horns; and in some breeds, for instance, in the sheep of North Wales, though both sexes are properly horned, the ewes are very liable to be hornless. I have been informed by a trustworthy witness, who purposely inspected a flock of these same sheep during the lambing season, that the horns at birth are generally more fully developed in the male than the female. Mr. J. Peel crossed his Lonk sheep, both sexes of which always bear horns, with hornless Leicesters and hornless Shropshire Downs; and the result was that the male offspring had their horns considerably reduced, while the females were wholly destitute of them. These several facts indicate that, with sheep, the horns are a much less firmly fixed character in the females than in the males; and this leads us to look at the horns as properly of masculine origin.

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of a distinct species, viz., the *Ant. dorcas* var. *Corine;* see Desmarest "Mammalogie," p. 455.

[13] Gray, "Catalogue Mamm. Brit. Mus.," part iii., 1852, p. 160.

With the adult musk ox (*Ovibos moschatus*) the horns of the male are larger than those of the female, and in the latter the bases do not touch.[14] In regard to ordinary cattle Mr. Blyth remarks: "In most of the wild bovine animals the horns are both longer and thicker in the bull than in the cow, and in the cow-banteng (*Bos sondaicus*) the horns are remarkably small, and inclined much backward. In the domestic races of cattle, both of the humped and humpless types, the horns are short and thick in the bull, longer and more slender in the cow and ox; and in the Indian buffalo they are shorter and thicker in the bull, longer and more slender in the cow. In the wild gaour (*B. gaurus*) the horns are mostly both longer and thicker in the bull than in the cow." [15] Dr. Forsyth Major also informs me that a fossil skull, believed to be that of the female *Bos etruscus*, has been found in the Val d'Arno, which is wholly without horns. In the *Rhinoceros simus*, as I may add, the horns of the female are generally longer but less powerful than in the male; and in some other species of rhinoceros they are said to be shorter in the female.[16] From these various facts we may infer as probable that horns of all kinds, even when they are equally developed in the two sexes, were primarily acquired by the male in order to conquer other males, and have been transferred more or less completely to the female.

The effects of castration deserve notice, as throwing light on this same point. Stags after the operation never renew their horns. The male reindeer, however, must be excepted, as after castration he does renew them. This fact, as well as the possession of horns by both sexes, seems at first to prove that the horns in this species do not constitute a sexual character;[17] but as they are developed at a very

[14] Richardson, "Fauna Bor. Americana," p. 278.

[15] "Land and Water," 1867, p. 346.

[16] Sir Andrew Smith, "Zoology of S. Africa," pl. xix. Owen, "Anatomy of Vertebrates," vol. iii. p. 624.

[17] This is the conclusion of Seidlitz, "Die Darwin'sche Theorie," 1871, p. 47.

early age, before the sexes differ in constitution, it is not surprising that they should be unaffected by castration, even if they were aboriginally acquired by the male. With sheep both sexes properly bear horns; and I am informed that with Welsh sheep the horns of the males are considerably reduced by castration; but the degree depends much on the age at which the operation is performed, as is likewise the case with other animals. Merino rams have large horns, while the ewes "generally speaking are without horns"; and in this breed castration seems to produce a somewhat greater effect, so that if performed at an early age the horns "remain almost undeveloped." [18] On the Guinea coast there is a breed in which the females never bear horns, and, as Mr. Winwood Reade informs me, the rams after castration are quite destitute of them. With cattle the horns of the males are much altered by castration; for, instead of being short and thick, they become longer than those of the cow, but otherwise resemble them. The *Antilope bezoartica* offers a somewhat analogous case: the males have long, straight, spiral horns, nearly parallel to each other, and directed backward; the females occasionally bear horns, but these when present are of a very different shape, for they are not spiral, and spreading widely, bend round with the points forward. Now it is a remarkable fact that, in the castrated male, as Mr. Blyth informs me, the horns are of the same peculiar shape as in the female, but longer and thicker. If we may judge from analogy, the female probably shows us, in these two cases of cattle and the antelope, the former condition of the horns in some early progenitor of each species. But why castration should lead to the reappearance of an early condition of the horns cannot be explained with any certainty. Nevertheless, it seems

[18] I am much obliged to Prof. Victor Carus for having made inquiries for me in Saxony on this subject. H. von Nathusius ("Viehzucht," 1872, p. 64) says that the horns of sheep castrated at an early period either altogether disappear or remain as mere rudiments; but I do not know whether he refers to merinos or to ordinary breeds.

probable that in nearly the same manner as the constitutional disturbance in the offspring, caused by a cross between two distinct species or races, often leads to the reappearance of long-lost characters,[19] so here, the disturbance in the constitution of the individual, resulting from castration, produces the same effect.

The tusks of the elephant, in the different species or races, differ according to sex, nearly as do the horns of ruminants. In India and Malacca the males alone are provided with well-developed tusks. The elephant of Ceylon is considered by most naturalists as a distinct race, but by some as a distinct species, and here "not one in a hundred is found with tusks, the few that possess them being exclusively males."[20] The African elephant is undoubtedly distinct, and the female has large, well-developed tusks, though not so large as those of the male.

These differences in the tusks of the several races and species of elephants—the great variability of the horns of deer, as notably in the wild reindeer—the occasional presence of horns in the female *Antilope bezoartica*, and their frequent absence in the female of *Antilocapra americana*—the presence of two tusks in some few male narwhals—the complete absence of tusks in some female walruses—are all instances of the extreme variability of secondary sexual characters, and of their liability to differ in closely allied forms.

Although tusks and horns appear in all cases to have been primarily developed as sexual weapons, they often serve other purposes. The elephant uses his tusks in attacking the tiger; according to Bruce, he scores the trunks of trees until they can be thrown down easily, and he likewise thus extracts the farinaceous cores of palms; in Africa

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[19] I have given various experiments and other evidence proving that this is the case in my "Variation of Animals and Plants under Domestication," vol. ii., 1868, pp. 39–47.

[20] Sir J. Emerson Tennent, "Ceylon," 1859, vol. ii. p. 274. For Malacca, "Journal of Indian Archipelago," vol. iv. p. 357.

he often uses one tusk, always the same, to probe the ground and thus ascertain whether it will bear his weight. The common bull defends the herd with his horns; and the elk in Sweden has been known, according to Lloyd, to strike a wolf dead with a single blow of his great horns. Many similar facts could be given. One of the most curious secondary uses to which the horns of an animal may be occasionally put, is that observed by Captain Hutton[21] with the wild goat (*Capra ægagrus*) of the Himalayas, and, as it is also said, with the ibex, namely, that when the male accidentally falls from a height he bends inward his head, and by alighting on his massive horns breaks the shock. The female cannot thus use her horns, which are smaller, but from her more quiet disposition she does not need this strange kind of shield so much.

Each male animal uses his weapons in his own peculiar fashion. The common ram makes a charge and butts with such force with the bases of his horns, that I have seen a powerful man knocked over like a child. Goats and certain species of sheep, for instance the *Ovis cycloceros* of Afghanistan,[22] rear on their hind legs, and then not only butt, but "make a cut down and a jerk up, with the ribbed front of their cimeter-shaped horn, as with a sabre. When the *O. cycloceros* attacked a large domestic ram, who was a noted bruiser, he conquered him by the sheer novelty of his mode of fighting, always closing at once with his adversary, and catching him across the face and nose with a sharp drawing jerk of the head, and then bounding out of the way before the blow could be returned." In Pembrokeshire a male goat, the master of a flock which during several generations had run wild, was known to have killed several males in single combat; this goat possessed enormous horns, measuring thirty-nine inches in a straight line

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[21] "Calcutta Journal of Nat. Hist.," vol. ii., 1843, p. 526.

[22] Mr. Blyth, in "Land and Water," March, 1867, p. 134, on the authority of Capt. Hutton and others. For the wild Pembrokeshire goats see the "Field," 1869, p. 150.

from tip to tip. The common bull, as every one knows, gores and tosses his opponent; but the Italian buffalo is said never to use his horns; he gives a tremendous blow with his convex forehead, and then tramples on his fallen enemy with his knees—an instinct which the common bull does not possess.[23] Hence a dog who pins a buffalo by the nose is immediately crushed. We must, however, remember that the Italian buffalo has been long domesticated, and it is by no means certain that the wild parent form had similar horns. Mr. Bartlett informs me that when a female Cape buffalo (*Bubalus caffer*) was turned into an inclosure with a bull of the same species, she attacked him, and he in return pushed her about with great violence. But it was manifest to Mr. Bartlett that, had not the bull shown dignified forbearance, he could easily have killed her by a single lateral thrust with his immense horns. The giraffe uses his short hair-covered horns, which are rather longer in the male than in the female, in a curious manner; for, with his long neck, he swings his head to either side, almost upside down, with such force that I have seen a hard plank deeply indented by a single blow.

With antelopes it is sometimes difficult to imagine how they can possibly use their curiously shaped horns; thus the spring-boc (*Ant. euchore*) has rather short upright horns, with the sharp points bent inward almost at right angles, so as to face each other; Mr. Bartlett does not know how they are used, but suggests that they would inflict a fearful wound down each side of the face of an antagonist. The slightly curved horns of the *Oryx leucoryx* (Fig. 63) are directed backward, and are of such length that their points reach beyond the middle of the back, over which they extend in almost parallel lines. Thus they seem singularly ill-fitted for fighting; but Mr. Bartlett informs me that when two of these animals prepare for battle, they kneel down,

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[23] M. E. M. Bailly, "Sur l'usage des Cornes," etc., "Annal. des Sc. Nat.," tom. ii., 1824, p. 369.

with their heads between their forelegs, and in this attitude the horns stand nearly parallel and close to the ground, with the points directed forward and a little upward. The combatants then gradually approach each other, and each endeavors to get the upturned points under the body of the other; if one succeeds in doing this, he suddenly springs up, throwing up his head at the same time, and can thus wound or perhaps even transfix his antagonist. Both animals always kneel down, so as to guard as far as possible against this manœuvre. It has been recorded that one of these antelopes has used his horns with effect even against

Fig. 63.—Oryx leucoryx, male (from the Knowsley Menagerie).

a lion; yet from being forced to place his head between the forelegs in order to bring the points of the horns forward, he would generally be under a great disadvantage when attacked by any other animal. It is, therefore, not probable that the horns have been modified into their present great length and peculiar position as a protection against beasts of prey. We can, however, see that, as soon as some ancient male progenitor of the Oryx acquired moderately long horns, directed a little backward, he would be compelled, in his battles with rival males, to bend his head somewhat inward or downward, as is now done by certain stags; and it is not improbable that he might have acquired the habit of at first

occasionally and afterward of regularly kneeling down. In this case it is almost certain that the males which possessed the longest horns would have had a great advantage over others with shorter horns; and then the horns would gradually have been rendered longer and longer, through sexual selection, until they acquired their present extraordinary length and position.

With stags of many kinds the branches of the horns offer a curious case of difficulty; for certainly a single straight point would inflict a much more serious wound than several diverging ones. In Sir Philip Egerton's museum there is a horn of the red-deer (*Cervus elaphus*), thirty inches in length, with "not fewer than fifteen snags or branches"; and at Moritzburg there is still preserved a pair of antlers of a red-deer, shot in 1699 by Frederick I., one of which bears the astonishing number of thirty-three branches and the other twenty-seven, making altogether sixty branches. Richardson figures a pair of antlers of the wild reindeer with twenty-nine points.[24] From the manner in which the horns are branched, and more especially from deer being known occasionally to fight together by kicking with their forefeet,[25] M. Bailly actually comes to the conclusion that their horns are more injurious than useful to them! But this author overlooks the pitched battles between rival males. As I felt much perplexed about the use or advantage of the branches, I applied to Mr. McNeill, of Colonsay, who has long and carefully observed the habits of red-deer, and he informs me that he has never seen some of the branches brought into use, but that the brow antlers, from inclining downward, are a great protection to the forehead, and their points are likewise used in attack. Sir Philip

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[24] On the horns of red-deer, Owen, "British Fossil Mammals," 1846, p. 478; Richardson on the horns of the reindeer, "Fauna Bor. Americana," 1829, p. 240. I am indebted to Prof. Victor Carus for the Moritzburg case.

[25] Hon. J. D. Caton ("Ottawa Acad. of Nat. Science," May, 1868, p. 9) says that the American deer fight with their forefeet, after "the question of superiority has been once settled and acknowledged in the herd." Bailly, "Sur l'usage des Cornes," "Annales des Sc. Nat.," tom. ii., 1824, p. 371.

Egerton also informs me both as to red-deer and fallow-deer that, in fighting, they suddenly dash together, and getting their horns fixed against each other's bodies, a desperate struggle ensues. When one is at last forced to yield and turn round, the victor endeavors to plunge his brow antlers into his defeated foe. It thus appears that the upper branches are used chiefly or exclusively for pushing and fencing. Nevertheless, in some species the upper branches are used as weapons of offence; when a man was attacked by a wapiti deer (*Cervus canadensis*) in Judge Caton's park in Ottawa, and several men tried to rescue him, the stag "never raised his head from the ground; in fact, he kept his face almost flat on the ground, with his nose nearly between his forefeet, except when he rolled his head to one side to take a new observation preparatory to a plunge." In this position the ends of the horns were directed against his adversaries. "In rolling his head he necessarily raised it somewhat, because his antlers were so long that he could not roll his head without raising them on one side, while, on the other side, they touched the ground." The stag by this procedure gradually drove the party of rescuers backward to a distance of 150 or 200 feet, and the attacked man was killed.[26]

Although the horns of stags are efficient weapons, there can, I think, be no doubt that a single point would have been much more dangerous than a branched antler; and Judge Caton, who has had large experience with deer, fully concurs in this conclusion. Nor do the branching horns, though highly important as a means of defence against rival stags, appear perfectly well adapted for this purpose, as they are liable to become interlocked. The suspicion has therefore crossed my mind that they may serve in part as ornaments. That the branched antlers of stags, as well as the elegant lyrated horns of certain ante-

[26] See a most interesting account in the Appendix to Hon. J. D. Caton's paper, as above quoted.

lopes, with their graceful double curvature (Fig. 64), are ornamental in our eyes, no one will dispute. If, then, the horns, like the splendid accoutrements of the knights of

FIG. 64.—Strepsiceros Kudu (from Sir Andrew Smith's "Zoology of South Africa").

old, add to the noble appearance of stags and antelopes, they may have been modified partly for this purpose, though mainly for actual service in battle; but I have no evidence in favor of this belief.

An interesting case has lately been published, from

which it appears that the horns of a deer in one district in the United States are now being modified through sexual and natural selection. A writer in an excellent American journal [27] says that he has hunted for the last twenty-one years in the Adirondacks, where the *Cervus virginianus* abounds. About fourteen years ago he first heard of *spike-horn bucks*. These became from year to year more common; about five years ago he shot one, and afterward another, and now they are frequently killed. "The spike-horn differs greatly from the common antler of the *C. virginianus*. It consists of a single spike, more slender than the antler, and scarcely half so long, projecting forward from the brow, and terminating in a very sharp point. It gives a considerable advantage to its possessor over the common buck. Besides enabling him to run more swiftly through the thick woods and underbrush (every hunter knows that does and yearling bucks run much more rapidly than the large bucks when armed with their cumbrous antlers), the spike-horn is a more effective weapon than the common antler. With this advantage the spike-horn bucks are gaining upon the common bucks, and may, in time, entirely supersede them in the Adirondacks. Undoubtedly, the first spike-horn buck was merely an accidental freak of nature. But his spike-horns gave him an advantage, and enabled him to propagate his peculiarity. His descendants, having a like advantage, have propagated the peculiarity in a constantly increasing ratio, till they are slowly crowding the antlered deer from the region they inhabit." A critic has well objected to this account by asking why, if the simple horns are now so advantageous, were the branched antlers of the parent form ever developed? To this I can only answer by remarking that a new mode of attack with new weapons might be a great advantage, as shown by the case of the *Ovis cycloceros*, who thus conquered a domestic ram famous for his fight-

[27] "The American Naturalist," Dec. 1869, p. 552.

ing power. Though the branched antlers of a stag are well adapted for fighting with his rivals, and though it might be an advantage to the prong-horned variety slowly to acquire long and branched horns, if he had to fight only with others of the same kind, yet it by no means follows that branched horns would be the best fitted for conquering a foe differently armed. In the foregoing case of the *Oryx leucoryx* it is almost certain that the victory would rest with an antelope having short horns, and who therefore did not need to kneel down, though an oryx might profit by having still longer horns, if he fought only with his proper rivals.

Male quadrupeds which are furnished with tusks use them in various ways, as in the case of horns. The boar strikes laterally and upward; the musk-deer downward with serious effect.[28] The walrus, though having so short a neck and so unwieldy a body, "can strike either upward or downward or sidewise, with equal dexterity."[29] I was informed by the late Dr. Falconer that the Indian elephant fights in a different manner according to the position and curvature of his tusks. When they are directed forward and upward he is able to fling a tiger to a great distance —it is said to even thirty feet; when they are short and turned downward he endeavors suddenly to pin the tiger to the ground, and, in consequence, is dangerous to the rider, who is liable to be jerked off the howdah.[30]

Very few male quadrupeds possess weapons of two distinct kinds specially adapted for fighting with rival males. The male muntjac-deer (Cervulus), however, offers an exception, as he is provided with horns and exserted canine teeth. But we may infer from what follows that one form of weapon has often been replaced in the course of ages by another. With ruminants the development of horns generally stands in an inverse relation with that of even mod-

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[28] Pallas, "Spicilegia Zoologica," fasc. xiii., 1779, p. 18.

[29] Lamont, "Seasons with the Sea-Horses," 1861, p. 141.

[30] See, also, Corse ("Philosoph. Transact.," 1799, p. 212) on the manner in which the short-tusked Mooknah variety attacks other elephants.

erately developed canine teeth. Thus camels, guanacos, chevrotains, and musk-deer are hornless, and they have efficient canines; these teeth being "always of smaller size in the females than in the males." The Camelidæ have, in addition to their true canines, a pair of canine-shaped incisors in their upper jaws.[31] Male deer and antelopes, on the other hand, possess horns, and they rarely have canine teeth; and these, when present, are always of small size, so that it is doubtful whether they are of any service in their battles. In *Antilope montana* they exist only as rudiments in the young male, disappearing as he grows old; and they are absent in the female at all ages; but the females of certain other antelopes and of certain deer have been known occasionally to exhibit rudiments of these teeth.[32] Stallions have small canine teeth, which are either quite absent or rudimentary in the mare; but they do not appear to be used in fighting, for stallions bite with their incisors, and do not open their mouths wide like camels and guanacos. Whenever the adult male possesses canines, now inefficient, while the female has either none or mere rudiments, we may conclude that the early male progenitor of the species was provided with efficient canines, which have been partially transferred to the females. The reduction of these teeth in the males seems to have followed from some change in their manner of fighting, often (but not in the horse) caused by the development of new weapons.

Tusks and horns are manifestly of high importance to their possessors, for their development consumes much organized matter. A single tusk of the Asiatic elephant—

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[31] Owen, "Anatomy of Vertebrates," vol. iii. p. 349.

[32] See Ruppell (in "Proc. Zoolog. Soc.," Jan. 12, 1836, p. 3) on the canines in deer and antelopes, with a note by Mr. Martin on a female American deer. See, also, Falconer ("Palæont. Memoirs and Notes," vol. i., 1868, p. 576) on canines in an adult female deer. In old males of the musk-deer the canines (Pallas, "Spic. Zoolog.," fasc. xiii., 1779, p. 18) sometimes grow to the length of three inches, while in old females a rudiment projects scarcely half an inch above the gums.

one of the extinct woolly species—and of the African elephant, have been known to weigh respectively 150, 160, and 180 pounds; and even greater weights have been given by some authors.[33] With deer, in which the horns are periodically renewed, the drain on the constitution must be greater; the horns, for instance, of the moose weigh from fifty to sixty pounds, and those of the extinct Irish elk from sixty to seventy pounds—the skull of the latter weighing on an average only five pounds and a quarter. Although the horns are not periodically renewed in sheep, yet their development, in the opinion of many agriculturists, entails a sensible loss to the breeder. Stags, moreover, in escaping from beasts of prey are loaded with an additional weight for the race, and are greatly retarded in passing through a woody country. The moose, for instance, with horns extending five and a half feet from tip to tip, although so skilful in their use that he will not touch or break a twig when walking quietly, cannot act so dexterously while rushing away from a pack of wolves. "During his progress he holds his nose up, so as to lay the horns horizontally back; and in this attitude cannot see the ground distinctly."[34] The tips of the horns of the great Irish elk were actually eight feet apart! While the horns are covered with velvet, which lasts with the red-deer for about twelve weeks, they are extremely sensitive to a blow; so that in Germany the stags at this time somewhat change their habits, and, avoiding dense forests, frequent young woods and low thickets.[35] These facts remind us that male birds have acquired ornamental plumes at the cost of retarded flight, and other ornaments at the cost of some loss of power in their battles with rival males.

With mammals, when, as is often the case, the sexes

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[33] Emerson Tennent, "Ceylon," 1859, vol. ii. p. 275; Owen, "British Fossil Mammals," 1846, p. 245.

[34] Richardson, "Fauna Bor. Americana," on the moose, *Alces palmata*, pp. 236, 237; on the expanse of the horns, "Land and Water," 1869, p. 143. See, also, Owen, "British Fossil Mammals," on the Irish elk, pp. 447, 455.

[35] "Forest Creatures," by C. Boner, 1861, p. 60.

differ in size, the males are almost always larger and stronger. I am informed by Mr. Gould that this holds good in a marked manner with the marsupials of Australia, the males of which appear to continue growing until an unusually late age. But the most extraordinary case is that of one of the seals (*Callorhinus ursinus*), a full-grown female weighing less than one-sixth of a full-grown male.[36] Dr. Gill remarks that it is with the polygamous seals, the males of which are well known to fight savagely together, that the sexes differ much in size; the monogamous species differing but little. Whales also afford evidence of the relation existing between the pugnacity of the males and their large size compared with that of the female; the males of the right-whales do not fight together, and they are not larger, but rather smaller, than their females; on the other hand, male sperm-whales fight much together, and their bodies are "often found scarred with the imprint of their rival's teeth," and they are double the size of the females. The greater strength of the male, as Hunter long ago remarked,[37] is invariably displayed in those parts of the body which are brought into action in fighting with rival males—for instance, in the massive neck of the bull. Male quadrupeds are also more courageous and pugnacious than the females. There can be little doubt that these characters have been gained partly through sexual selection, owing to a long series of victories by the stronger and more courageous males over the weaker, and partly through the inherited effects of use. It is probable that the successive variations in strength, size, and courage, whether due to mere variability or to the effects of use, by the accumulation of which male quadrupeds have acquired these characteristic qualities, occurred rather late in life,

[36] See the very interesting paper by Mr. J. A. Allen in "Bull. Mus. Comp. Zoolog. of Cambridge, United States," vol. ii., No. 1, p. 82. The weights were ascertained by a careful observer, Capt. Bryant. Dr. Gill in "The American Naturalist," Jan. 1871. Prof. Shaler on the relative size of the sexes of whales, "American Naturalist," Jan. 1873.

[37] "Animal Economy," p. 45.

and were consequently to a large extent limited in their transmission to the same sex.

From these considerations I was anxious to obtain information as to the Scotch deer-hound, the sexes of which differ more in size than those of any other breed (though bloodhounds differ considerably), or than in any wild canine species known to me. Accordingly, I applied to Mr. Cupples, well known for his success with this breed, who has weighed and measured many of his own dogs, and who has with great kindness collected for me the following facts from various sources. Fine male dogs, measured at the shoulder, range from 28 inches, which is low, to 33 or even 34 inches in height; and in weight from 80 pounds, which is light, to 120 pounds, or even more. The females range in height from 23 to 27, or even to 28 inches; and in weight from 50 to 70, or even 80 pounds.[38] Mr. Cupples concludes that from 95 to 100 pounds for the male, and 70 for the female, would be a safe average; but there is reason to believe that formerly both sexes attained a greater weight. Mr. Cupples has weighed puppies when a fortnight old; in one litter the average weight of four males exceeded that of two females by six and a half ounces; in another litter the average weight of four males exceeded that of one female by less than one ounce; the same males when three weeks old exceeded the female by seven and a half ounces, and at the age of six weeks by nearly fourteen ounces. Mr. Wright, of Yeldersley House, in a letter to Mr. Cupples, says: "I have taken notes on the sizes and weights of puppies of many litters, and, as far as my experience goes, dog-puppies as a rule differ very little from bitches till they arrive at about five or six months old; and then the dogs begin to increase, gaining upon the bitches

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[38] See, also, Richardson's "Manual on the Dog," p. 59. Much valuable information on the Scottish deer-hound is given by Mr. McNeill, who first called attention to the inequality in size between the sexes, in Scrope's "Art of Deer-Stalking." I hope that Mr. Cupples will keep to his intention of publishing a full account and history of this famous breed.

both in weight and size. At birth, and for several weeks afterward, a bitch-puppy will occasionally be larger than any of the dogs, but they are invariably beaten by them later." Mr. McNeill, of Colonsay, concludes that "the males do not attain their full growth till over two years old, though the females attain it sooner." According to Mr. Cupples' experience, male dogs go on growing in stature till they are from twelve to eighteen months old, and in weight till from eighteen to twenty-four months old; while the females cease increasing in stature at the age of from nine to fourteen or fifteen months, and in weight at the age of from twelve to fifteen months. From these various statements it is clear that the full difference in size between the male and female Scotch deer-hound is not acquired until rather late in life. The males almost exclusively are used for coursing, for, as Mr. McNeill informs me, the females have not sufficient strength and weight to pull down a full-grown deer. From the names used in old legends, it appears, as I hear from Mr. Cupples, that, at a very ancient period, the males were the most celebrated, the females being mentioned only as the mothers of famous dogs. Hence, during many generations, it is the male which has been chiefly tested for strength, size, speed, and courage, and the best will have been bred from. As, however, the males do not attain their full dimensions until rather late in life, they will have tended, in accordance with the law often indicated, to transmit their characters to their male offspring alone; and thus the great inequality in size between the sexes of the Scotch deer-hound may probably be accounted for.

The males of some few quadrupeds possess organs or parts developed solely as a means of defence against the attacks of other males. Some kinds of deer use, as we have seen, the upper branches of their horns chiefly or exclusively for defending themselves; and the Oryx antelope, as I am informed by Mr. Bartlett, fences most skilfully with his long, gently curved horns; but these are likewise used

as organs of offence. The same observer remarks that rhinoceroses, in fighting, parry each other's sidelong blows with their horns, which clatter loudly together, as do the tusks of boars. Although wild boars fight desperately, they seldom, according to Brehm, receive fatal wounds, as the blows fall on each other's tusks, or on the layer of gristly skin covering the shoulder, called by the German hunters the shield; and here we have a part specially modified for defence. With boars in the prime of life (see Fig. 65) the tusks in the lower jaw are used for fighting, but they become in old age, as Brehm states, so much curved inward and upward over the snout that they can no longer be used in this way. They may, however, still serve, and even more effectively, as a means of defence. In compensation for the loss of the lower tusks as weapons of offence, those in the upper jaw, which always project a little laterally, increase in old age so much in length and curve so much upward, that they can be used for attack. Nevertheless, an old boar is not so dangerous to man as one at the age of six or seven years.[39]

FIG. 65.—Head of Common Wild Boar, in prime of life (from Brehm).

In the full-grown male Babirusa pig of Celebes (Fig. 66) the lower tusks are formidable weapons, like those of the European boar in the prime of life, while the upper tusks are so long and have their points so much curled inward, sometimes even touching the forehead, that they are utterly useless as weapons of attack. They more nearly resemble horns than teeth, and are so manifestly useless as teeth that the animal was formerly supposed to rest his head by hook-

[39] Brehm, "Thierleben," B. ii. s. 729–732.

ing them on a branch! Their convex surfaces, however, if the head were held a little laterally, would serve as an excellent guard; and hence, perhaps, it is that in old animals they "are generally broken off, as if by fighting." [40] Here, then, we have a curious case of the upper tusks of the Babirusa regularly assuming, during the prime of life, a structure which apparently renders them fitted only for

Fig. 66.—Skull of the Babirusa Pig (from Wallace's "Malay Archipelago").

defence; while in the European boar the lower tusks assume in a less degree, and only during old age, nearly the same form, and then serve in like manner solely for defence.

In the wart-hog (*Phacochoerus æthiopicus*, Fig. 67) the tusks in the upper jaw of the male curve upward during the prime of life, and from being pointed serve as formidable weapons. The tusks in the lower jaw are sharper than

[40] See Mr. Wallace's interesting account of this animal, "The Malay Archipelago," 1869, vol. i. p. 435.

those in the upper, but from their shortness it seems hardly possible that they can be used as weapons of attack. They must, however, greatly strengthen those in the upper jaw, from being ground so as to fit closely against their bases. Neither the upper nor the lower tusks appear to have been specially modified to act as guards, though no doubt they are to a certain extent used for this purpose. But the wart-hog is not destitute of other special means of protection, for it has, on each side of the face, beneath the eyes, a rather stiff, yet flexible, cartilaginous, oblong pad (Fig. 67), which projects two or three inches outward; and it ap-

FIG. 67.—Head of female Æthiopian Wart-hog, from "Proc. Zool. Soc.," 1869, showing the same characters as the male, though on a reduced scale.—N.B. When the engraving was first made, I was under the impression that it represented the male.

peared to Mr. Bartlett and myself, when viewing the living animal, that these pads, when struck from beneath by the tusks of an opponent, would be turned upward, and would thus admirably protect the somewhat prominent eyes. I may add, on the authority of Mr. Bartlett, that these boars when fighting stand directly face to face.

Lastly, the African river-hog (*Potomochoerus penicillatus*) has a hard cartilaginous knob on each side of the face beneath the eyes, which answers to the flexible pad of the wart-hog; it has also two bony prominences on the upper jaw above the nostrils. A boar of this species in the Zoo-

logical Gardens recently broke into the cage of the wart-hog. They fought all night long, and were found in the morning much exhausted, but not seriously wounded. It is a significant fact, as showing the purpose of the above-described projections and excrescences, that these were covered with blood, and were scored and abraded in an extraordinary manner.

Although the males of so many members of the pig family are provided with weapons, and, as we have just seen, with means of defence, these weapons seem to have been acquired within a rather late geological period. Dr. Forsyth Major specifies[41] several miocene species, in none of which do the tusks appear to have been largely developed in the males; and Prof. Rütimeyer was formerly struck with this same fact.

The mane of the lion forms a good defence against the attacks of rival lions, the one danger to which he is liable; for the males, as Sir A. Smith informs me, engage in terrible battles, and a young lion dares not approach an old one. In 1857 a tiger at Bromwich broke into the cage of a lion, and a fearful scene ensued; "the lion's mane saved his neck and head from being much injured, but the tiger at last succeeded in ripping up his belly, and in a few minutes he was dead."[42] The broad ruff round the throat and chin of the Canadian lynx (*Felis canadensis*) is much longer in the male than in the female; but whether it serves as a defence I do not know. Male seals are well known to fight desperately together, and the males of certain kinds (*Otaria jubata*)[43] have great manes, while the females have small ones or none. The male baboon of the Cape of Good Hope (*Cynocephalus porcarius*) has a much longer mane and larger ca-

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[41] "Atti della Soc. Italiana di Sc. Nat.," 1873, vol. xv. fasc. iv.

[42] "The Times," Nov. 10, 1857. In regard to the Canada lynx, see Audubon and Bachman, "Quadrupeds of N. America," 1846, p. 39.

[43] Dr. Murie, on Otaria, "Proc. Zoolog. Soc.," 1869, p. 109. Mr. J. A. Allen, in the paper above quoted (p. 75), doubts whether the hair, which is longer on the neck in the male than in the female, deserves to be called a mane.

nine teeth than the female; and the mane probably serves as a protection, for, on asking the keepers in the Zoological Gardens, without giving them any clew to my object, whether any of the monkeys especially attacked each other by the nape of the neck, I was answered that this was not the case, except with the above baboon. In the Hamadryas baboon, Ehrenberg compares the mane of the adult male to that of a young lion, while in the young of both sexes and in the female the mane is almost absent.

It appeared to me probable that the immense woolly mane of the male American bison, which reaches almost to the ground, and is much more developed in the males than in the females, served as a protection to them in their terrible battles; but an experienced hunter told Judge Caton that he had never observed anything which favored this belief. The stallion has a thicker and fuller mane than the mare; and I have made particular inquiries of two great trainers and breeders, who have had charge of many entire horses, and am assured that they "invariably endeavor to seize one another by the neck." It does not, however, follow, from the foregoing statements, that when the hair on the neck serves as a defence, that it was originally developed for this purpose, though this is probable in some cases, as in that of the lion. I am informed by Mr. McNeill that the long hairs on the throat of the stag (*Cervus elaphus*) serve as a great protection to him when hunted, for the dogs generally endeavor to seize him by the throat; but it is not probable that these hairs were specially developed for this purpose; otherwise the young and the females would have been equally protected.

Choice in Pairing by Either Sex of Quadrupeds.—Before describing, in the next chapter, the differences between the sexes in voice, odors emitted, and ornaments, it will be convenient here to consider whether the sexes exert any choice in their unions. Does the female prefer any particular male, either before or after the males may have fought together for

supremacy; or does the male, when not a polygamist, select any particular female? The general impression among breeders seems to be that the male accepts any female; and this, owing to his eagerness, is, in most cases, probably the truth. Whether the female as a general rule indifferently accepts any male is much more doubtful. In the fourteenth chapter, on Birds, a considerable body of direct and indirect evidence was advanced, showing that the female selects her partner; and it would be a strange anomaly if female quadrupeds, which stand higher in the scale and have higher mental powers, did not generally, or at least often, exert some choice. The female could in most cases escape, if wooed by a male that did not please or excite her; and when pursued by several males, as commonly occurs, she would often have the opportunity, while they were fighting together, of escaping with some one male, or at least of temporarily pairing with him. This latter contingency has often been observed in Scotland with female red-deer, as I am informed by Sir Philip Egerton and others.[44]

It is scarcely possible that much should be known about female quadrupeds in a state of nature making any choice in their marriage unions. The following curious details on the courtship of one of the eared seals (*Callorhinus ursinus*) are given[45] on the authority of Capt. Bryant, who had ample opportunities for observation. He says, "Many of the females on their arrival at the island where they breed appear desirous of returning to some particular male, and frequently climb the outlying rocks to overlook the rookeries, calling out and listening as if for a familiar voice. Then changing to another place they do the same again. . . . As soon as a female reaches the shore, the nearest male goes down to

[44] Mr. Boner, in his excellent description of the habits of the red-deer in Germany ("Forest Creatures," 1861, p. 81) says, "while the stag is defending his rights against one intruder, another invades the sanctuary of his harem, and carries off trophy after trophy." Exactly the same thing occurs with seals: see Mr. J. A. Allen, ibid., p. 100.

[45] Mr. J. A. Allen, in "Bull. Mus. Comp. Zoolog. of Cambridge, United States," vol. ii., No. 1, p. 99.

meet her, making meanwhile a noise like the clucking of a hen to her chickens. He bows to her and coaxes her until he gets between her and the water so that she cannot escape him. Then his manner changes, and with a harsh growl he drives her to a place in his harem. This continues until the lower row of harems is nearly full. Then the males higher up select the time when their more fortunate neighbors are off their guard to steal their wives. This they do by taking them in their mouths and lifting them over the heads of the other females, and carefully placing them in their own harem, carrying them as cats do their kittens. Those still higher up pursue the same method until the whole space is occupied. Frequently a struggle ensues between two males for the possession of the same female, and both seizing her at once pull her in two or terribly lacerate her with their teeth. When the space is all filled, the old male walks around complacently reviewing his family, scolding those who crowd or disturb the others, and fiercely driving off all intruders. This surveillance always keeps him actively occupied."

As so little is known about the courtship of animals in a state of nature, I have endeavored to discover how far our domesticated quadrupeds evince any choice in their unions. Dogs offer the best opportunity for observation, as they are carefully attended to and well understood. Many breeders have expressed a strong opinion on this head. Thus, Mr. Mayhew remarks: "The females are able to bestow their affections; and tender recollections are as potent over them as they are known to be in other cases, where higher animals are concerned. Bitches are not always prudent in their loves, but are apt to fling themselves away on curs of low degree. If reared with a companion of vulgar appearance, there often springs up between the pair a devotion which no time can afterward subdue. The passion, for such it really is, becomes of a more than romantic endurance." Mr. Mayhew, who attended chiefly to the smaller breeds, is convinced that the females are strongly attracted by males of a large

size.[46] The well-known veterinary Blaine states[47] that his own female pug became so attached to a spaniel, and a female setter to a cur, that in neither case would they pair with a dog of their own breed until several weeks had elapsed. Two similar and trustworthy accounts have been given me in regard to a female retriever and a spaniel, both of which became enamored with terrier-dogs.

Mr. Cupples informs me that he can personally vouch for the accuracy of the following more remarkable case, in which a valuable and wonderfully intelligent female terrier loved a retriever belonging to a neighbor to such a degree that she had often to be dragged away from him. After their permanent separation, although repeatedly showing milk in her teats, she would never acknowledge the courtship of any other dog, and, to the regret of her owner, never bore puppies. Mr. Cupples also states that, in 1868, a female deer-hound in his kennel thrice produced puppies, and on each occasion showed a marked preference for one of the largest and handsomest, but not the most eager, of four deer-hounds living with her, all in the prime of life. Mr. Cupples has observed that the female generally favors a dog whom she has associated with and knows; her shyness and timidity at first incline her against a strange dog. The male, on the contrary, seems rather inclined toward strange females. It appears to be rare when the male refuses any particular female, but Mr. Wright, of Yeldersley House, a great breeder of dogs, informs me that he has known some instances; he cites the case of one of his own deer-hounds, who would not take any notice of a particular female mastiff, so that another deer-hound had to be employed. It would be superfluous to give, as I could, other instances, and I will only add that Mr. Barr, who has carefully bred many bloodhounds, states that in almost every instance par-

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[46] "Dogs: their Management," by E. Mayhew, M.R.C.V.S., 2d edit., 1864, pp. 187–192.

[47] Quoted by Alex. Walker, "On Intermarriage," 1838, p. 276; see, also, p. 244.

ticular individuals of opposite sexes show a decided preference for each other. Finally, Mr. Cupples, after attending to this subject for another year, has written to me, "I have had full confirmation of my former statement, that dogs in breeding form decided preferences for each other, being often influenced by size, bright color, and individual characters, as well as by the degree of their previous familiarity."

In regard to horses, Mr. Blenkiron, the greatest breeder of racehorses in the world, informs me that stallions are so frequently capricious in their choice, rejecting one mare and without any apparent cause taking to another, that various artifices have to be habitually used. The famous Monarque, for instance, would never consciously look at the dam of Gladiateur, and a trick had to be practiced. We can partly see the reason why valuable racehorse stallions, which are in such demand as to be exhausted, should be so particular in their choice. Mr. Blenkiron has never known a mare reject a horse; but this has occurred in Mr. Wright's stable, so that the mare had to be cheated. Prosper Lucas[48] quotes various statements from French authorities, and remarks, "On voit des étalons qui s'éprennent d'une jument, et négligent toutes les autres." He gives, on the authority of Baëlen, similar facts in regard to bulls; and Mr. H. Reeks assures me that a famous short-horn bull belonging to his father "invariably refused to be matched with a black cow." Hoffberg, in describing the domesticated reindeer of Lapland, says, "Fœminæ majores et fortiores mares præ cæteris admittunt, ad eos confugiunt, a junioribus agitatæ, qui hos in fugam conjiciunt."[49] A clergyman who has bred many pigs asserts that sows often reject one boar and immediately accept another.

From these facts there can be no doubt that, with most of our domesticated quadrupeds, strong individual antipathies

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[48] "Traité de l'Héréd. Nat." tom. ii., 1850, p. 296.
[49] "Amœnitates Acad.," vol. iv., 1788, p. 160.

and preferences are frequently exhibited, and much more commonly by the female than by the male. This being the case, it is improbable that the unions of quadrupeds in a state of nature should be left to mere chance. It is much more probable that the females are allured or excited by particular males, who possess certain characters in a higher degree than other males; but what these characters are we can seldom or never discover with certainty.

CHAPTER XVIII

SECONDARY SEXUAL CHARACTERS OF MAMMALS—*continued*

Voice—Remarkable sexual peculiarities in seals—Odor—Development of the hair—Color of the hair and skin—Anomalous case of the female being more ornamented than the male—Color and ornaments due to sexual selection—Color acquired for the sake of protection—Color, though common to both sexes, often due to sexual selection—On the disappearance of spots and stripes in adult quadrupeds—On the colors and ornaments of the Quadrumana—Summary

QUADRUPEDS use their voices for various purposes, as a signal of danger, as a call from one member of a troop to another, or from the mother to her lost offspring, or from the latter for protection to their mother; but such uses need not here be considered. We are concerned only with the difference between the voices of the sexes, for instance between that of the lion and lioness, or of the bull and cow. Almost all male animals use their voices much more during the rutting season than at any other time; and some, as the giraffe and porcupine,[1] are said to be completely mute excepting at this season. As the throats (*i.e.*, the larynx and thyroid bodies[2]) of stags periodically become enlarged at the beginning of the breeding season, it might be thought that their powerful voices must be somehow of high importance to them; but this is very doubtful. From information given to me by two experienced observers, Mr. McNeill and Sir P. Egerton, it

[1] Owen, "Anatomy of Vertebrates," vol. iii. p. 585.
[2] Ibid., p. 595.

seems that young stags under three years old do not roar or bellow, and that the old ones begin bellowing at the commencement of the breeding season, at first only occasionally and moderately, while they restlessly wander about in search of the females. Their battles are prefaced by loud and prolonged bellowing, but during the actual conflict they are silent. Animals of all kinds which habitually use their voices utter various noises under any strong emotion, as when enraged and preparing to fight; but this may merely be the result of nervous excitement, which leads to the spasmodic contraction of almost all the muscles of the body, as when a man grinds his teeth and clinches his fists in rage or agony. No doubt stags challenge each other to mortal combat by bellowing; but those with the more powerful voices, unless at the same time the stronger, better armed, and more courageous, would not gain any advantage over their rivals.

It is possible that the roaring of the lion may be of some service to him by striking terror into his adversary; for when enraged he likewise erects his mane and thus instinctively tries to make himself appear as terrible as possible. But it can hardly be supposed that the bellowing of the stag, even if it be of service to him in this way, can have been important enough to have led to the periodical enlargement of the throat. Some writers suggest that the bellowing serves as a call to the female; but the experienced observers above quoted inform me that female deer do not search for the male, though the males search eagerly for the females, as indeed might be expected from what we know of the habits of other male quadrupeds. The voice of the female, on the other hand, quickly brings to her one or more stags,[3] as is well known to the hunters who in wild countries imitate her cry. If we could believe that the male had the power to excite or allure the female by his voice, the periodical

[3] See Major W. Ross King ("The Sportsman in Canada," 1866, pp. 53, 131) on the habits of the moose and wild reindeer.

enlargement of his vocal organs would be intelligible on the principle of sexual selection, together with inheritance limited to the same sex and season; but we have no evidence in favor of this view. As the case stands, the loud voice of the stag during the breeding season does not seem to be of any special service to him, either during his courtship or battles, or in any other way. But may we not believe that the frequent use of the voice, under the strong excitement of love, jealousy, and rage, continued during many generations, may at last have produced an inherited effect on the vocal organs of the stag, as well as of other male animals? This appears to me, in our present state of knowledge, the most probable view.

The voice of the adult male gorilla is tremendous, and he is furnished with a laryngeal sac, as is the adult male orang.[4] The gibbons rank among the noisiest of monkeys, and the Sumatra species (*Hylobates syndactylus*) is also furnished with an air-sac; but Mr. Blyth, who has had opportunities for observation, does not believe that the male is noisier than the female. Hence, these latter monkeys probably use their voices as a mutual call, and this is certainly the case with some quadrupeds; for instance, the beaver.[5] Another gibbon, the *H. agilis*, is remarkable from having the power of giving a complete and correct octave of musical notes,[6] which we may reasonably suspect serves as a sexual charm; but I shall have to recur to this subject in the next chapter. The vocal organs of the American *Mycetes caraya* are one-third larger in the male than in the female, and are wonderfully powerful. These monkeys in warm weather make the forests resound at morning and evening with their overwhelming voices. The males begin the dreadful concert, and often continue it during many hours, the

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[4] Owen, "Anatomy of Vertebrates," vol. iii. p. 600.

[5] Mr. Green, in the "Journal of the Linnæan Society," vol. x. Zoology, 1869, p. 362.

[6] C. L. Martin, "General Introduction to the Nat. Hist. of Mamm. Animals," 1841, p. 431.

females sometimes joining in with their less powerful voices. An excellent observer, Rengger,[7] could not perceive that they were excited to begin by any special cause; he thinks that, like many birds, they delight in their own music, and try to excel each other. Whether most of the foregoing monkeys have acquired their powerful voices in order to beat their rivals and charm the females, or whether the vocal organs have been strengthened and enlarged through the inherited effects of long-continued use without any particular good being thus gained, I will not pretend to say; but the former view, at least in the case of the *Hylobates agilis*, seems the most probable.

I may here mention two very curious sexual peculiarities occurring in seals, because they have been supposed by some writers to affect the voice. The nose of the male sea-elephant (*Macrorhinus proboscideus*) becomes greatly elongated during the breeding season, and can then be erected. In this state it is sometimes a foot in length. The female is not thus provided at any period of life. The male makes a wild, hoarse, gurgling noise, which is audible at a great distance and is believed to be strengthened by the proboscis, the voice of the female being different. Lesson compares the erection of the proboscis with the swelling of the wattles of male gallinaceous birds while courting the females. In another allied kind of seal, the bladder-nose (*Cystophora cristata*), the head is covered by a great hood or bladder. This is supported by the septum of the nose, which is produced far backward and rises into an internal crest seven inches in height. The hood is clothed with short hair, and is muscular; it can be inflated until it more than equals the whole head in size! The males when rutting fight furiously on the ice, and their roaring "is said to be sometimes so loud as to be heard four miles off." When attacked they likewise roar or bellow; and whenever irritated the bladder is inflated and quivers. Some naturalists believe that the

[7] "Naturgeschichte der Säugethiere von Paraguay," 1830, s. 15, 21.

voice is thus strengthened, but various other uses have been assigned to this extraordinary structure. Mr. R. Brown thinks that it serves as a protection against accidents of all kinds; but this is not probable, for, as I am assured by Mr. Lamont, who killed 600 of these animals, the hood is rudimentary in the females, and it is not developed in the males during youth.[8]

Odor.—With some animals, as with the notorious skunk of America, the overwhelming odor which they emit appears to serve exclusively as a defence. With shrew-mice (Sorex) both sexes possess abdominal scent-glands, and there can be little doubt, from the rejection of their bodies by birds and beasts of prey, that the odor is protective; nevertheless, the glands become enlarged in the males during the breeding season. In many other quadrupeds the glands are of the same size in both sexes,[9] but their uses are not known. In other species the glands are confined to the males, or are more developed than in the females; and they almost always become more active during the rutting season. At this period the glands on the sides of the face of the male elephant enlarge, and emit a secretion having a strong musky odor. The males, and rarely the females, of many kinds of bats have glands and protrudable sacs situated in various parts; and it is believed that these are odoriferous.

The rank effluvium of the male goat is well known, and that of certain male deer is wonderfully strong and persistent. On the banks of the Plata I perceived the air tainted

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[8] On the sea-elephant, see an article by Lesson, in "Dict. Class. Hist. Nat.," tom. xiii. p. 418. For the Cystophora or Stemmatopus, see Dr. Dekay, "Annals of Lyceum of Nat. Hist. New York," vol. i., 1824, p. 94. Pennant has also collected information from the sealers on this animal. The fullest account is given by Mr. Brown, in "Proc. Zoolog. Soc.," 1868, p. 435.

[9] As with the castoreum of the beaver, see Mr. L. H. Morgan's most interesting work, "The American Beaver," 1868, p. 300. Pallas ("Spic. Zoolog.," fasc. viii., 1779, p. 23) has well discussed the odoriferous glands of mammals. Owen ("Anat. of Vertebrates," vol. iii. p. 634) also gives an account of these glands, including those of the elephant, and (p. 763) those of shrew-mice. On Bats, Mr. Dobson in "Proc. Zoolog. Soc.," 1873, p. 241.

with the odor of the male *Cervus campestris*, at half a mile to leeward of a herd; and a silk handkerchief, in which I carried home a skin, though often used and washed, retained, when first unfolded, traces of the odor for one year and seven months. This animal does not emit its strong odor until more than a year old, and if castrated while young never emits it.[10] Besides the general odor, permeating the whole body of certain ruminants (for instance, *Bos moschatus*) in the breeding season, many deer, antelopes, sheep, and goats possess odoriferous glands in various situations, more especially on their faces. The so-called tear-sacs, or suborbital pits, come under this head. These glands secrete a semifluid fetid matter which is sometimes so copious as to stain the whole face, as I have myself seen in an antelope. They are "usually larger in the male than in the female, and their development is checked by castration."[11] According to Desmarest they are altogether absent in the female of *Antilope subgutturosa*. Hence, there can be no doubt that they stand in close relation with the reproductive functions. They are also sometimes present, and sometimes absent, in nearly allied forms. In the adult male musk-deer (*Moschus moschiferus*) a naked space round the tail is bedewed with an odoriferous fluid, while in the adult female, and in the male until two years old, this space is covered with hair and is not odoriferous. The proper musk-sac of this deer is from its position necessarily confined to the male, and forms an additional scent-organ. It is a singular fact that the matter secreted by this latter gland does not, according to Pallas, change in consistence, or increase in quantity, during the rutting season; nevertheless, this naturalist admits that its presence is in some way connected with the act of reproduction. He gives, however,

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[10] Rengger, "Naturgeschichte der Säugethiere von Paraguay," 1830, s. 355. This observer also gives some curious particulars in regard to the odor.

[11] Owen, "Anatomy of Vertebrates," vol. iii. p. 632. See, also, Dr. Murie's observations on these glands in the "Proc. Zoolog. Soc.," 1870, p. 340. Desmarest, on the *Antilope subgutturosa*, "Mammalogie," 1820, p. 455.

only a conjectural and unsatisfactory explanation of its use.[12]

In most cases, when only the male emits a strong odor during the breeding season, it probably serves to excite or allure the female. We must not judge on this head by our own taste, for it is well known that rats are enticed by certain essential oils, and cats by valerian, substances far from agreeable to us; and that dogs, though they will not eat carrion, sniff and roll on it. From the reasons given when discussing the voice of the stag, we may reject the idea that the odor serves to bring the females from a distance to the males. Active and long-continued use cannot here have come into play, as in the case of the vocal organs. The odor emitted must be of considerable importance to the male, inasmuch as large and complex glands, furnished with muscles for everting the sac, and for closing or opening the orifice, have in some cases been developed. The development of these organs is intelligible through sexual selection, if the most odoriferous males are the most successful in winning the females, and leaving offspring to inherit their gradually perfected glands and odors.

Development of the Hair.—We have seen that male quadrupeds often have the hair on their necks and shoulders much more developed than the females; and many additional instances could be given. This sometimes serves as a defence to the male during his battles; but whether the hair in most cases has been specially developed for this purpose is very doubtful. We may feel almost certain that this is not the case when only a thin and narrow crest runs along the back; for a crest of this kind would afford scarcely any protection, and the ridge of the back is not a place likely to be injured; nevertheless, such

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[12] Pallas, "Spicilegia Zoolog.," fasc. xiii., 1799, p. 24; Desmoulins, "Dict. Class. d'Hist. Nat.," tom. iii. p. 586.

crests are sometimes confined to the males, or are much more developed in them than in the females. Two antelopes, the *Tragelaphus scriptus* [13] (see Fig. 70, p. 702) and *Portax picta*, may be given as instances. When stags, and the males of the wild goat, are enraged or terrified, these crests stand erect; [14] but it cannot be supposed that they have been developed merely for the sake of exciting fear in their enemies. One of the above-named antelopes, the *Portax picta*, has a large, well-defined brush of black hair on the throat, and this is much larger in the male than in the female. In the *Ammotragus tragelaphus* of North Africa, a member of the sheep family, the forelegs are almost concealed by an extraordinary growth of hair, which depends from the neck and upper halves of the legs; but Mr. Bartlett does not believe that this mantle is of the least use to the male, in whom it is much more developed than in the female.

Male quadrupeds of many kinds differ from the females in having more hair, or hair of a different character, on certain parts of their faces. Thus the bull alone has curled hair on the forehead.[15] In three closely allied sub-genera of the goat family, only the males possess beards, sometimes of large size; in two other sub-genera both sexes have a beard, but it disappears in some of the domestic breeds of the common goat; and neither sex of the Hemitragus has a beard. In the ibex the beard is not developed during the summer, and it is so small at other times that it may be called rudimentary.[16] With some monkeys the beard is confined to the male, as in the orang; or is much larger in the male than in the female, as in the *Mycetes caraya* and *Pithecia satanas* (Fig. 68). So it is with the whiskers of some

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[13] Dr. Gray, "Gleanings from the Menagerie at Knowsley," pl. 28.

[14] Judge Caton on the Wapiti, "Transact. Ottawa Acad. Nat. Sciences," 1868, pp. 36, 40; Blyth, "Land and Water," on *Capra ægagrus*, 1867, p. 37.

[15] "Hunter's Essays and Observations," edited by Owen, 1861, vol. i. p. 236.

[16] See Dr. Gray's "Cat. of Mammalia in British Museum," part iii., 1852, p. 144.

species of Macacus,[17] and, as we have seen, with the manes of some species of baboons. But with most kinds of monkeys the various tufts of hair about the face and head are alike in both sexes.

The males of various members of the ox family (Bovidæ) and of certain antelopes are furnished with a dewlap,

Fig. 68.—Pithecia satanas, male (from Brehm).

or great fold of skin on the neck, which is much less developed in the female.

Now, what must we conclude with respect to such sexual differences as these? No one will pretend that the beards of certain male goats, or the dewlap of the bull, or the crests of hair along the backs of certain male antelopes, are of any use to them in their ordinary habits. It is possible that the immense beard of the male Pithecia, and the large beard of

[17] Rengger, "Säugethiere," etc., s. 14; Desmarest, "Mammalogie," p. 66.

the male orang, may protect their throats when fighting; for the keepers in the Zoological Gardens inform me that many monkeys attack each other by the throat; but it is not probable that the beard has been developed for a distinct purpose from that served by the whiskers, mustache, and other tufts of hair on the face; and no one will suppose that these are useful as a protection. Must we attribute all these appendages of hair or skin to mere purposeless variability in the male? It cannot be denied that this is possible; for in many domesticated quadrupeds certain characters, apparently not derived through reversion from any wild parent-form, are confined to the males, or are more developed in them than in the females—for instance, the hump on the male zebu-cattle of India, the tail of fat-tailed rams, the arched outline of the forehead in the males of several breeds of sheep, and, lastly, the mane, the long hairs on the hindlegs, and the dewlap of the male of the Berbura goat.[18] The mane, which occurs only in the rams of an African breed of sheep, is a true secondary sexual character, for, as I hear from Mr. Winwood Reade, it is not developed if the animal be castrated. Although we ought to be extremely cautious, as shown in my work on "Variation Under Domestication," in concluding that any character, even with animals kept by semi-civilized people, has not been subjected to selection by man, and thus augmented, yet in the cases just specified this is improbable; more especially as the characters are confined to the males, or are more strongly developed in them than in the females. If it were positively known that the above African ram is a descendant of the same primitive stock as the other breeds of sheep, and if the Berbura male goat with his mane, dewlap, etc., is descended from the same stock as other goats, then, assuming that selection has not

[18] See the chapters on these several animals in vol. i. of my "Variation of Animals under Domestication"; also vol. ii. p. 73; also chap. xx. on the practice of selection by semi-civilized people. For the Berbura goat, see Dr. Gray, "Catalogue," ibid., p. 157.

been applied to these characters, they must be due to simple variability, together with sexually limited inheritance.

Hence it appears reasonable to extend this same view to all analogous cases with animals in a state of nature. Nevertheless I cannot persuade myself that it generally holds good, as in the case of the extraordinary development of hair on the throat and forelegs of the male Ammotragus, or in that of the immense beard of the male Pithecia. Such study as I have been able to give to nature makes me believe that parts or organs which are highly developed were acquired at some period for a special purpose. With those antelopes in which the adult male is more strongly colored than the female, and with those monkeys in which the hair on the face is elegantly arranged and colored in a diversified manner, it seems probable that the crests and tufts of hair were gained as ornaments; and this I know is the opinion of some naturalists. If this be correct, there can be little doubt that they were gained or at least modified through sexual selection; but how far the same view may be extended to other mammals is doubtful.

Color of the Hair and of the Naked Skin.—I will first give briefly all the cases known to me of male quadrupeds differing in color from the females. With Marsupials, as I am informed by Mr. Gould, the sexes rarely differ in this respect; but the great red kangaroo offers a striking exception, "delicate blue being the prevailing tint in those parts of the female which in the male are red." [19] In the *Didelphis opossum* of Cayenne the female is said to be a little more red than the male. Of the Rodents Dr. Gray remarks: "African squirrels, especially those found in the tropical regions, have the fur much brighter and more vivid at some seasons of the year than at others, and the fur of

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[19] *Osphranter rufus*, Gould, "Mammals of Australia," 1863, vol. ii. On the Didelphis, Desmarest, "Mammalogie," p. 256.

the male is generally brighter than that of the female."[20] Dr. Gray informs me that he specified the African squirrels, because, from their unusually bright colors, they best exhibit this difference. The female of the *Mus minutus* of Russia is of a paler and dirtier tint than the male. In a large number of bats the fur of the male is lighter than in the female.[21] Mr. Dobson also remarks, with respect to these animals: "Differences, depending partly or entirely on the possession by the male of fur of a much more brilliant hue, or distinguished by different markings or by the greater length of certain portions, are met only, to any appreciable extent, in the frugivorous bats in which the sense of sight is well developed." This last remark deserves attention, as bearing on the question whether bright colors are serviceable to male animals from being ornamental. In one genus of sloths, it is now established, as Dr. Gray states, "that the males are ornamented differently from the females—that is to say, that they have a patch of soft short hair between the shoulders, which is generally of a more or less orange color, and in one species pure white. The females, on the contrary, are destitute of this mark."

The terrestrial Carnivora and Insectivora rarely exhibit sexual differences of any kind, including color. The ocelot (*Felis pardalis*), however, is exceptional, for the colors of the female, compared with those of the male, are "moins apparentes, le fauve étant plus terne, le blanc moins pur, les raies ayant moins de largeur et les taches moins de diamètre."[22] The sexes of the allied *Felis mitis* also differ, but in a less degree; the general hues of the female being rather paler than in the male, with the spots less black. The marine Carnivora or seals, on the other hand, some-

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[20] "Annals and Mag. of Nat. Hist.," Nov. 1867, p. 325. On the *Mus minutus*, Desmarest, "Mammalogie," p. 304.

[21] J. A. Allen, in "Bulletin of Mus. Comp. Zoolog. of Cambridge, United States," 1869, p. 207. Mr. Dobson on sexual characters in the Chiroptera, "Proc. Zoolog. Soc.," 1873, p. 241. Dr. Gray on Sloths, ibid., 1871, p. 436.

[22] Desmarest, "Mammalogie," 1820, p. 220. On *Felis mitis*, Rengger, ibid., s. 194.

times differ considerably in color, and they present, as we have already seen, other remarkable sexual differences. Thus the male of the *Otaria nigrescens* of the southern hemisphere is of a rich brown shade above; while the female, who acquires her adult tints earlier in life than the male, is dark gray above, the young of both sexes being of a deep chocolate color. The male of the northern *Phoca groenlandica* is tawny gray, with a curious saddle-shaped dark mark on the back; the female is much smaller, and has a very different appearance, being "dull white or yellowish straw-color, with a tawny hue on the back"; the young at first are pure white, and can "hardly be distinguished among the icy hummocks and snow, their color thus acting as a protection." [23]

With Ruminants sexual differences of color occur more commonly than in any other order. A difference of this kind is general in the Strepsicerene antelopes; thus the male nilghau (*Portax picta*) is bluish gray and much darker than the female, with the square white patch on the throat, the white marks on the fetlocks, and the black spots on the ears all much more distinct. We have seen that in this species the crests and tufts of hair are likewise more developed in the male than in the hornless female. I am informed by Mr. Blyth that the male, without shedding his hair, periodically becomes darker during the breeding season. Young males cannot be distinguished from young females until about twelve months old; and if the male is emasculated before this period, he never, according to the same authority, changes color. The importance of this latter fact, as evidence that the coloring of the Portax is of sexual origin, becomes obvious, when we hear[24] that neither the red summer-coat nor the blue winter-coat of

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[23] Dr. Murie on the Otaria, "Proc. Zool. Soc.," 1869, p. 108. Mr. R. Brown, on the *P. groenlandica*, ibid., 1868, p. 417. See, also, on the colors of seals, Desmarest, ibid., pp. 243, 249.

[24] Judge Caton, in "Transactions of the Ottawa Academy of Natural Sciences," 1868, p. 4.

the Virginian deer is at all affected by emasculation. With most or all of the highly ornamented species of Tragelaphus the males are darker than the hornless females, and their crests of hair are more fully developed. In the male of that magnificent antelope, the Derbyan eland, the body is redder, the whole neck much blacker and the white band which separates these colors broader than in the female. In the Cape eland, also, the male is slightly darker than the female.[25]

In the Indian black-buck (*A. bezoartica*), which belongs to another tribe of antelopes, the male is very dark, almost black; while the hornless female is fawn-colored. We meet in this species, as Mr. Blyth informs me, with an exactly similar series of facts as in the *Portax picta*, namely, in the male periodically changing color during the breeding season, in the effects of emasculation on this change, and in the young of both sexes being indistinguishable from each other. In the *Antilope niger* the male is black, the female, as well as the young of both sexes, being brown; in *A. sing-sing* the male is much brighter colored than the hornless female, and his chest and belly are blacker; in the male *A. caama*, the marks and lines which occur on various parts of the body are black, instead of brown, as in the female; in the brindled gnu (*A. gorgon*) "the colors of the male are nearly the same as those of the female, only deeper, and of a brighter hue."[26] Other analogous cases could be added.

The Banteng bull (*Bos sondaicus*) of the Malayan Archi-

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[25] Dr. Gray, "Cat. of Mamm. in Brit. Mus.," part iii., 1852, pp. 134–142; also Dr. Gray, "Gleanings from the Menagerie of Knowsley," in which there is a splendid drawing of the *Oreas derbianus:* see the text on Tragelaphus. For the Cape eland (*Oreas canna*), see Andrew Smith, "Zoology of S. Africa," pl. 41 and 42. There are also many of these antelopes in the Zoological Gardens.

[26] On the *Ant. niger*, see "Proc. Zool. Soc.," 1850, p. 133. With respect to an allied species, in which there is an equal sexual difference in color, see Sir S. Baker, "The Albert Nyanza," 1866, vol. ii. p. 327. For the *A. sing-sing*, Gray, "Cat. B. Mus." p. 100. Desmarest, "Mammalogie," p. 468, on the *A. caama*. Andrew Smith, "Zoology of S. Africa," on the Gnu.

pelago is almost black, with white legs and buttocks; the cow is of a bright dun, as are the young males until about the age of three years, when they rapidly change color. The emasculated bull reverts to the color of the female. The female Kemas goat is paler, and both it and the female *Capra ægagrus* are said to be more uniformly tinted than their males. Deer rarely present any sexual differences in color. Judge Caton, however, informs me that in the males of the wapiti deer (*Cervus canadensis*) the neck, belly, and legs are much darker than in the female; but during the winter the darker tints gradually fade away and disappear. I may here mention that Judge Caton has in his park three races of the Virginian deer which differ slightly in color, but the differences are almost exclusively confined to the blue winter or breeding coat; so that this case may be compared with those given in a previous chapter of closely allied or representative species of birds, which differ from each other only in their breeding plumage.[27] The females of *Cervus paludosus* of South America, as well as the young of both sexes, do not possess the black stripes on the nose and the blackish brown line on the breast, which are characteristic of the adult males.[28] Lastly, as I am informed by Mr. Blyth, the mature male of the beautifully colored and spotted axis deer is considerably darker than the female; and this hue the castrated male never acquires.

The last Order which we need consider is that of the Primates. The male of the *Lemur macaco* is generally coal-black, while the female is brown.[29] Of the Quadrumana of the New World, the females and young of *Mycetes*

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[27] "Ottawa Academy of Sciences," May 21, 1868, pp. 3, 5.

[28] S. Müller, on the Banteng, "Zoog. Indischen Archipel.," 1839–44, tab. 35; see, also, Raffles, as quoted by Mr. Blyth, in "Land and Water," 1867, p. 476. On goats, Dr. Gray, "Cat. Brit. Mus.," p. 146; Desmarest, "Mammalogie," p. 432. On the *Cervus paludosus*, Rengger, ibid., s. 345.

[29] Sclater, "Proc. Zool. Soc.," 1866, p. 1. The same fact has also been fully ascertained by MM. Pollen and Van Dam. See, also, Dr. Gray in "Annals and Mag. of Nat. Hist.," May, 1871, p. 340.

caraya are grayish yellow and like each other; in the second year the young male becomes reddish brown; in the third, black, excepting the stomach, which, however, becomes quite black in the fourth or fifth year. There is also a strongly marked difference in color between the sexes of *Mycetes seniculus* and *Cebus capucinus;* the young of the former, and I believe of the latter species, resembling the females. With *Pithecia leucocephala* the young likewise resemble the females, which are brownish black above and light rusty red beneath, the adult males being black. The ruff of hair round the face of *Ateles marginatus* is tinted yellow in the male and white in the female. Turning to the Old World, the males of *Hylobates hoolock* are always black, with the exception of a white band over the brows; the females vary from whity brown to a dark tint mixed with black, but are never wholly black.[30] In the beautiful *Cercopithecus diana*, the head of the adult male is of an intense black, while that of the female is dark gray; in the former the fur between the thighs is of an elegant fawn-color, in the latter it is paler. In the beautiful and curious mustache monkey (*Cercopithecus cephas*) the only difference between the sexes is that the tail of the male is chestnut and that of the female gray; but Mr. Bartlett informs me that all the hues become more pronounced in the male when adult, while in the female they remain as they were during youth. According to the colored figures given by Solomon Muller, the male of *Semnopithecus chrysomelas* is nearly black, the female being pale brown. In the *Cercopithecus cynosurus* and *griseoviridis* one part of the body, which is confined to the male sex, is of the most brilliant blue or green, and contrasts strikingly with the naked skin on the hinder part of the body, which is vivid red.

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[30] On Mycetes, Rengger, ibid., s. 14; and Brehm, "Illustrirtes Thierleben," B. i. s. 96, 107. On Ateles, Desmarest, "Mammalogie," p. 75. On Hylobates, Blyth, "Land and Water," 1867, p. 135. On the Semnopithecus, S. Müller, "Zoog. Indischen Archipel.," tab. x.

Lastly, in the baboon family, the adult male of *Cynocephalus hamadryas* differs from the female not only by his immense mane, but slightly in the color of the hair and of the naked callosities. In the drill (*C. leucophæus*) the females and young are much paler colored, with less green, than the adult males. No other member in the whole class of mammals is colored in so extraordinary a manner as the adult male mandrill (*C. mormon*). The face at this age becomes of a fine blue, with the ridge and tip of the nose of the most brilliant red. According to some authors, the face is also marked with whitish stripes, and is shaded in parts with black, but the colors appear to be variable. On the forehead there is a crest of hair, and on the chin a yellow beard. "Toutes les parties supérieures de leurs cuisses et le grand espace nu de leurs fesses sont également colorés du rouge le plus vif, avec un mélange de bleu qui ne manque réellement pas d'élégance." [31] When the animal is excited all the naked parts become much more vividly tinted. Several authors have used the strongest expressions in describing these resplendent colors, which they compare with those of the most brilliant birds. Another remarkable peculiarity is that when the great canine teeth are fully developed, immense protuberances of bone are formed on each cheek, which are deeply furrowed longitudinally, and the naked skin over them is brilliantly colored, as just described (Fig. 69). In the adult females and in the young of both sexes these protuberances are scarcely perceptible; and the naked parts are much less bright colored, the face being almost black, tinged with blue. In the adult female, however, the nose at certain regular intervals of time becomes tinted with red.

In all the cases hitherto given the male is more strongly or brighter colored than the female, and differs from the

[31] Gervais, "Hist. Nat. des Mammifères," 1854, p. 103. Figures are given of the skull of the male. Also Desmarest, "Mammalogie," p. 70. Geoffroy St.-Hilaire and F. Cuvier, "Hist. Nat. des Mamm.," 1824, tom. i.

young of both sexes. But as with some few birds it is the female which is brighter colored than the male, so with the Rhesus monkey (*Macacus rhesus*) the female has a large surface of naked skin round the tail, of a brilliant carmine red, which, as I was assured by the keepers in the Zoological Gardens, periodically becomes even yet more vivid, and

Fig. 69.—Head of male Mandrill (from Gervais, "Hist. Nat. des Mammifères").

her face also is pale red. On the other hand, in the adult male and in the young of both sexes (as I saw in the Gardens), neither the naked skin at the posterior end of the body, nor the face, shows a trace of red. It appears, however, from some published accounts, that the male does occasionally, or during certain seasons, exhibit some traces of the red. Although he is thus less ornamented than the

female, yet in the larger size of his body, larger canine teeth, more developed whiskers, more prominent superciliary ridges, he follows the common rule of the male excelling the female.

I have now given all the cases known to me of a difference in color between the sexes of mammals. Some of these may be the result of variations confined to one sex and transmitted to the same sex, without any good being gained, and therefore without the aid of selection. We have instances of this with our domesticated animals, as in the males of certain cats being rusty red, while the females are tortoise-shell colored. Analogous cases occur in nature: Mr. Bartlett has seen many black varieties of the jaguar, leopard, vulpine phalanger, and wombat; and he is certain that all, or nearly all, these animals were males. On the other hand, with wolves, foxes, and apparently American squirrels, both sexes are occasionally born black. Hence it is quite possible that with some mammals a difference in color between the sexes, especially when this is congenital, may simply be the result, without the aid of selection, of the occurrence of one or more variations which from the first were sexually limited in their transmission. Nevertheless it is improbable that the diversified, vivid, and contrasted colors of certain quadrupeds, for instance, of the above monkeys and antelopes, can thus be accounted for. We should bear in mind that these colors do not appear in the male at birth, but only at or near maturity; and that, unlike ordinary variations, they are lost if the male be emasculated. It is on the whole probable that the strongly marked colors and other ornamental characters of male quadrupeds are beneficial to them in their rivalry with other males, and have consequently been acquired through sexual selection. This view is strengthened by the differences in color between the sexes occurring almost exclusively, as may be collected from the previous details, in those groups and sub-groups of mammals which present other and strongly marked second-

ary sexual characters; these being likewise due to sexual selection.

Quadrupeds manifestly take notice of color. Sir S. Baker repeatedly observed that the African elephant and rhinoceros attacked white or gray horses with special fury. I have elsewhere shown[32] that half-wild horses apparently prefer to pair with those of the same color, and that herds of fallow-deer of different colors, though living together, have long kept distinct. It is a more significant fact that a female zebra would not admit the addresses of a male ass until he was painted so as to resemble a zebra, and then, as John Hunter remarks, "she received him very readily. In this curious fact we have instinct excited by mere color, which had so strong an effect as to get the better of everything else. But the male did not require this; the female being an animal somewhat similar to himself was sufficient to rouse him." [33]

In an earlier chapter we have seen that the mental powers of the higher animals do not differ in kind, though greatly in degree, from the corresponding powers of man, especially of the lower and barbarous races; and it would appear that even their taste for the beautiful is not widely different from that of the Quadrumana. As the negro of Africa raises the flesh on his face into parallel ridges "or cicatrices, high above the natural surface, which unsightly deformities are considered great personal attractions" [34]—as negroes and savages in many parts of the world paint their faces with red, blue, white, or black bars—so the male mandrill of Africa appears to have acquired his deeply furrowed and gaudily colored face from having been thus rendered attractive to the female. No doubt it is to us a most grotesque notion that the posterior end of the body should be colored

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[32] "The Variation of Animals and Plants under Domestication," 1868, vol. ii. pp. 102, 103.

[33] "Essays and Observations by J. Hunter," edited by Owen, 1861, vol. i. p. 194.

[34] Sir S. Baker, "The Nile Tributaries of Abyssinia," 1867.

for the sake of ornament even more brilliantly than the face; but this is not more strange than that the tails of many birds should be especially decorated.

With mammals we do not at present possess any evidence that the males take pains to display their charms before the female; and the elaborate manner in which this is performed by male birds and other animals is the strongest argument in favor of the belief that the females admire, or are excited by, the ornaments and colors displayed before them. There is, however, a striking parallelism between mammals and birds in all their secondary sexual characters, namely, in their weapons for fighting with rival males, in their ornamental appendages, and in their colors. In both classes, when the male differs from the female, the young of both sexes almost always resemble each other, and in a large majority of cases resemble the adult female. In both classes the male assumes the characters proper to his sex shortly before the age of reproduction; and, if emasculated at an early period, loses them. In both classes, the change of color is sometimes seasonal, and the tints of the naked parts sometimes become more vivid during the act of courtship. In both classes the male is almost always more vividly or strongly colored than the female, and is ornamented with larger crests of hair or feathers, or other such appendages. In a few exceptional cases the female in both classes is more highly ornamented than the male. With many mammals, and at least in the case of one bird, the male is more odoriferous than the female. In both classes the voice of the male is more powerful than that of the female. Considering this parallelism there can be little doubt that the same cause, whatever it may be, has acted on mammals and birds; and the result, as far as ornamental characters are concerned, may be attributed, as it appears to me, to the long-continued preference of the individuals of one sex for certain individuals of the opposite sex, combined with their success in leaving a larger number of offspring to inherit their superior attractions.

Equal Transmission of Ornamental Characters to Both Sexes.—With many birds, ornaments, which analogy leads us to believe were primarily acquired by the males, have been transmitted equally, or almost equally, to both sexes; and we may now inquire how far this view applies to mammals. With a considerable number of species, especially of the smaller kinds, both sexes have been colored, independently of sexual selection, for the sake of protection; but not, as far as I can judge, in so many cases, nor in so striking a manner, as in most of the lower classes. Audubon remarks that he often mistook the muskrat,[35] while sitting on the banks of a muddy stream, for a clod of earth, so complete was the resemblance. The hare on her form is a familiar instance of concealment through color; yet this principle partly fails in a closely allied species, the rabbit, for when running to its burrow it is made conspicuous to the sportsman, and no doubt to all beasts of prey, by its upturned white tail. No one doubts that the quadrupeds inhabiting snow-clad regions have been rendered white to protect them from their enemies, or to favor their stealing on their prey. In regions where snow never lies for long a white coat would be injurious; consequently, species of this color are extremely rare in the hotter parts of the world. It deserves notice that many quadrupeds inhabiting moderately cold regions, although they do not assume a white winter dress, become paler during this season; and this apparently is the direct result of the conditions to which they have long been exposed. Pallas[36] states that in Siberia a change of this nature occurs with the wolf, two species of Mustela, the domestic horse, the *Equus hemionus*, the domestic cow, two species of antelopes, the musk-deer, the roe, elk and reindeer. The roe, for instance, has a red summer and a grayish-white winter coat; and the latter may perhaps serve

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[35] *Fiber zibethicus*, Audubon and Bachman, "The Quadrupeds of N. America," 1846, p. 109.

[36] "Novæ species Quadrupedum e Glirium ordine," 1778, p. 7. What I have called the roe is the *Capreolus sibiricus subcaudatus* of Pallas.

as a protection to the animal while wandering through the leafless thickets, sprinkled with snow and hoarfrost. If the above-named animals were gradually to extend their range into regions perpetually covered with snow, their pale winter coats would probably be rendered, through natural selection, whiter and whiter, until they became as white as snow.

Mr. Reeks has given me a curious instance of an animal profiting by being peculiarly colored. He raised from fifty to sixty white and brown piebald rabbits in a large walled orchard, and he had at the same time some similarly colored cats in his house. Such cats, as I have often noticed, are very conspicuous during day; but as they used to lie in watch during the dusk at the mouths of the burrows, the rabbits apparently did not distinguish them from their party-colored brethren. The result was that, within eighteen months, every one of these party-colored rabbits was destroyed; and there was evidence that this was effected by the cats. Color seems to be advantageous to another animal, the skunk, in a manner of which we have had many instances in other classes. No animal will voluntarily attack one of these creatures, on account of the dreadful odor which it emits when irritated; but during the dusk it would not easily be recognized, and might be attacked by a beast of prey. Hence it is, as Mr. Belt believes,[37] that the skunk is provided with a great white bushy tail, which serves as a conspicuous warning.

Although we must admit that many quadrupeds have received their present tints either as a protection or as an aid in procuring prey, yet with a host of species the colors are far too conspicuous and too singularly arranged to allow us to suppose that they serve for these purposes. We may take as an illustration certain antelopes; when we see the square white patch on the throat, the white marks on the fetlocks, and the round black spots on the ears, all more distinct in the male of the *Portax picta* than in the

[37] "The Naturalist in Nicaragua," p. 249.

female; when we see that the colors are more vivid, that the narrow white lines on the flank and the broad white bar on the shoulder are more distinct in the male *Oreas derbyanus* than in the female; when we see a similar difference between the sexes of the curiously ornamented *Tragelaphus scriptus* (Fig. 70), we cannot believe that dif-

Fig. 70.—Tragelaphus scriptus, male (from the Knowsley Menagerie).

ferences of this kind are of any service to either sex in their daily habits of life. It seems a much more probable conclusion that the various marks were first acquired by the males and their colors intensified through sexual selection, and then partially transferred to the females. If this view be admitted, there can be little doubt that the equally sin-

gular colors and marks of many other antelopes, though common to both sexes, have been gained and transmitted in a like manner. Both sexes, for instance, of the koodoo (*Strepsiceros kudu*) (Fig. 64) have narrow white vertical lines on their hind flanks, and an elegant angular white mark on their foreheads. Both sexes in the genus Damalis are very oddly colored; in *D. pygarga* the back and neck are pur-

Fig. 71.—Damalis pygarga, male (from the Knowsley Menagerie).

plish red, shading on the flanks into black; and these colors are abruptly separated from the white belly and from a large white space on the buttocks; the head is still more oddly colored, a large oblong white mask, narrowly edged with black, covers the face up to the eyes (Fig. 71); there are three white stripes on the forehead, and the ears are marked with white. The fawns of this species are of a uniform pale yellowish brown. In *Da-*

malis albifrons the coloring of the head differs from that in the last species in a single white stripe replacing the three stripes, and in the ears being almost wholly white.[38] After having studied to the best of my ability the sexual differences of animals belonging to all classes, I cannot avoid the conclusion that the curiously arranged colors of many antelopes, though common to both sexes, are the result of sexual selection primarily applied to the male.

The same conclusion may, perhaps, be extended to the tiger, one of the most beautiful animals in the world, the sexes of which cannot be distinguished by color, even by the dealers in wild beasts. Mr. Wallace believes[39] that the striped coat of the tiger "so assimilates with the vertical stems of the bamboo as to assist greatly in concealing him from his approaching prey." But this view does not appear to me satisfactory. We have some slight evidence that his beauty may be due to sexual selection, for in two species of Felis the analogous marks and colors are rather brighter in the male than in the female. The zebra is conspicuously striped, and stripes cannot afford any protection on the open plains of South Africa. Burchell,[40] in describing a herd, says, "their sleek ribs glistened in the sun, and the brightness and regularity of their striped coats presented a picture of extraordinary beauty, in which probably they are not surpassed by any other quadruped." But as throughout the whole group of the Equidæ the sexes are identical in color, we have here no evidence of sexual selection. Nevertheless, he who attributes the white and dark vertical stripes on the flanks of various antelopes to this process will probably extend the same view to the Royal Tiger and beautiful Zebra.

We have seen in a former chapter that when young animals belonging to any class follow nearly the same habits of

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[38] See the fine plates in A. Smith's, "Zoology of S. Africa," and Dr. Gray's "Gleanings from the Menagerie of Knowsley."

[39] "Westminster Review," July 1, 1867, p. 5.

[40] "Travels in South Africa," 1824, vol. ii. p. 315.

life as their parents, and yet are colored in a different manner, it may be inferred that they have retained the coloring of some ancient and extinct progenitor. In the family of pigs, and in the tapirs, the young are marked with longitudinal stripes, and thus differ from all the existing adult species in these two groups. With many kinds of deer the young are marked with elegant white spots, of which their parents exhibit not a trace. A graduated series can be followed from the axis deer, both sexes of which at all ages and during all seasons are beautifully spotted (the male being rather more strongly colored than the female), to species in which neither the old nor the young are spotted. I will specify some of the steps in this series. The Mantchurian deer (*Cervus mantchuricus*) is spotted during the whole year, but, as I have seen in the Zoological Gardens, the spots are much plainer during the summer, when the general color of the coat is lighter, than during the winter, when the general color is darker and the horns are fully developed. In the hog-deer (*Hyelaphus porcinus*) the spots are extremely conspicuous during the summer, when the coat is reddish brown, but quite disappear during the winter, when the coat is brown.[41] In both these species the young are spotted. In the Virginian deer the young are likewise spotted, and about five per cent of the adult animals living in Judge Caton's park, as I am informed by him, temporarily exhibit, at the period when the red summer-coat is being replaced by the bluish winter-coat, a row of spots on each flank, which are always the same in number, though very variable in distinctness. From this condition there is but a very small step to the complete absence of spots in the adults at all seasons; and, lastly, to their absence at all ages and seasons, as occurs with certain species. From the existence of this perfect series, and

[41] Dr. Gray, "Gleanings from the Menagerie of Knowsley," p. 64. Mr. Blyth, in speaking ("Land and Water," 1869, p. 242) of the hog-deer of Ceylon, says it is more brightly spotted with white than the common hog-deer, at the season when it renews its horns.

more especially from the fawns of so many species being spotted, we may conclude that the now living members of the deer family are the descendants of some ancient species which, like the axis deer, was spotted at all ages and seasons. A still more ancient progenitor probably somewhat resembled the *Hyomoschus aquaticus*—for this animal is spotted, and the hornless males have large exserted canine teeth, of which some few true deer still retain rudiments. Hyomoschus, also, offers one of those interesting cases of a form linking together two groups, for it is intermediate in certain osteological characters between the pachyderms and ruminants, which were formerly thought to be quite distinct.[42]

A curious difficulty here arises. If we admit that colored spots and stripes were first acquired as ornaments, how comes it that so many existing deer, the descendants of an aboriginally spotted animal, and all the species of pigs and tapirs, the descendants of an aboriginally striped animal, have lost in their adult state their former ornaments? I cannot satisfactorily answer this question. We may feel almost sure that the spots and stripes disappeared at or near maturity in the progenitors of our existing species, so that they were still retained by the young; and, owing to the law of inheritance at corresponding ages, were transmitted to the young of all succeeding generations. It may have been a great advantage to the lion and puma, from the open nature of their usual haunts, to have lost their stripes, and to have been thus rendered less conspicuous to their prey; and if the successive variations by which this end was gained occurred rather late in life, the young would have retained their stripes, as is now the case. As to deer, pigs, and tapirs, Fritz Müller has suggested to me that these animals, by the removal of their spots or stripes through natural selection, would have been less easily seen by

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[42] Falconer and Cautley, "Proc. Geolog. Soc.," 1843; and Falconer's "Pal. Memoirs," vol. i. p. 196.

their enemies, and that they would have especially required this protection, as soon as the carnivora increased in size and number during the tertiary periods. This may be the true explanation, but it is rather strange that the young should not have been thus protected, and still more so that the adults of some species should have retained their spots, either partially or completely, during part of the year. We know that, when the domestic ass varies and becomes reddish brown, gray, or black, the stripes on the shoulders and even on the spine frequently disappear, though we cannot explain the cause. Very few horses, except dun-colored kinds, have stripes on any part of their bodies, yet we have good reason to believe that the aboriginal horse was striped on the legs and spine, and probably on the shoulders.[43] Hence, the disappearance of the spots and stripes in our adult existing deer, pigs, and tapirs may be due to a change in the general color of their coats; but whether this change was effected through sexual or natural selection, or was due to the direct action of the conditions of life, or to some other unknown cause, it is impossible to decide. An observation made by Mr. Sclater well illustrates our ignorance of the laws which regulate the appearance and disappearance of stripes; the species of Asinus which inhabit the Asiatic continent are destitute of stripes, not having even the cross shoulder-stripe, while those which inhabit Africa are conspicuously striped, with the partial exception of *A. tæniopus*, which has only the cross shoulder-stripe and generally some faint bars on the legs; and this species inhabits the almost intermediate region of Upper Egypt and Abyssinia.[44]

Quadrumana.—Before we conclude, it will be well to add a few remarks on the ornaments of monkeys. In most

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[43] "The Variation of Animals and Plants under Domestication," 1868, vol. i. pp. 61–64.

[44] "Proc. Zoolog. Soc.," 1862, p. 164. See, also, Dr. Hartmann, "Ann. d. Landw.," Bd. xliii. s. 222.

of the species the sexes resemble each other in color, but in some, as we have seen, the males differ from the females, especially in the color of the naked parts of the skin, in the development of the beard, whiskers, and mane. Many species are colored either in so extraordinary or so beautiful a manner, and are furnished with such curious and elegant crests of hair, that we can hardly avoid looking at these

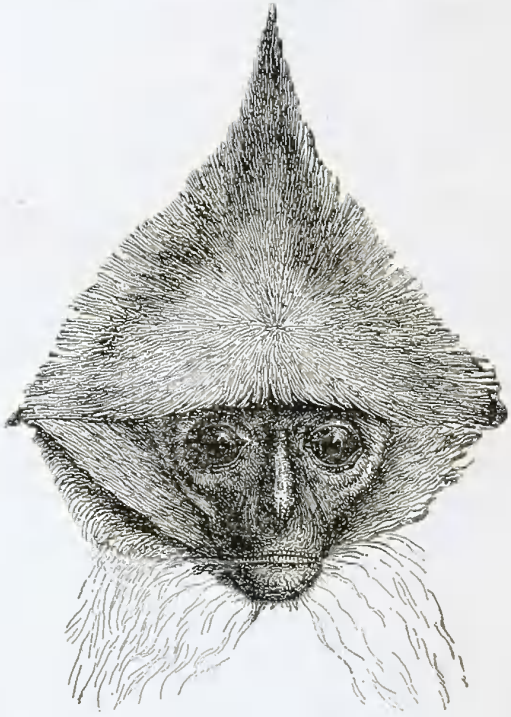

FIG. 72.—Head of Semnopithecus rubicundus. This and the following figures (from Prof. Gervais) are given to show the odd arrangement and development of the hair on the head.

characters as having been gained for the sake of ornament. The accompanying figures (Figs. 72 to 76) serve to show the arrangement of the hair on the face and head in several species. It is scarcely conceivable that these crests of hair, and the strongly contrasted colors of the fur and skin, can be the result of mere variability without the aid of selection; and it is inconceivable that they can be of use in any ordi-

nary way to these animals. If so, they have probably been gained through sexual selection, though transmitted equally, or almost equally, to both sexes. With many of the Quadrumana, we have additional evidence of the action of sexual selection in the greater size and strength of the

FIG. 73.—Head of Semnopithecus comatus.

FIG. 74.—Head of Cebus capucinus.

FIG. 75.—Head of Ateles marginatus.

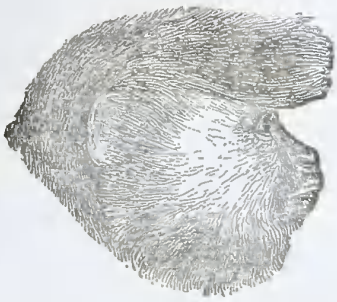

FIG. 76.—Head of Cebus vellerosus.

males, and in the greater development of their canine teeth, in comparison with the females.

A few instances will suffice of the strange manner in which both sexes of some species are colored, and of the beauty of others. The face of the *Cercopithecus petaurista* (Fig. 77) is black, the whiskers and beard being white, with a defined, round white spot on the nose, covered with short white hair,

which gives to the animal an almost ludicrous aspect. The *Semnopithecus frontatus* likewise has a blackish face with a

Fig. 77.—Cercopithecus petaurista (from Brehm).

long black beard, and a large naked spot on the forehead of a bluish white color. The face of *Macacus lasiotus* is dirty flesh-colored, with a defined red spot on each cheek. The

appearance of *Cercocebus æthiops* is grotesque, with its black face, white whiskers and collar, chestnut head, and a large naked white spot over each eyelid. In very many species, the beard, whiskers, and crests of hair round the face are of a different color from the rest of the head, and, when different, are always of a lighter tint,[45] being often pure white, sometimes bright yellow, or reddish. The whole face of the South American *Brachyurus calvus* is of a "glowing scarlet hue"; but this color does not appear until the animal is nearly mature.[46] The naked skin of the face differs wonderfully in color in the various species. It is often brown or flesh-color, with parts perfectly white, and often as black as that of the most sooty negro. In the Brachyurus the scarlet tint is brighter than that of the most blushing Caucasian damsel. It is sometimes more distinctly orange than in any Mongolian, and in several species it is blue, passing into violet or gray. In all the species known to Mr. Bartlett, in which the adults of both sexes have strongly colored faces, the colors are dull or absent during early youth. This likewise holds good with the mandrill and Rhesus, in which the face and the posterior parts of the body are brilliantly colored in one sex alone. In these latter cases we have reason to believe that the colors were acquired through sexual selection; and we are naturally led to extend the same view to the foregoing species, though both sexes when adult have their faces colored in the same manner.

Although many kinds of monkeys are far from beautiful according to our taste, other species are universally admired for their elegant appearance and bright colors. The *Semnopithecus nemœus*, though peculiarly colored, is described as extremely pretty; the orange-tinted face is surrounded by long whiskers of glossy whiteness, with a line of chestnut red over the eyebrows; the fur on the back is of a delicate

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[45] I observed this fact in the Zoological Society's Gardens; and many cases may be seen in the colored plates in Geoffroy St. Hilaire and F. Cuvier, "Histoire Naturel des Mammifères," tom. i., 1824.

[46] Bates, "The Naturalist on the Amazons," 1863, vol. ii. p. 310.

gray, with a square patch on the loins, the tail and the forearms being of a pure white; a gorget of chestnut surmounts the chest; the thighs are black, with the legs chestnut red. I will mention only two other monkeys for their beauty; and I have selected these as presenting slight sexual differences in color, which renders it in some degree probable that

Fig. 78.—Cercopithecus diana (from Brehm).

both sexes owe their elegant appearance to sexual selection. In the mustache-monkey (*Cercopithecus cephus*) the general color of the fur is mottled greenish with the throat white; in the male the end of the tail is chestnut, but the face is the most ornamented part, the skin being chiefly bluish gray, shading into a blackish tint beneath the eyes, with

the upper lip of a delicate blue, clothed on the lower edge with a thin black mustache; the whiskers are orange colored, with the upper part black, forming a band which extends backward to the ears, the latter being clothed with whitish hairs. In the Zoological Society's Gardens I have often overheard visitors admiring the beauty of another monkey, deservedly called *Cercopithecus diana* (Fig. 78); the general color of the fur is gray; the chest and inner surface of the forelegs are white; a large triangular defined space on the hinder part of the back is rich chestnut; in the male the inner sides of the thighs and the abdomen are delicate fawn colored, and the top of the head is black; the face and ears are intensely black, contrasting finely with a white transverse crest over the eyebrows, and a long, white, peaked beard, of which the basal portion is black.[47]

In these and many other monkeys, the beauty and singular arrangement of their colors, and still more the diversified and elegant arrangement of the crests and tufts of hair on their heads, force the conviction on my mind that these characters have been acquired through sexual selection exclusively as ornaments.

Summary.—The law of battle for the possession of the female appears to prevail throughout the whole great class of mammals. Most naturalists will admit that the greater size, strength, courage, and pugnacity of the male, his special weapons of offence, as well as his special means of defence, have been acquired or modified through that form of selection which I have called sexual. This does not depend on any superiority in the general struggle for life, but on certain individuals of one sex, generally the male, being successful in conquering other males, and leaving a larger number of offspring to inherit their superiority than do the less successful males.

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[47] I have seen most of the above monkeys in the Zoological Society's Gardens. The description of the *Semnopithecus nemœus* is taken from Mr. W. C. Martin's "Nat. Hist. of Mammalia," 1841, p. 460; see, also, pp. 475, 523.

There is another and more peaceful kind of contest, in which the males endeavor to excite or allure the females by various charms. This is probably carried on in some cases by the powerful odors emitted by the males during the breeding season, the odoriferous glands having been acquired through sexual selection. Whether the same view can be extended to the voice is doubtful, for the vocal organs of the males must have been strengthened by use during maturity, under the powerful excitements of love, jealousy, or rage, and will consequently have been transmitted to the same sex. Various crests, tufts, and mantles of hair, which are either confined to the male or are more developed in this sex than in the female, seem in most cases to be merely ornamental, though they sometimes serve as a defence against rival males. There is even reason to suspect that the branching horns of stags, and the elegant horns of certain antelopes, though properly serving as weapons of offence or defence, have been partly modified for ornament.

When the male differs in color from the female, he generally exhibits darker and more strongly contrasted tints. We do not in this class meet with the splendid red, blue, yellow, and green tints, so common with male birds and many other animals. The naked parts, however, of certain Quadrumana must be excepted; for such parts, often oddly situated, are brilliantly colored in some species. The colors of the male in other cases may be due to simple variation, without the aid of selection. But when the colors are diversified and strongly pronounced, when they are not developed until near maturity, and when they are lost after emasculation, we can hardly avoid the conclusion that they have been acquired through sexual selection for the sake of ornament, and have been transmitted exclusively, or almost exclusively, to the same sex. When both sexes are colored in the same manner, and the colors are conspicuous or curiously arranged, without being of the least apparent use as a protection, and especially when they are associated with

various other ornamental appendages, we are led by analogy to the same conclusion, namely, that they have been acquired through sexual selection, although transmitted to both sexes. That conspicuous and diversified colors, whether confined to the males or common to both sexes, are as a general rule associated in the same groups and sub-groups with other secondary sexual characters serving for war or for ornament, will be found to hold good, if we look back to the various cases given in this and the last chapter.

The law of equal transmission of characters to both sexes, as far as color and other ornaments are concerned, has prevailed far more extensively with mammals than with birds; but weapons, such as horns and tusks, have often been transmitted either exclusively or much more perfectly to the males than to the females. This is surprising, for, as the males generally use their weapons for defence against enemies of all kinds, their weapons would have been of service to the females. As far as we can see, their absence in this sex can be accounted for only by the form of inheritance which has prevailed. Finally, with quadrupeds the contest between the individuals of the same sex, whether peaceful or bloody, has, with the rarest exceptions, been confined to the males; so that the latter have been modified through sexual selection, far more commonly than the females, either for fighting with each other or for alluring the opposite sex.

PART THREE

SEXUAL SELECTION IN RELATION TO MAN AND CONCLUSION

CHAPTER XIX

SECONDARY SEXUAL CHARACTERS OF MAN

Differences between man and woman—Causes of such differences and of certain characters common to both sexes—Law of battle—Differences in mental powers, and voice—On the influence of beauty in determining the marriages of mankind—Attention paid by savages to ornaments—Their ideas of beauty in woman—The tendency to exaggerate each natural peculiarity

WITH mankind the differences between the sexes are greater than in most of the Quadrumana, but not so great as in some, for instance, the mandrill. Man on an average is considerably taller, heavier, and stronger than woman, with squarer shoulders and more plainly pronounced muscles. Owing to the relation which exists between muscular development and the projection of the brows,[1] the superciliary ridge is generally more marked in man than in woman. His body, and especially his face, is more hairy, and his voice has a different and more powerful tone. In certain races the women are said to differ slightly in tint from the men. For instance, Schweinfurth, in speaking of a negress belonging to the Monbuttoos, who inhabit the interior of Africa a few degrees north of the Equator, says, "Like all her race, she had a skin several shades lighter than her husband's, being something of the

[1] Schaaffhausen, translation in "Anthropological Review," Oct. 1868, pp. 419, 420, 427.

color of half-roasted coffee."[2] As the women labor in the fields and are quite unclothed, it is not likely that they differ in color from the men owing to less exposure to the weather. European women are perhaps the brighter colored of the two sexes, as may be seen when both have been equally exposed.

Man is more courageous, pugnacious, and energetic than woman, and has a more inventive genius. His brain is absolutely larger, but whether or not proportionately to his larger body, has not, I believe, been fully ascertained. In woman the face is rounder; the jaws and the base of the skull smaller; the outlines of the body rounder, in parts more prominent; and her pelvis is broader than in man;[3] but this latter character may perhaps be considered rather as a primary than a secondary sexual character. She comes to maturity at an earlier age than man.

As with animals of all classes, so with man, the distinctive characters of the male sex are not fully developed until he is nearly mature; and if emasculated they never appear. The beard, for instance, is a secondary sexual character, and male children are beardless, though at an early age they have abundant hair on the head. It is probably due to the rather late appearance in life of the successive variations whereby man has acquired his masculine characters, that they are transmitted to the male sex alone. Male and female children resemble each other closely, like the young of so many other animals in which the adult sexes differ widely; they likewise resemble the mature female much more closely than the mature male. The female, however, ultimately assumes certain distinctive characters, and in the formation of her skull is said to be intermediate between the child and the man.[4] Again, as the young of closely

[2] "The Heart of Africa," English transl., 1873, vol. i. p. 544.

[3] Ecker, translation in "Anthropological Review," Oct. 1868, pp. 351–356. The comparison of the form of the skull in men and women has been followed out with much care by Welcker.

[4] Ecker and Welcker, ibid., pp. 352, 355; Vogt, "Lectures on Man," Eng. translat., p. 81.

allied though distinct species do not differ nearly so much from each other as do the adults, so it is with the children of the different races of man. Some have even maintained that race differences cannot be detected in the infantile skull.[5] In regard to color, the newborn negro child is reddish nut-brown, which soon becomes slaty gray; the black color being fully developed within a year in the Soudan, but not until three years in Egypt. The eyes of the negro are at first blue, and the hair chestnut brown rather than black, being curled only at the ends. The children of the Australians immediately after birth are yellowish brown, and become dark at a later age. Those of the Guaranys of Paraguay are whitish yellow, but they acquire in the course of a few weeks the yellowish brown tint of their parents. Similar observations have been made in other parts of America.[6]

I have specified the foregoing differences between the male and female sex in mankind, because they are curiously like those of the Quadrumana. With these animals the female is mature at an earlier age than the male; at least this is certainly the case in the *Cebus azaræ*.[7] The males of most species are larger and stronger than the females, of which fact the gorilla affords a well-known instance. Even in so trifling a character as the greater prominence of the superciliary ridge, the males of certain monkeys differ from the females,[8] and agree in this respect with mankind. In the gorilla and certain other monkeys, the cranium of the adult male presents a strongly marked

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[5] Schaaffhausen, "Anthropolog. Review," ibid., p. 429.

[6] Pruner-Bey, on negro infants, as quoted by Vogt, "Lectures on Man," Eng. translat., 1864, p. 189: for further facts on negro infants, as quoted from Winterbottom and Camper, see Lawrence, "Lectures on Physiology," etc., 1822, p. 451. For the infants of the Guaranys, see Rengger, "Säugethiere," etc., s. 3. See, also, Godron, "De l'Espèce," tom. ii., 1859, p. 253. For the Australians, Waitz, "Introduct. to Anthropology," Eng. translat., 1863, p. 99.

[7] Rengger, "Säugethiere," etc., 1830, s. 49.

[8] As the *Macacus cynomolgus* (Desmarest, "Mammalogie," p. 65) and in *Hylobates agilis* (Geoffroy St.-Hilaire and F. Cuvier, "Hist. Nat. des Mamm.," 1824, tom. i. p. 2).

sagittal crest, which is absent in the female; and Ecker found a trace of a similar difference between the two sexes in the Australians.[9] With monkeys, when there is any difference in the voice, that of the male is the more powerful. We have seen that certain male monkeys have a well-developed beard, which is quite deficient or much less developed in the female. No instance is known of the beard, whiskers, or mustache being larger in the female than in the male monkey. Even in the color of the beard there is a curious parallelism between man and the Quadrumana, for with man, when the beard differs in color from the hair of the head, as is commonly the case, it is, I believe, almost always of a lighter tint, being often reddish. I have repeatedly observed this fact in England; but two gentlemen have lately written to me, saying that they form an exception to the rule. One of these gentlemen accounts for the fact by the wide difference in color of the hair on the paternal and maternal sides of his family. Both had been long aware of this peculiarity (one of them having often been accused of dyeing his beard), and had been thus led to observe other men, and were convinced that the exceptions were very rare. Dr. Hooker attended to this little point for me in Russia, and found no exception to the rule. In Calcutta, Mr. J. Scott, of the Botanic Gardens, was so kind as to observe the many races of men to be seen there, as well as in some other parts of India, namely, two races in Sikhim, the Bhoteas, Hindus, Burmese and Chinese, most of which races have very little hair on the face; and he always found that when there was any difference in color between the hair of the head and the beard, the latter was invariably lighter. Now with monkeys, as has already been stated, the beard frequently differs strikingly in color from the hair of the head, and in such cases it is always of a lighter hue, being often pure white, sometimes yellow or reddish.[10]

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[9] "Anthropolog. Rev.," Oct. 1868, p. 358.

[10] Mr. Blyth informs me that he has only seen one instance of the beard,

In regard to the general hairiness of the body, the women in all races are less hairy than the men; and in some few Quadrumana the under side of the body of the female is less hairy than that of the male." Lastly, male monkeys, like men, are bolder and fiercer than the females. They lead the troop, and when there is danger, come to the front. We thus see how close is the parallelism between the sexual differences of man and the Quadrumana. With some few species, however, as with certain baboons, the orang and the gorilla, there is a considerably greater difference between the sexes, as in the size of the canine teeth, in the development and color of the hair, and especially in the color of the naked parts of the skin, than in mankind.

All the secondary sexual characters of man are highly variable, even within the limits of the same race; and they differ much in the several races. These two rules hold good generally throughout the animal kingdom. In the excellent observations made on board the "Novara" [12] the male Australians were found to exceed the females by only 65 millimetres in height, while with the Javans the average excess was 218 millimetres; so that in this latter race the difference in height between the sexes is more than thrice as great as with the Australians. Numerous measurements were carefully made of the stature, the circumference of the neck and chest, the length of the backbone and of the arms, in various races; and nearly all these measurements show

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whiskers, etc., in a monkey becoming white with old age, as is so commonly the case with us. This, however, occurred in an aged *Macacus cynomolgus* kept in confinement, whose mustaches were "remarkably long and human-like." Altogether this old monkey presented a ludicrous resemblance to one of the reigning monarchs of Europe, after whom he was universally nicknamed. In certain races of man the hair on the head hardly ever becomes gray; thus Mr. D. Forbes has never, as he informs me, seen an instance with the Aymaras and Quichuas of S. America.

[11] This is the case with the females of several species of Hylobates; see Geoffroy St.-Hilaire and F. Cuvier, "Hist. Nat. des Mamm.," tom. i. See, also, on *H. lar*. "Penny Cyclopædia," vol. ii. pp. 149, 150.

[12] The results were deduced by Dr. Weisbach from the measurements made by Drs. K. Scherzer and Schwarz; see "Reise der Novara; Anthropolog. Theil," 1867, ss. 216, 231. 234, 236, 239, 269.

that the males differ much more from one another than do the females. This fact indicates that, as far as these characters are concerned, it is the male which has been chiefly modified, since the several races diverged from their common stock.

The development of the beard and the hairiness of the body differ remarkably in the men of distinct races, and even in different tribes or families of the same race. We Europeans see this among ourselves. In the Island of St. Kilda, according to Martin,[13] the men do not acquire beards until the age of thirty or upward, and even then the beards are very thin. On the Europæo-Asiatic continent, beards prevail until we pass beyond India; though with the natives of Ceylon they are often absent, as was noticed in ancient times by Diodorus.[14] Eastward of India beards disappear, as with the Siamese, Malays, Kalmucks, Chinese and Japanese; nevertheless the Ainos,[15] who inhabit the northernmost islands of the Japan Archipelago, are the hairiest men in the world. With negroes the beard is scanty or wanting, and they rarely have whiskers; in both sexes the body is frequently almost destitute of fine down.[16] On the other hand, the Papuans of the Malay Archipelago, who are nearly as black as negroes, possess well-developed beards.[17] In the Pacific Ocean the inhabitants of the Fiji Archipelago have large bushy beards, while those of the not distant archipelagoes of Tonga and Samoa are beardless; but these men belong to distinct races. In the Ellice group all the inhabitants belong to the same race; yet on one island alone, namely, Nunemaya, "the men have splen-

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[13] "Voyage to St. Kilda," 3d edit., 1753, p. 37.

[14] Sir J. E. Tennent, "Ceylon," vol. ii., 1859, p. 107.

[15] Quatrefages, "Revue des Cours Scientifiques," Aug. 29, 1868, p. 630; Vogt, "Lectures on Man," Eng. translat., p. 127.

[16] On the beards of negroes, Vogt, "Lectures," etc., p. 127; Waitz, "Introduct. to Anthropology," Eng. translat., 1863, vol. i. p. 96. It is remarkable that in the United States ("Investigations in Military and Anthropological Statistics of American Soldiers," 1869, p. 569) the pure negroes and their crossed offspring seem to have bodies almost as hairy as Europeans.

[17] Wallace, "The Malay Arch.," vol. ii., 1869, p. 178.

did beards"; while on the other islands "they have, as a rule, a dozen straggling hairs for a beard." [18]

Throughout the great American continent the men may be said to be beardless; but in almost all the tribes a few short hairs are apt to appear on the face, especially in old age. With the tribes of North America, Catlin estimates that eighteen out of twenty men are completely destitute by nature of a beard; but occasionally there may be seen a man, who has neglected to pluck out the hairs at puberty, with a soft beard an inch or two in length. The Guaranys of Paraguay differ from all the surrounding tribes in having a small beard, and even some hair on the body, but no whiskers.[19] I am informed by Mr. D. Forbes, who particularly attended to this point, that the Aymaras and Quichuas of the Cordillera are remarkably hairless, yet in old age a few straggling hairs occasionally appear on the chin. The men of these two tribes have very little hair on the various parts of the body where hair grows abundantly in Europeans, and the women have none on the corresponding parts. The hair on the head, however, attains an extraordinary length in both sexes, often reaching almost to the ground; and this is likewise the case with some of the North American tribes. In the amount of hair, and in the general shape of the body, the sexes of the American aborigines do not differ so much from each other as in most other races.[20] This fact is analogous with what occurs with some closely allied monkeys; thus the sexes of the chimpanzee are not as different as those of the orang or gorilla.[21]

In the previous chapters we have seen that with mam-

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[18] Dr. J. Barnard Davis, On Oceanic Races, in "Anthropolog. Review," April, 1870, pp. 185, 191.

[19] Catlin, "North American Indians," 3d edit., 1842, vol. ii. p. 227. On the Guaranys, see Azara, "Voyage dans l'Amérique Mérid.," tom. ii., 1809, p. 58; also Rengger, "Säugethiere von Paraguay," s. 3.

[20] Prof. and Mrs. Agassiz ("Journey in Brazil," p. 530) remark that the sexes of the American Indians differ less than those of the negroes and of the higher races. See, also, Rengger, ibid., p. 3, on the Guaranys.

[21] Rütimeyer, "Die Grenzen der Thierwelt; eine Betrachtung zu Darwin's Lehre," 1868, s. 54.

mals, birds, fishes, insects, etc., many characters, which there is every reason to believe were primarily gained through sexual selection by one sex, have been transferred to the other. As this same form of transmission has apparently prevailed much with mankind, it will save useless repetition if we discuss the origin of characters peculiar to the male sex together with certain other characters common to both sexes.

Law of Battle.—With savages, for instance the Australians, the women are the constant cause of war both between members of the same tribe and between distinct tribes. So no doubt it was in ancient times; "nam fuit ante Helenam mulier teterrima belli causa." With some of the North American Indians, the contest is reduced to a system. That excellent observer, Hearne,[22] says: "It has ever been the custom among these people for the men to wrestle for any woman to whom they are attached; and, of course, the strongest party always carries off the prize. A weak man, unless he be a good hunter, and well beloved, is seldom permitted to keep a wife that a stronger man thinks worth his notice. This custom prevails throughout all the tribes, and causes a great spirit of emulation among their youth, who are upon all occasions, from their childhood, trying their strength and skill in wrestling." With the Guanas of South America, Azara states that the men rarely marry till twenty years old or more, as before that age they cannot conquer their rivals.

Other similar facts could be given; but even if we had no evidence on this head, we might feel almost sure from the analogy of the higher Quadrumana,[23] that the law of battle had prevailed with man during the early stages of

[22] "A Journey from Prince of Wales Fort," 8vo. edit. Dublin, 1796, p. 104. Sir J. Lubbock ("Origin of Civilization," 1870, p. 69) gives other and similar cases in North America. For the Guanas of S. America, see Azara, "Voyages," etc., tom. ii. p. 94.

[23] On the fighting of the male gorillas, see Dr. Savage, in "Boston Journal of Nat. Hist.," vol. v., 1847, p. 423. On *Presbytis entellus*, see the "Indian Field," 1859, p. 146.

his development. The occasional appearance at the present day of canine teeth which project above the others, with traces of a diastema or open space for the reception of the opposite canines, is in all probability a case of reversion to a former state, when the progenitors of man were provided with these weapons, like so many existing male Quadrumana. It was remarked in a former chapter that as man gradually became erect, and continually used his hands and arms for fighting with sticks and stones, as well as for the other purposes of life, he would have used his jaws and teeth less and less. The jaws, together with their muscles, would then have been reduced through disuse, as would the teeth through the not well understood principles of correlation and economy of growth; for we everywhere see that parts which are no longer of service are reduced in size. By such steps the original inequality between the jaws and teeth in the two sexes of mankind would ultimately have been obliterated. The case is almost parallel with that of many male Ruminants in which the canine teeth have been reduced to mere rudiments or have disappeared, apparently in consequence of the development of horns. As the prodigious difference between the skulls of the two sexes in the orang and gorilla stands in close relation with the development of the immense canine teeth in the males, we may infer that the reduction of the jaws and teeth in the early male progenitors of man must have led to a most striking and favorable change in his appearance.

There can be little doubt that the greater size and strength of man, in comparison with woman, together with his broader shoulders, more developed muscles, rugged outline of body, his greater courage and pugnacity, are all due in chief part to inheritance from his half-human male ancestors. These characters would, however, have been preserved or even augmented during the long ages of man's savagery, by the success of the strongest and boldest men, both in the general struggle for life and in their contests for wives; a success which would have insured their leaving a more

numerous progeny than their less favored brethren. It is not probable that the greater strength of man was primarily acquired through the inherited effects of his having worked harder than woman for his own subsistence and that of his family; for the women in all barbarous nations are compelled to work at least as hard as the men. With civilized people the arbitrament of battle for the possession of the women has long ceased; on the other hand, the men, as a general rule, have to work harder than the women for their joint subsistence, and thus their greater strength will have been kept up.

Differences in the Mental Powers of the Two Sexes.—With respect to differences of this nature between man and woman, it is probable that sexual selection has played a highly important part. I am aware that some writers doubt whether there is any such inherent difference; but this is at least probable from the analogy of the lower animals which present other secondary sexual characters. No one disputes that the bull differs in disposition from the cow, the wild boar from the sow, the stallion from the mare, and, as is well known to the keepers of menageries, the males of the larger apes from the females. Woman seems to differ from man in mental disposition, chiefly in her greater tenderness and less selfishness; and this holds good even with savages, as shown by a well-known passage in Mungo Park's Travels, and by statements made by many other travellers. Woman, owing to her maternal instincts, displays these qualities toward her infants in an eminent degree; therefore it is likely that she would often extend them toward her fellow-creatures. Man is the rival of other men; he delights in competition, and this leads to ambition which passes too easily into selfishness. These latter qualities seem to be his natural and unfortunate birthright. It is generally admitted that with woman the powers of intuition, of rapid perception, and perhaps of imitation, are more strongly marked than in man; but some, at least, of these faculties are char-

acteristic of the lower races, and therefore of a past and lower state of civilization.

The chief distinction in the intellectual powers of the two sexes is shown by man's attaining to a higher eminence, in whatever he takes up, than can woman—whether requiring deep thought, reason, or imagination, or merely the use of the senses and hands. If two lists were made of the most eminent men and women in poetry, painting, sculpture, music (inclusive both of composition and performance), history, science, and philosophy, with half a dozen names under each subject, the two lists would not bear comparison. We may also infer, from the law of the deviation from averages, so well illustrated by Mr. Galton, in his work on "Hereditary Genius," that if men are capable of a decided pre-eminence over women in many subjects, the average of mental power in man must be above that of woman.

Among the half-human progenitors of man and among savages there have been struggles between the males during many generations for the possession of the females. But mere bodily strength and size would do little for victory, unless associated with courage, perseverance, and determined energy. With social animals, the young males have to pass through many a contest before they win a female, and the older males have to retain their females by renewed battles. They have, also, in the case of mankind, to defend their females, as well as their young, from enemies of all kinds, and to hunt for their joint subsistence. But to avoid enemies, or to attack them with success, to capture wild animals, and to fashion weapons, requires the aid of the higher mental faculties, namely, observation, reason, invention, or imagination. These various faculties will thus have been continually put to the test and selected during manhood; they will, moreover, have been strengthened by use during this same period of life. Consequently, in accordance with the principle often alluded to, we might expect that they would at least tend to be transmitted chiefly to the male offspring at the corresponding period of manhood.

Now, when two men are put into competition, or a man with a woman, both possessed of every mental quality in equal perfection, save that one has higher energy, perseverance, and courage, the latter will generally become more eminent in every pursuit, and will gain the ascendency.[24] He may be said to possess genius—for genius has been declared by a great authority to be patience; and patience, in this sense, means unflinching, undaunted perseverance. But this view of genius is perhaps deficient; for without the higher powers of the imagination and reason, no eminent success can be gained in many subjects. These latter faculties, as well as the former, will have been developed in man, partly through sexual selection—that is, through the contest of rival males, and partly through natural selection—that is, from success in the general struggle for life; and as in both cases the struggle will have been during maturity, the characters gained will have been transmitted more fully to the male than to the female offspring. It accords in a striking manner with this view of the modification and reinforcement of many of our mental faculties by sexual selection, that, first, they notoriously undergo a considerable change at puberty,[25] and, secondly, that eunuchs remain throughout life inferior in these same qualities. Thus man has ultimately become superior to woman. It is, indeed, fortunate that the law of the equal transmission of characters to both sexes prevails with mammals; otherwise it is probable that man would have become as superior in mental endowment to woman, as the peacock is in ornamental plumage to the peahen.

It must be borne in mind that the tendency in characters acquired by either sex late in life, to be transmitted to the same sex at the same age, and of early acquired characters

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[24] J. Stuart Mill remarks ("The Subjection of Women," 1869, p. 122), "The things in which man most excels woman are those which require most plodding and long hammering at single thoughts." What is this but energy and perseverance?

[25] Maudsley, "Mind and Body," p. 31.

to be transmitted to both sexes, are rules which, though general, do not always hold. If they always held good, we might conclude (but I here exceed my proper bounds) that the inherited effects of the early education of boys and girls would be transmitted equally to both sexes; so that the present inequality in mental power between the sexes would not be effaced by a similar course of early training; nor can it have been caused by their dissimilar early training. In order that woman should reach the same standard as man, she ought, when nearly adult, to be trained to energy and perseverance, and to have her reason and imagination exercised to the highest point; and then she would probably transmit these qualities chiefly to her adult daughters. All women, however, could not be thus raised, unless during many generations those who excelled in the above robust virtues were married, and produced offspring in larger numbers than other women. As before remarked of bodily strength, although men do not now fight for their wives, and this form of selection has passed away, yet, during manhood, they generally undergo a severe struggle in order to maintain themselves and their families; and this will tend to keep up or even increase their mental powers, and, as a consequence, the present inequality between the sexes.[28]

Voice and Musical Powers.—In some species of Quadrumana there is a great difference between the adult sexes, in the power of their voices and in the development of the vocal organs; and man appears to have inherited this difference from his early progenitors. His vocal cords are about one-third longer than in woman, or than in boys;

[28] An observation by Vogt bears on this subject; he says, "It is a remarkable circumstance that the difference between the sexes, as regards the cranial cavity, increases with the development of the race, so that the male European excels much more the female than the negro the negress. Welcker confirms this statement of Huschke from his measurements of negro and German skulls." But Vogt admits ("Lectures on Man," Eng. translat., 1864, p. 81) that more observations are requisite on this point.

and emasculation produces the same effect on him as on the lower animals, for it "arrests that prominent growth of the thyroid, etc., which accompanies the elongation of the cords."[27] With respect to the cause of this difference between the sexes, I have nothing to add to the remarks in the last chapter on the probable effects of the long-continued use of the vocal organs by the male under the excitement of love, rage, and jealousy. According to Sir Duncan Gibb,[28] the voice and the form of the larynx differ in the different races of mankind; but with the Tartars, Chinese, etc., the voice of the male is said not to differ so much from that of the female as in most other races.

The capacity and love for singing or music, though not a sexual character in man, must not here be passed over. Although the sounds emitted by animals of all kinds serve many purposes, a strong case can be made out that the vocal organs were primarily used and perfected in relation to the propagation of the species. Insects and some few spiders are the lowest animals which voluntarily produce any sound; and this is generally effected by the aid of beautifully constructed stridulating organs, which are often confined to the males. The sounds thus produced consist, I believe in all cases, of the same note, repeated rhythmically;[29] and this is sometimes pleasing even to the ears of man. The chief and, in some cases, exclusive purpose appears to be either to call or charm the opposite sex.

The sounds produced by fishes are said in some cases to be made only by the males during the breeding season. All the air-breathing Vertebrata necessarily possess an apparatus for inhaling and expelling air, with a pipe capable of being closed at one end. Hence when the primeval members of this class were strongly excited and their muscles violently contracted, purposeless sounds would

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[27] Owen, "Anatomy of Vertebrates," vol. iii. p. 603.

[28] "Journal of the Anthropolog. Soc.," April, 1869, pp. lvii. and lxvi.

[29] Dr. Scudder, "Notes on Stridulation," in "Proc. Boston Soc. of Nat. Hist.," vol. xi., April, 1868.

almost certainly have been produced; and these, if they proved in any way serviceable, might readily have been modified or intensified by the preservation of properly adapted variations. The lowest Vertebrates which breathe air are Amphibians; and of these, frogs and toads possess vocal organs, which are incessantly used during the breeding season, and which are often more highly developed in the male than in the female. The male alone of the tortoise utters a noise, and this only during the season of love. Male alligators roar or bellow during the same season. Every one knows how much birds use their vocal organs as a means of courtship; and some species likewise perform what may be called instrumental music.

In the class of Mammals with which we are here more particularly concerned, the males of almost all the species use their voices during the breeding season much more than at any other time; and some are absolutely mute excepting at this season. With other species both sexes, or only the females, use their voices as a love-call. Considering these facts, and that the vocal organs of some quadrupeds are much more largely developed in the male than in the female, either permanently or temporarily, during the breeding season; and considering that in most of the lower classes the sounds produced by the males serve not only to call but to excite or allure the female, it is a surprising fact that we have not as yet any good evidence that these organs are used by male mammals to charm the females. The American *Mycetes caraya* perhaps forms an exception, as does the *Hylobates agilis*, an ape allied to man. This gibbon has an extremely loud but musical voice. Mr. Waterhouse states:[30] "It appeared to me that in ascending and descending the scale, the intervals were always exactly half tones; and I am sure that the highest note was the exact octave to the lowest. The quality of the notes is very musical; and I do

[30] Given in W. C. L. Martin's "General Introduct. to Nat. History of Mamm. Animals," 1841, p. 432; Owen, "Anatomy of Vertebrates," vol. iii. p. 600.

not doubt that a good violinist would be able to give a correct idea of the gibbon's composition, excepting as regards its loudness." Mr. Waterhouse then gives the notes. Prof. Owen, who is a musician, confirms the foregoing statement, and remarks, though erroneously, that this gibbon "alone of brute mammals may be said to sing." It appears to be much excited after its performance. Unfortunately, its habits have never been closely observed in a state of nature; but, from the analogy of other animals, it is probable that it uses its musical powers more especially during the season of courtship.

This gibbon is not the only species in the genus which sings, for my son, Francis Darwin, attentively listened in the Zoological Gardens to *H. leuciscus* while singing a cadence of three notes, in true musical intervals, and with a clear musical tone. It is a more surprising fact that certain rodents utter musical sounds. Singing mice have often been mentioned and exhibited, but imposture has commonly been suspected. We have, however, at last a clear account by a well-known observer, the Rev. S. Lockwood,[31] of the musical powers of an American species, the *Hesperomys cognatus*, belonging to a genus distinct from that of the English mouse. This little animal was kept in confinement, and the performance was repeatedly heard. In one of the two chief songs, "the last bar would frequently be prolonged to two or three; and she would sometimes change from C sharp and D, to C natural and D, then warble on these two notes a while, and wind up with a quick chirp on C sharp and D. The distinctness between the semitones was very marked, and easily appreciable to a good ear." Mr. Lockwood gives both songs in musical notation; and adds that though this little mouse "had no ear for time, yet she would keep to the key of B (two flats) and strictly in a major key. . . . Her soft clear voice falls an octave with all the precision possible; then, at

[31] The "American Naturalist," 1872, p. 761.

the wind-up, it rises again into a very quick trill on C sharp and D."

A critic has asked how the ears of man, and he ought to have added of other animals, could have been adapted by selection so as to distinguish musical notes. But this question shows some confusion on the subject; a noise is the sensation resulting from the coexistence of several aërial "simple vibrations" of various periods, each of which intermits so frequently that its separate existence cannot be perceived. It is only in the want of continuity of such vibrations, and in their want of harmony *inter se*, that a noise differs from a musical note. Thus an ear to be capable of discriminating noises—and the high importance of this power to all animals is admitted by every one—must be sensitive to musical notes. We have evidence of this capacity even low down in the animal scale; thus Crustaceans are provided with auditory hairs of different lengths, which have been seen to vibrate when the proper musical notes are struck.[32] As stated in a previous chapter, similar observations have been made on the hairs of the antennæ of gnats. It has been positively asserted by good observers that spiders are attracted by music. It is also well known that some dogs howl when hearing particular tones.[33] Seals apparently appreciate music, and their fondness for it "was well known to the ancients, and is often taken advantage of by the hunters of the present day."[34]

Therefore, as far as the mere perception of musical notes is concerned, there seems no special difficulty in the case of man or of any other animal. Helmholtz has explained, on physiological principles, why concords are agreeable and discords disagreeable to the human ear; but we are little

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[32] Helmholtz, "Théorie Phys. de la Musique," 1868, p. 187.

[33] Several accounts have been published to this effect. Mr. Peach writes to me that he has repeatedly found that an old dog of his howls when B flat is sounded on the flute, and to no other note. I may add another instance of a dog always whining, when one note on a concertina, which was out of tune, was played.

[34] Mr. R. Brown, in "Proc. Zoolog. Soc.," 1868, p. 410.

concerned with these, as music in harmony is a late invention. We are more concerned with melody, and here again, according to Helmholtz, it is intelligible why the notes of our musical scale are used. The ear analyzes all sounds into their component "simple vibrations," although we are not conscious of this analysis. In a musical note the lowest in pitch of these is generally predominant, and the others which are less marked are the octave, the twelfth, the second octave, etc., all harmonies of the fundamental predominant note; any two notes of our scale have many of these harmonic over-tones in common. It seems pretty clear, then, that if an animal always wished to sing precisely the same song, he would guide himself by sounding those notes in succession which possess many over-tones in common—that is, he would choose for his song notes which belong to our musical scale.

But if it be further asked why musical tones in a certain order and rhythm give man and other animals pleasure, we can no more give the reason than for the pleasantness of certain tastes and smells. That they do give pleasure of some kind to animals we may infer from their being produced during the season of courtship by many insects, spiders, fishes, amphibians, and birds; for, unless the females were able to appreciate such sounds and were excited or charmed by them, the persevering efforts of the males, and the complex structures often possessed by them alone, would be useless; and this it is impossible to believe.

Human song is generally admitted to be the basis or origin of instrumental music. As neither the enjoyment nor the capacity of producing musical notes are faculties of the least use to man in reference to his daily habits of life, they must be ranked among the most mysterious with which he is endowed. They are present, though in a very rude condition, in men of all races, even the most savage; but so different is the taste of the several races, that our music gives no pleasure to savages, and their music is to us in most cases hideous and unmeaning. Dr. Seemann, in some interesting

remarks on this subject,[35] "doubts whether, even among the nations of Western Europe, intimately connected as they are by close and frequent intercourse, the music of the one is interpreted in the same sense by the others. By travelling eastward we find that there is certainly a different language of music. Songs of joy and dance accompaniments are no longer, as with us, in the major keys, but always in the minor." Whether or not the half-human progenitors of man possessed, like the singing gibbons, the capacity of producing, and therefore no doubt of appreciating, musical notes, we know that man possessed these faculties at a very remote period. M. Lartet has described two flutes, made out of the bones and horns of the reindeer, found in caves together with flint tools and the remains of extinct animals. The arts of singing and of dancing are also very ancient, and are now practiced by all or nearly all the lowest races of man. Poetry, which may be considered as the offspring of song, is likewise so ancient that many persons have felt astonished that it should have arisen during the earliest ages of which we have any record.

We see that the musical faculties, which are not wholly deficient in any race, are capable of prompt and high development, for Hottentots and Negroes have become excellent musicians, although in their native countries they rarely practice anything that we should consider music. Schweinfurth, however, was pleased with some of the simple melodies which he heard in the interior of Africa. But there is nothing anomalous in the musical faculties lying dormant in man; some species of birds which never naturally sing can, without much difficulty, be taught to do so; thus a house sparrow has learned the song of a linnet. As these two species are closely allied, and belong to the order of Insessores, which includes nearly all the singing birds in the world, it is possible that a progenitor of the sparrow

[35] "Journal of Anthropolog. Soc.," Oct. 1870, p. clv. See, also, the several later chapters in Sir John Lubbock's "Prehistoric Times," second edition, 1869, which contain an admirable account of the habits of savages.

may have been a songster. It is more remarkable that parrots, belonging to a group distinct from the Insessores, and having differently constructed vocal organs, can be taught not only to speak, but to pipe or whistle tunes invented by man, so that they must have some musical capacity. Nevertheless it would be very rash to assume that parrots are descended from some ancient form which was a songster. Many cases could be advanced of organs and instincts originally adapted for one purpose having been utilized for some distinct purpose.[86] Hence the capacity for high musical development, which the savage races of man possess, may be due either to the practice by our semi-human progenitors of some rude form of music, or simply to their having acquired the proper vocal organs for a different purpose. But in this latter case we must assume, as in the above instance of parrots, and as seems to occur with many animals, that they already possessed some sense of melody.

Music arouses in us various emotions, but not the more terrible ones of horror, fear, rage, etc. It awakens the gentler feelings of tenderness and love, which readily pass into devotion. In the Chinese annals it is said: "Music hath the power of making heaven descend upon earth." It likewise stirs up in us the sense of triumph and the glorious ardor for war. These powerful and mingled feelings may well give rise to the sense of sublimity. We can concentrate, as Dr. Seemann observes, greater intensity of feeling in a single musical note than in pages of writing. It is probable that nearly the same emotions, but much weaker and far less complex, are felt by birds when the male pours forth his full volume of song, in rivalry with other males,

[86] Since this chapter was printed, I have seen a valuable article by Mr. Chauncey Wright ("North American Review," Oct. 1870, page 293), who, in discussing the above subject, remarks, "There are many consequences of the ultimate laws or uniformities of nature, through which the acquisition of one useful power will bring with it many resulting advantages as well as limiting disadvantages, actual or possible, which the principle of utility may not have comprehended in its action." As I have attempted to show in an early chapter of this work, this principle has an important bearing on the acquisition by man of some of his mental characteristics.

to captivate the female. Love is still the commonest theme of our songs. As Herbert Spencer remarks, "music arouses dormant sentiments of which we had not conceived the possibility, and do not know the meaning; or, as Richter says, tells us of things we have not seen and shall not see." Conversely, when vivid emotions are felt and expressed by the orator, or even in common speech, musical cadences and rhythm are instinctively used. The negro in Africa when excited often bursts forth in song; "another will reply in song, while the company, as if touched by a musical wave, murmur a chorus in perfect unison." [37] Even monkeys express strong feelings in different tones—anger and impatience by low—fear and pain by high notes.[38] The sensations and ideas thus excited in us by music, or expressed by the cadences of oratory, appear from their vagueness, yet depth, like mental reversions to the emotions and thoughts of a long-past age.

All these facts with respect to music and impassioned speech become intelligible to a certain extent, if we may assume that musical tones and rhythm were used by our half-human ancestors during the season of courtship, when animals of all kinds are excited not only by love, but by the strong passions of jealousy, rivalry, and triumph. From the deeply-laid principle of inherited associations, musical tones in the case would be likely to call up vaguely and indefinitely the strong emotions of a long-past age. As we have every reason to suppose that articulate speech is one of the latest, as it certainly is the highest, of the arts acquired by man, and as the instinctive power of producing musical notes and rhythms is developed low down in the animal series, it would be altogether opposed to the principle of evolution if we were to admit that man's musical capacity has been developed from the tones used in impassioned speech. We must suppose that the rhythms and

[37] Winwood Reade, "The Martyrdom of Man," 1872, p. 441, and "African Sketch Book," 1873, vol. ii. p. 313.

[38] Rengger, "Säugethiere von Paraguay," s. 49.

cadences of oratory are derived from previously developed musical powers.[39] We can thus understand how it is that music, dancing, song, and poetry are such very ancient arts. We may go even further than this, and, as remarked in a former chapter, believe that musical sounds afforded one of the bases for the development of language.[40]

As the males of several quadrumanous animals have their vocal organs much more developed than in the females, and as a gibbon, one of the anthropomorphous apes, pours forth a whole octave of musical notes, and may be said to sing, it appears probable that the progenitors of man, either the males or females or both sexes, before acquiring the power of expressing their mutual love in articulate language, endeavored to charm each other with musical notes and rhythm. So little is known about the use of the voice by the Quadrumana during the season of love, that we have no means of judging whether the habit of singing was first acquired by our male or female ancestors. Women are generally thought to possess sweeter voices than men, and as far as this serves as any guide, we may infer that they first acquired musical powers in order to attract the other sex.[41] But if so, this must have occurred long ago,

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[39] See the very interesting discussion on the "Origin and Function of Music," by Mr. Herbert Spencer, in his collected "Essays," 1858, p. 359. Mr. Spencer comes to an exactly opposite conclusion to that at which I have arrived. He concludes, as did Diderot formerly, that the cadences used in emotional speech afford the foundation from which music has been developed; while I conclude that musical notes and rhythm were first acquired by the male or female progenitors of mankind for the sake of charming the opposite sex. Thus musical tones became firmly associated with some of the strongest passions an animal is capable of feeling, and are consequently used instinctively, or through association, when strong emotions are expressed in speech. Mr. Spencer does not offer any satisfactory explanation, nor can I, why high or deep notes should be expressive, both with man and the lower animals, of certain emotions. Mr. Spencer gives also an interesting discussion on the relations between poetry, recitative, and song.

[40] I find in Lord Monboddo's "Origin of Language," vol. i., 1774, p. 469, that Dr. Blacklock likewise thought "that the first language among men was music, and that before our ideas were expressed by articulate sounds, they were communicated by tones, varied according to different degrees of gravity and acuteness."

[41] See an interesting discussion on this subject by Häckel, "Generelle Morph.," B. ii., 1866, s. 246.

before our ancestors had become sufficiently human to treat and value their women merely as useful slaves. The impassioned orator, bard, or musician, when with his varied tones and cadences he excites the strongest emotions in his hearers, little suspects that he uses the same means by which his half-human ancestors long ago aroused each other's ardent passions during their courtship and rivalry.

The Influence of Beauty in Determining the Marriages of Mankind.—In civilized life man is largely, but by no means exclusively, influenced in the choice of his wife by external appearance; but we are chiefly concerned with primeval times, and our only means of forming a judgment on this subject is to study the habits of existing semi-civilized and savage nations. If it can be shown that the men of different races prefer women having various characteristics, or conversely with the women, we have then to inquire whether such choice, continued during many generations, would produce any sensible effect on the race, either on one sex or both, according to the form of inheritance which has prevailed.

It will be well first to show in some detail that savages pay the greatest attention to their personal appearance.[42] That they have a passion for ornament is notorious; and an English philosopher goes so far as to maintain that clothes were first made for ornament and not for warmth. As Prof. Waitz remarks, "however poor and miserable man is, he finds a pleasure in adorning himself." The extravagance of the naked Indians of South America in decorating

[42] A full and excellent account of the manner in which savages in all parts of the world ornament themselves, is given by the Italian traveller, Prof. Mantegazza, "Rio de la Plata, Viaggi e Studi," 1867, pp. 525–545; all the following statements, when other references are not given, are taken from this work. See, also, Waitz, "Introduct. to Anthropolog.," Eng. transl., vol. i., 1863, p. 275, *et passim*. Lawrence also gives very full details in his "Lectures on Physiology," 1822. Since this chapter was written Sir J. Lubbock has published his "Origin of Civilization," 1870, in which there is an interesting chapter on the present subject, and from which (pp. 42, 48) I have taken some facts about savages dyeing their teeth and hair, and piercing their teeth.

themselves is shown "by a man of large stature gaining with difficulty enough by the labor of a fortnight to procure in exchange the *chica* necessary to paint himself red." [43] The ancient barbarians of Europe during the Reindeer period brought to their caves any brilliant or singular objects which they happened to find. Savages at the present day everywhere deck themselves with plumes, necklaces, armlets, earrings, etc. They paint themselves in the most diversified manner. "If painted nations," as Humboldt observes, "had been examined with the same attention as clothed nations, it would have been perceived that the most fertile imagination and the most mutable caprice have created the fashions of painting, as well as those of garments."

In one part of Africa the eyelids are colored black; in another the nails are colored yellow or purple. In many places the hair is dyed of various tints. In different countries the teeth are stained black, red, blue, etc., and in the Malay Archipelago it is thought shameful to have white teeth "like those of a dog." Not one great country can be named, from the Polar regions in the north to New Zealand in the south, in which the aborigines do not tattoo themselves. This practice was followed by the Jews of old, and by the ancient Britons. In Africa some of the natives tattoo themselves, but it is a much more common practice to raise protuberances by rubbing salt into incisions made in various parts of the body; and these are considered by the inhabitants of Kordofan and Darfur "to be great personal attractions." In the Arab countries no beauty can be perfect until the cheeks "or temples have been gashed." [44] In South America, as Humboldt remarks, "a mother would be accused of culpable indifference toward her children, if she did not employ artificial means to shape the calf of the

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[43] Humboldt, "Personal Narrative," Eng. translat., vol. iv. p. 515; on the imagination shown in painting the body, p. 522; on modifying the form of the calf of the leg, p. 466.

[44] "The Nile Tributaries, 1867; "The Albert N'yanza," 1866, vol. i. p. 218.

leg after the fashion of the country." In the Old and New Worlds the shape of the skull was formerly modified during infancy in the most extraordinary manner, as is still the case in many places, and such deformities are considered ornamental. For instance, the savages of Colombia[45] deem a much flattened head "an essential point of beauty."

The hair is treated with especial care in various countries; it is allowed to grow to full length, so as to reach to the ground, or is combed into "a compact frizzled mop, which is the Papuan's pride and glory."[46] In Northern Africa "a man requires a period of from eight to ten years to perfect his coiffure." With other nations the head is shaved, and in parts of South America and Africa even the eyebrows and eyelashes are eradicated. The natives of the Upper Nile knock out the four front teeth, saying that they do not wish to resemble brutes. Further south, the Batokas knock out only the two upper incisors, which, as Livingstone[47] remarks, gives the face a hideous appearance, owing to the prominence of the lower jaw; but these people think the presence of the incisors most unsightly, and on beholding some Europeans, cried out, "Look at the great teeth!" The chief Sebituani tried in vain to alter this fashion. In various parts of Africa and in the Malay Archipelago the natives file the incisors into points like those of a saw, or pierce them with holes, into which they insert studs.

As the face with us is chiefly admired for its beauty, so with savages it is the chief seat of mutilation. In all quarters of the world the septum, and, more rarely, the wings of the nose are pierced; rings, sticks, feathers, and other ornaments being inserted into the holes. The ears are everywhere pierced and similarly ornamented, and with

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[45] Quoted by Prichard, "Phys. Hist. of Mankind," 4th edit., vol. i., 1851, p. 321.

[46] On the Papuans, Wallace, "The Malay Archipelago," vol. ii. p. 445. On the coiffure of the Africans, Sir S. Baker, "The Albert N'yanza," vol. i. p. 210.

[47] "Travels," p. 533.

the Botocudos and Lenguas of South America the hole is gradually so much enlarged that the lower edge touches the shoulder. In North and South America and in Africa either the upper or lower lip is pierced; and with the Botocudos the hole in the lower lip is so large that a disk of wood, four inches in diameter, is placed in it. Mantegazza gives a curious account of the shame felt by a South American native, and of the ridicule which he excited, when he sold his *tembeta*—the large colored piece of wood which is passed through the hole. In Central Africa the women perforate the lower lip and wear a crystal, which, from the movement of the tongue, has "a wriggling motion, indescribably ludicrous during conversation." The wife of the chief of Latooka told Sir S. Baker[48] that Lady Baker "would be much improved if she would extract her four front teeth from the lower jaw, and wear the long-pointed, polished crystal in her under lip." Further south with the Makalolo, the upper lip is perforated, and a large metal and bamboo ring, called a *pelelé*, is worn in the hole. "This caused the lip in one case to project two inches beyond the tip of the nose; and when the lady smiled the contraction of the muscles elevated it over the eyes. 'Why do the women wear these things?' the venerable chief, Chinsurdi, was asked. Evidently surprised at such a stupid question, he replied, 'For beauty! They are the only beautiful things women have; men have beards, women have none. What kind of a person would she be without the pelelé? She would not be a woman at all with a mouth like a man, but no beard.'" [49]

Hardly any part of the body which can be unnaturally modified has escaped. The amount of suffering thus caused must have been extreme, for many of the operations require several years for their completion, so that the idea of their necessity must be imperative. The motives are various; the

[48] "The Albert N'yanza," 1866, vol. i. p. 217.

[49] Livingstone, "British Association," 1860; report given in the "Athenæum," July 7, 1860, p. 29.

men paint their bodies to make themselves appear terrible in battle; certain mutilations are connected with religious rites, or they mark the age of puberty, or the rank of the man, or they serve to distinguish the tribes. Among savages the same fashions prevail for long periods,[50] and thus mutilations, from whatever cause first made, soon come to be valued as distinctive marks. But self-adornment, vanity, and the admiration of others seem to be the commonest motives. In regard to tattooing, I was told by the missionaries in New Zealand, that when they tried to persuade some girls to give up the practice, they answered, "We must just have a few lines on our lips; else when we grow old we shall be so very ugly." With the men of New Zealand, a most capable judge[51] says, "to have fine tattooed faces was the great ambition of the young, both to render themselves attractive to the ladies, and conspicuous in war." A star tattooed on the forehead and a spot on the chin are thought by the women in one part of Africa to be irresistible attractions.[52] In most, but not all, parts of the world the men are more ornamental than the women, and often in a different manner; sometimes, though rarely, the women are hardly at all ornamented. As the women are made by savages to perform the greatest share of the work, and as they are not allowed to eat the best kinds of food, so it accords with the characteristic selfishness of man that they should not be allowed to obtain or use the finest ornaments. Lastly, it is a remarkable fact, as proved by the foregoing quotations, that the same fashions in modifying the shape of the head, in ornamenting the hair, in painting, tattooing, in perforating the nose, lips, or ears, in removing or filing the teeth, etc., now prevail, and have long prevailed, in the most distant quarters of the world. It is extremely improbable that

[50] Sir S. Baker (ibid., vol. i. p. 210) speaking of the natives of Central Africa, says, "every tribe has a distinct and unchanging fashion for dressing the hair." See Agassiz ("Journey in Brazil," 1868, p. 318) on the invariability of the tattooing of the Amazonian Indians.

[51] Rev. R. Taylor, "New Zealand and its Inhabitants," 1855, p. 152

[52] Mantegazza, "Viaggi e Studi," p. 542.

these practices, followed by so many distinct nations, should be due to tradition from any common source. They indicate the close similarity of the mind of man, to whatever race he may belong, just as do the almost universal habits of dancing, masquerading, and making rude pictures.

Having made these preliminary remarks on the admiration felt by savages for various ornaments, and for deformities most unsightly in our eyes, let us see how far the men are attracted by the appearance of their women, and what are their ideas of beauty. I have heard it maintained that savages are quite indifferent about the beauty of their women, valuing them solely as slaves; it may therefore be well to observe that this conclusion does not at all agree with the care which the women take in ornamenting themselves, or with their vanity. Burchell[53] gives an amusing account of a Bushwoman who used as much grease, red ochre, and shining powder "as would have ruined any but a very rich husband." She displayed also "much vanity and too evident a consciousness of her superiority." Mr. Winwood Reade informs me that the negroes of the West Coast often discuss the beauty of their women. Some competent observers have attributed the fearfully common practice of infanticide partly to the desire felt by the women to retain their good looks.[54] In several regions the women wear charms and use love philters to gain the affections of the men; and Mr. Brown enumerates four plants used for this purpose by the women of Northwestern America.[55]

Hearne,[56] an excellent observer, who lived many years with the American Indians, says, in speaking of the women, "Ask a Northern Indian what is beauty, and he will answer: A broad, flat face; small eyes, high cheek-bones, three or

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[53] "Travels in S. Africa," 1824, vol. i. p. 414.

[54] See, for references, Gerland, "Ueber das Aussterben der Naturvölker," 1868, s. 51, 53, 55; also Azara, "Voyages," etc., tom. ii. p. 116.

[55] On the vegetable productions used by the Northwestern American Indians, "Pharmaceutical Journal," vol. x.

[56] "A Journey from Prince of Wales Fort," 8vo, edit. 1796, p. 89.

four broad, black lines across each cheek; a low forehead, a large, broad chin; a clumsy hook nose, a tawny hide, and breasts hanging down to the belt." Pallas, who visited the northern parts of the Chinese empire, says "those women are preferred who have the Mandschú form; that is to say, a broad face, high cheek-bones, very broad noses, and enormous ears;" [57] and Vogt remarks that the obliquity of the eye, which is proper to the Chinese and Japanese, is exaggerated in their pictures for the purpose, as it "seems, of exhibiting its beauty, as contrasted with the eye of the red-haired barbarians." It is well known, as Huc repeatedly remarks, that the Chinese of the interior think Europeans hideous, with their white skins and prominent noses. The nose is far from being too prominent, according to our ideas, in the natives of Ceylon; yet "the Chinese in the seventh century, accustomed to the flat features of the Mongol races, were surprised at the prominent noses of the Cingalese; and Thsang described them as having 'the beak of a bird, with the body of a man.'"

Finlayson, after minutely describing the people of Cochin China, says that their rounded heads and faces are their chief characteristics; and, he adds, "the roundness of the whole countenance is more striking in the women, who are reckoned beautiful in proportion as they display this form of face." The Siamese have small noses with divergent nostrils, a wide mouth, rather thick lips, a remarkably large face, with very high and broad cheek-bones. It is, therefore, not wonderful that "beauty, according to our notion, is a stranger to them. Yet they consider their own females to be much more beautiful than those of Europe." [58]

It is well known that with many Hottentot women the posterior part of the body projects in a wonderful manner;

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[57] Quoted by Prichard, "Phys. Hist. of Mankind," 3d ed. vol. iv., 1844, p. 519; Vogt, "Lectures on Man," Eng. trans., p. 129. On the opinion of the Chinese on the Cingalese, E. Tennent, "Ceylon," 1859, vol. ii. p. 107.

[58] Prichard, as taken from Crawfurd and Finlayson, "Phys. Hist. of Mankind," vol. iv. pp. 534, 535.

they are steatopygous; and Sir Andrew Smith is certain that this peculiarity is greatly admired by the men.[59] He once saw a woman who was considered a beauty, and she was so immensely developed behind, that when seated on level ground she could not rise, and had to push herself along until she came to a slope. Some of the women in various negro tribes have the same peculiarity; and, according to Burton, the Somal men "are said to choose their wives by ranging them in a line, and by picking her out who projects furthest *a tergo*. Nothing can be more hateful to a negro than the opposite form." [60]

With respect to color, the negroes rallied Mungo Park on the whiteness of his skin and the prominence of his nose, both of which they considered as "unsightly and unnatural conformations." He in return praised the glossy jet of their skins and the lovely depression of their noses; this, they said, was "honey mouth," nevertheless they gave him food. The African Moors also "knitted their brows and seemed to shudder" at the whiteness of his skin. On the eastern coast, the negro boys, when they saw Burton, cried out, "Look at the white man; does he not look like a white ape?" On the western coast, as Mr. Winwood Reade informs me, the negroes admire a very black skin more than one of a lighter tint. But their horror of whiteness may be attributed, according to this same traveller, partly to the belief held by most negroes, that demons and spirits are white, and partly to their thinking it a sign of ill health.

The Banyai of the more southern part of the continent are negroes, but "a great many of them are of a light coffee-and-milk color, and, indeed, this color is considered handsome throughout the whole country"; so that here we have

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[59] Idem illustrissimus viator dixit mihi præcinctorium vel tabulam fœminæ, quod nobis teterrimum est, quondam permagno æstimari ab hominibus in hâc gente. Nunc res mutata est, et censent talem conformationem minime optandam esse.

[60] "The Anthropological Review," November, 1864, p. 237. For additional references see Waitz, "Introduct. to Anthropology," Eng. translat., 1863, vol. i. p. 105.

a different standard of taste. With the Kaffirs, who differ much from negroes, "the skin, except among the tribes near Delagoa Bay, is not usually black, the prevailing color being a mixture of black and red, the most common shade being chocolate. Dark complexions, as being most common, are naturally held in the highest esteem. To be told that he is light colored, or like a white man, would be deemed a very poor compliment by a Kaffir. I have heard of one unfortunate man who was so very fair that no girl would marry him." One of the titles of the Zulu king is "You who are black."[61] Mr. Galton, in speaking to me about the natives of South Africa, remarked that their ideas of beauty seem very different from ours; for in one tribe two slim, slight, and pretty girls were not admired by the natives.

Turning to other quarters of the world: In Java, a yellow, not a white, girl is considered, according to Madame Pfeiffer, a beauty. A man of Cochin China "spoke with contempt of the wife of the English Ambassador, that she had white teeth like a dog, and a rosy color like that of potato flowers." We have seen that the Chinese dislike our white skin, and that the North Americans admire "a tawny hide." In South America, the Yuracaras, who inhabit the wooded, damp slopes of the eastern Cordillera, are remarkably pale colored, as their name in their own language expresses; nevertheless they consider European women as very inferior to their own.[62]

In several of the tribes of North America the hair on the head grows to a wonderful length; and Catlin gives a curious proof how much this is esteemed, for the chief of the Crows was elected to this office from having the

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[61] Mungo Park's "Travels in Africa," 4to, 1816, pp. 53, 131. Burton's statement is quoted by Schaaffhausen, "Archiv für Anthropolog.," 1866, s. 163. On the Banyai, Livingstone, "Travels," p. 64. On the Kaffirs, the Rev. J. Shooter, "The Kaffirs of Natal and the Zulu Country," 1857, p. 1.

[62] For the Javans and Cochin-Chinese, see Waitz, "Introduct. to Anthropology," Eng. translat., vol. i. p. 305. On the Yuracaras, A. d'Orligny, as quoted in Prichard, "Phys. Hist. of Mankind," vol. v. 3d edit. p. 476.

longest hair of any man in the tribe, namely, ten feet and seven inches. The Aymaras and Quichuas of South America likewise have very long hair; and this, as Mr. D. Forbes informs me, is so much valued as a beauty, that cutting it off was the severest punishment which he could inflict on them. In both the northern and southern halves of the continent the natives sometimes increase the apparent length of their hair by weaving into it fibrous substances. Although the hair on the head is thus cherished, that on the face is considered by the North American Indians "as very vulgar," and every hair is carefully eradicated. This practice prevails throughout the American continent from Vancouver's Island in the north to Tierra del Fuego in the south. When York Minster, a Fuegian on board the "Beagle," was taken back to his country, the natives told him he ought to pull out the few short hairs on his face. They also threatened a young missionary, who was left for a time with them, to strip him naked, and pluck the hairs from his face and body, yet he was far from being a hairy man. This fashion is carried so far that the Indians of Paraguay eradicate their eyebrows and eyelashes, saying that they do not wish to be like horses.[63]

It is remarkable that throughout the world the races which are almost completely destitute of a beard dislike hairs on the face and body, and take pains to eradicate them. The Kalmucks are beardless, and they are well known, like the Americans, to pluck out all straggling hairs; and so it is with the Polynesians, some of the Malays, and the Siamese. Mr. Veitch states that the Japanese ladies "all objected to our whiskers, considering them very ugly, and told us to cut them off, and be like Japanese men." The New Zealanders have short, curled beards; yet they formerly plucked out the hairs on the face. They had

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[63] "North American Indians," by G. Catlin, 3d edit., 1842, vol. i. p. 49; vol. ii. p. 227. On the natives of Vancouver's Island, see Sproat, "Scenes and Studies of Savage Life," 1868, p. 25. On the Indians of Paraguay, Azara, "Voyages," tom. ii. p. 105.

a saying that "there is no woman for a hairy man"; but it would appear that the fashion has changed in New Zealand, perhaps owing to the presence of Europeans, and I am assured that beards are now admired by the Maories.[64]

On the other hand, bearded races admire and greatly value their beards; among the Anglo-Saxons every part of the body had a recognized value; "the loss of the beard being estimated at twenty shillings, while the breaking of a thigh was fixed at only twelve."[65] In the East men swear solemnly by their beards. We have seen that Chinsurdi, the chief of the Makalolo in Africa, thought that beards were a great ornament. In the Pacific the Fijian's beard is "profuse and bushy, and is his greatest pride"; while the inhabitants of the adjacent archipelagoes of Tonga and Samoa are "beardless, and abhor a rough chin." In one island alone of the Ellice group "the men are heavily bearded, and not a little proud thereof."[66]

We thus see how widely the different races of man differ in their taste for the beautiful. In every nation sufficiently advanced to have made effigies of their gods or of their deified rulers, the sculptors no doubt have endeavored to express their highest ideal of beauty and grandeur.[67] Under this point of view it is well to compare in our mind the Jupiter or Apollo of the Greeks with the Egyptian or Assyrian statues; and these with the hideous bass-reliefs on the ruined buildings of Central America.

I have met with very few statements opposed to this conclusion. Mr. Winwood Reade, however, who has had ample opportunities for observation, not only with the negroes of the West Coast of Africa, but with those of the

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[64] On the Siamese, Prichard, ibid., vol. iv. p. 533. On the Japanese, Veitch in "Gardeners' Chronicle," 1860, p. 1104. On the New Zealanders, Mantegazza, "Viaggi e Studi," 1867, p. 526. For the other nations mentioned, see references in Lawrence, "Lectures on Physiology," etc., 1822, p. 272.

[65] Lubbock, "Origin of Civilization," 1870, p. 321.

[66] Dr. Barnard Davis quotes Mr. Prichard and others for these facts in regard to the Polynesians, in "Anthropological Review," April, 1870, pp. 185, 191.

[67] Ch. Comte has remarks to this effect in his "Traité de Législation," 3d edit., 1837, p. 136.

interior who have never associated with Europeans, is convinced that their ideas of beauty are *on the whole* the same as ours; and Dr. Rohlfs writes to me to the same effect with respect to Bornu and the countries inhabited by the Pullo tribes. Mr. Reade found that he agreed with the negroes in their estimation of the beauty of the native girls; and that their appreciation of the beauty of European women corresponded with ours. They admire long hair, and use artificial means to make it appear abundant; they admire also a beard, though themselves very scantily provided. Mr. Reade feels doubtful what kind of nose is most appreciated: a girl has been heard to say, "I do not want to marry him, he has got no nose"; and this shows that a very flat nose is not admired. We should, however, bear in mind that the depressed, broad noses and projecting jaws of the negroes of the West Coast are exceptional types with the inhabitants of Africa. Notwithstanding the foregoing statements, Mr. Reade admits that negroes "do not like the color of our skin; they look on blue eyes with aversion, and they think our noses too long and our lips too thin." He does not think it probable that negroes would ever prefer the most beautiful European woman, on the mere grounds of physical admiration, to a good-looking negress.[68]

The general truth of the principle, long ago insisted on by Humboldt,[69] that man admires and often tries to exaggerate whatever characters nature may have given him, is shown in many ways. The practice of beardless

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[68] "The African Sketch Book," vol. ii., 1873, pp. 253, 394, 521. The Fuegians, as I have been informed by a missionary who long resided with them, consider European women as extremely beautiful; but from what we have seen of the judgment of the other aborigines of America, I cannot but think that this must be a mistake, unless indeed the statement refers to the few Fuegians who have lived for some time with Europeans, and who must consider us as superior beings. I should add that a most experienced observer, Capt. Burton, believes that a woman whom we consider beautiful is admired throughout the world. "Anthropological Review," March, 1864, p. 245.

[69] "Personal Narrative," Eng. translat., vol. iv. p. 518, and elsewhere. Mantegazza, in his "Viaggi e Studi," 1867, strongly insists on this same principle.

races extirpating every trace of a beard, and often all the hairs on the body, affords one illustration. The skull has been greatly modified during ancient and modern times by many nations; and there can be little doubt that this has been practiced, especially in North and South America, in order to exaggerate some natural and admired peculiarity. Many American Indians are known to admire a head so extremely flattened as to appear to us idiotic. The natives on the northwestern coast compress the head into a pointed cone; and it is their constant practice to gather the hair into a knot on the top of the head, for the sake, as Dr. Wilson remarks, "of increasing the apparent elevation of the favorite conoid form." The inhabitants of Arakhan "admire a broad, smooth forehead, and, in order to produce it, they fasten a plate of lead on the heads of the new-born children." On the other hand, "a broad, well-rounded occiput is considered a great beauty" by the natives of the Fiji islands.[70]

As with the skull, so with the nose; the ancient Huns during the age of Attila were accustomed to flatten the noses of their infants with bandages, "for the sake of exaggerating a natural conformation." With the Tahitians, to be called *long-nose* is considered as an insult, and they compress the noses and foreheads of their children for the sake of beauty. The same holds with the Malays of Sumatra, the Hottentots, certain Negroes, and the natives of Brazil.[71] The Chinese have by nature unusually small feet;[72] and it is well known that the women of the upper classes distort their feet to

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[70] On the skulls of the American tribes, see Nott and Gliddon, "Types of Mankind," 1854, p. 440; Prichard, "Phys. History of Mankind," vol. i., 3d edit., p. 321; on the natives of Arakhan, ibid., vol. iv. p. 537. Wilson, "Physical Ethnology," Smithsonian Institution, 1863, p. 288; on the Fijians, p. 290. Sir J. Lubbock ("Prehistoric Times," 2d edit., 1869, p. 506) gives an excellent résumé on this subject.

[71] On the Huns, Godron, "De l'Espèce," tom. ii., 1859, p. 300. On the Tahitians, Waitz, "Anthropolog," Eng. translat., vol. i. p. 305. Marsden, quoted by Prichard, "Phys. Hist. of Mankind," 3d edit., vol. v. p. 67. Lawrence, "Lectures on Physiology," p. 337.

[72] This fact was ascertained in the "Reise der Novara: Anthropolog. Thiel," Dr. Weisbach, 1867, s. 265.

make them still smaller. Lastly, Humboldt thinks that the American Indians prefer coloring their bodies with red paint in order to exaggerate their natural tint; and until recently European women added to their naturally bright colors by rouge and white cosmetics; but it may be doubted whether barbarous nations have generally had any such intention in painting themselves.

In the fashions of our own dress we see exactly the same principle and the same desire to carry every point to an extreme; we exhibit, also, the same spirit of emulation. But the fashions of savages are far more permanent than ours; and whenever their bodies are artificially modified, this is necessarily the case. The Arab women of the Upper Nile occupy about three days in dressing their hair; they never imitate other tribes, "but simply vie with each other in the superlativeness of their own style." Dr. Wilson, in speaking of the compressed skulls of various American races, adds, "such usages are among the least eradicable, and long survive the shock of revolutions that change dynasties and efface more important national peculiarities."[73] The same principle comes into play in the art of breeding; and we can thus understand, as I have elsewhere explained,[74] the wonderful development of the many races of animals and plants which have been kept merely for ornament. Fanciers always wish each character to be somewhat increased; they do not admire a medium standard; they certainly do not desire any great and abrupt change in the character of their breeds; they admire solely what they are accustomed to, but they ardently desire to see each characteristic feature a little more developed.

The senses of man and of the lower animals seem to be so constituted that brilliant colors and certain forms, as well as harmonious and rhythmical sounds, give pleasure and are

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[73] "Smithsonian Institution," 1863, p. 289. On the fashions of Arab women, Sir S. Baker, "The Nile Tributaries," 1867, p. 121.

[74] "The Variation of Animals and Plants under Domestication," vol. i. p. 214; vol. ii. p. 240.

called beautiful; but why this should be so we know not. It is certainly not true that there is in the mind of man any universal standard of beauty with respect to the human body. It is, however, possible that certain tastes may in the course of time become inherited, though there is no evidence in favor of this belief; and if so, each race would possess its own innate ideal standard of beauty. It has been argued[75] that ugliness consists in an approach to the structure of the lower animals, and no doubt this is partly true with the more civilized nations, in which intellect is highly appreciated; but this explanation will hardly apply to all forms of ugliness. The men of each race prefer what they are accustomed to; they cannot endure any great change; but they like variety, and admire each characteristic carried to a moderate extreme.[76] Men accustomed to a nearly oval face, to straight and regular features, and to bright colors, admire, as we Europeans know, these points when strongly developed. On the other hand, men accustomed to a broad face, with high cheek-bones, a depressed nose, and a black skin, admire these peculiarities when strongly marked. No doubt characters of all kinds may be too much developed for beauty. Hence a perfect beauty, which implies many characters modified in a particular manner, will be in every race a prodigy. As the great anatomist Bichat long ago said, if every one were cast in the same mold, there would be no such thing as beauty. If all our women were to become as beautiful as the Venus de' Medici, we should for a time be charmed; but we should soon wish for variety; and as soon as we had obtained variety, we should wish to see certain characters a little exaggerated beyond the then existing common standard.

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[75] Schaaffhausen, "Archiv für Anthropologie," 1866, s. 164.

[76] Mr. Bain has collected ("Mental and Moral Science," 1868, pp. 304–314) about a dozen more or less different theories of the idea of beauty; but none is quite the same as that here given.

CHAPTER XX

SECONDARY SEXUAL CHARACTERS OF MAN—*continued*

On the effects of the continued selection of women according to a different standard of beauty in each race—On the causes which interfere with sexual selection in civilized and savage nations—Conditions favorable to sexual selection during primeval times—On the manner of action of sexual selection with mankind—On the women in savage tribes having some power to choose their husbands—Absence of hair on the body, and development of the beard—Color of the skin—Summary

WE have seen in the last chapter that with all barbarous races ornaments, dress, and external appearance are highly valued; and that the men judge of the beauty of their women by widely different standards. We must next inquire whether this preference, and the consequent selection during many generations of those women which appear to the men of each race the most attractive, has altered the character either of the females alone or of both sexes. With mammals the general rule appears to be that characters of all kinds are inherited equally by the males and females; we might therefore expect that with mankind any characters gained by the females or by the males, through sexual selection, would commonly be transferred to the offspring of both sexes. If any change has thus been effected, it is almost certain that the different races would be differently modified, as each has its own standard of beauty.

With mankind, especially with savages, many causes interfere with the action of sexual selection as far as the bodily frame is concerned. Civilized men are largely attracted by the mental charms of women, by their wealth, and especially by their social position; for men rarely marry

into a much lower rank. The men who succeed in obtaining the more beautiful women will not have a better chance of leaving a long line of descendants than other men with plainer wives, save the few who bequeath their fortunes according to primogeniture. With respect to the opposite form of selection, namely, of the more attractive men by the women, although in civilized nations women have free or almost free choice, which is not the case with barbarous races, yet their choice is largely influenced by the social position and wealth of the men; and the success of the latter in life depends much on their intellectual powers and energy, or on the fruits of these same powers in their forefathers. No excuse is needed for treating this subject in some detail; for, as the German philosopher Schopenhauer remarks, "the final aim of all love intrigues, be they comic or tragic, is really of more importance than all other ends in human life. What it all turns upon is nothing less than the composition of the next generation. . . . It is not the weal or woe of any one individual, but that of the human race to come, which is here at stake." [1]

There is, however, reason to believe that in certain civilized and semi-civilized nations sexual selection has effected something in modifying the bodily frame of some of the members. Many persons are convinced, as it appears to me with justice, that our aristocracy, including under this term all wealthy families in which primogeniture has long prevailed, from having chosen during many generations from all classes the more beautiful women as their wives, have become handsomer, according to the European standard, than the middle classes; yet the middle classes are placed under equally favorable conditions of life for the perfect development of the body. Cook remarks that the superiority in personal appearance "which is observable in the erees or nobles in all the other islands (of the Pacific)

[1] "Schopenhauer and Darwinism," in "Journal of Anthropology," Jan. 1872, p. 323.

is found in the Sandwich Islands''; but this may be chiefly due to their better food and manner of life.

The old traveller Chardin, in describing the Persians, says their "blood is now highly refined by frequent intermixtures with the Georgians and Circassians, two nations which surpass all the world in personal beauty. There is hardly a man of rank in Persia who is not born of a Georgian or Circassian mother." He adds that they inherit their beauty, "not from their ancestors, for without the above mixture the men of rank in Persia, who are descendants of the Tartars, would be extremely ugly."[2] Here is a more curious case; the priestesses who attended the temple of Venus Erycina at San Giuliano, in Sicily, were selected for their beauty out of the whole of Greece; they were not vestal virgins, and Quatrefages,[3] who states the foregoing fact, says that the women of San Giuliano are now famous as the most beautiful in the island, and are sought by artists as models. But it is obvious that the evidence in all the above cases is doubtful.

The following case, though relating to savages, is well worth giving from its curiosity. Mr. Winwood Reade informs me that the Jollofs, a tribe of negroes on the west coast of Africa, "are remarkable for their uniformly fine appearance." A friend of his asked one of these men, "How is it that every one whom I meet is so fine looking, not only your men, but your women?" The Jollof answered, "It is very easily explained: it has always been our custom to pick out our worse-looking slaves and to sell them." It need hardly be added that, with all savages, female slaves serve as concubines. That this negro should have attributed, whether rightly or wrongly, the fine appearance of his tribe to the long-continued elimination of the ugly women is not so surprising as it may at first ap-

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[2] These quotations are taken from Lawrence ("Lectures on Physiology," etc., 1822, p. 393), who attributes the beauty of the upper classes in England to the men having long selected the more beautiful women.

[3] "Anthropologie," "Revue des Cours Scientifiques," Oct. 1858, p. 721.

pear; for I have elsewhere shown[4] that negroes fully appreciate the importance of selection in the breeding of their domestic animals, and I could give from Mr. Reade additional evidence on this head.

The Causes which Prevent or Check the Action of Sexual Selection with Savages.—The chief causes are, first, so-called communal marriages or promiscuous intercourse; secondly, the consequences of female infanticide; thirdly, early betrothals; and lastly, the low estimation in which women are held, as mere slaves. These four points must be considered in some detail.

It is obvious that as long as the pairing of man, or of any other animal, is left to mere chance, with no choice exerted by either sex, there can be no sexual selection; and no effect will be produced on the offspring by certain individuals having had an advantage over others in their courtship. Now it is asserted that there exist at the present day tribes which practice what Sir J. Lubbock by courtesy calls communal marriages; that is, all the men and women in the tribe are husbands and wives to one another. The licentiousness of many savages is no doubt astonishing, but it seems to me that more evidence is requisite, before we fully admit that their intercourse is in any case promiscuous. Nevertheless all those who have most closely studied the subject,[5] and whose judgment is worth much more than mine, believe that communal marriage (this expression being variously guarded) was the original and universal form throughout

[4] "The Variation of Animals and Plants under Domestication," vol. i. p. 207.

[5] Sir J. Lubbock, "The Origin of Civilization," 1870, chap. iii., especially pp. 60–67. Mr. M'Lennan, in his extremely valuable work on "Primitive Marriage," 1865, p. 163, speaks of the union of the sexes "in the earliest times as loose, transitory, and in some degree promiscuous." Mr. M'Lennan and Sir J. Lubbock have collected much evidence on the extreme licentiousness of savages at the present time. Mr. L. H. Morgan, in his interesting memoir on the classificatory system of relationship ("Proc. American Acad. of Sciences," vol. vii., Feb. 1868, p. 475), concludes that polygamy and all forms of marriage during primeval times were essentially unknown. It appears also, from Sir J. Lubbock's work, that Bachofen likewise believes that communal intercourse originally prevailed.

the world, including therein the intermarriage of brothers and sisters. The late Sir A. Smith, who had travelled widely in South Africa, and knew much about the habits of savages there and elsewhere, expressed to me the strongest opinion that no race exists in which woman is considered as the property of the community. I believe that his judgment was largely determined by what is implied by the term marriage. Throughout the following discussion I use the term in the same sense as when naturalists speak of animals as monogamous, meaning thereby that the male is accepted by or chooses a single female, and lives with her either during the breeding season or for the whole year, keeping possession of her by the law of might; or, as when they speak of a polygamous species, meaning that the male lives with several females. This kind of marriage is all that concerns us here, as it suffices for the work of sexual selection. But I know that some of the writers above referred to imply by the term marriage a recognized right protected by the tribe.

The indirect evidence in favor of the belief of the former prevalence of communal marriages is strong, and rests chiefly on the terms of relationship which are employed between the members of the same tribe, implying a connection with the tribe, and not with either parent. But the subject is too large and complex for even an abstract to be here given, and I will confine myself to a few remarks. It is evident in the case of such marriages, or where the marriage tie is very loose, that the relationship of the child to its father cannot be known. But it seems almost incredible that the relationship of the child to its mother should ever be completely ignored, especially as the women in most savage tribes nurse their infants for a long time. Accordingly, in many cases the lines of descent are traced through the mother alone, to the exclusion of the father. But in other cases the terms employed express a connection with the tribe alone, to the exclusion even of the mother. It seems possible that the connection between the related members of the same barbarous tribe, exposed to all sorts of danger, might

be so much more important, owing to the need of mutual protection and aid, than that between the mother and her child, as to lead to the sole use of terms expressive of the former relationships; but Mr. Morgan is convinced that this view is by no means sufficient.

The terms of relationship used in different parts of the world may be divided, according to the author just quoted, into two great classes, the classificatory and descriptive—the latter being employed by us. It is the classificatory system which so strongly leads to the belief that communal and other extremely loose forms of marriage were originally universal. But as far as I can see, there is no necessity on this ground for believing in absolutely promiscuous intercourse; and I am glad to find that this is Sir J. Lubbock's view. Men and women, like many of the lower animals, might formerly have entered into strict though temporary unions for each birth, and in this case nearly as much confusion would have arisen in the terms of relationship as in the case of promiscuous intercourse. As far as sexual selection is concerned, all that is required is that choice should be exerted before the parents unite, and it signifies little whether the unions last for life or only for a season.

Besides the evidence derived from the terms of relationship, other lines of reasoning indicate the former wide prevalence of communal marriage. Sir J. Lubbock accounts[6] for the strange and widely extended habit of exogamy—that is, the men of one tribe taking wives from a distinct tribe—by communism having been the original form of intercourse; so that a man never obtained a wife for himself unless he captured her from a neighboring and hostile tribe, and then she would naturally have become his sole and valuable property. Thus the practice of capturing wives might have arisen; and from the honor so gained it might ultimately have become the universal habit. According to Sir J. Lubbock,[6] we can also thus understand "the necessity of

[6] Address to British Association, "On the Social and Religious Condition of the Lower Races of Man," 1870, p. 20.

expiation for marriage as an infringement of tribal rites, since, according to old ideas, a man had no right to appropriate to himself that which belonged to the whole tribe." Sir J. Lubbock further gives a curious body of facts showing that in old times high honor was bestowed on women who were utterly licentious; and this, as he explains, is intelligible, if we admit that promiscuous intercourse was the aboriginal, and therefore long revered, custom of the tribe.[7]

Although the manner of development of the marriage tie is an obscure subject, as we may infer from the divergent opinions on several points between the three authors who have studied it most closely, namely, Mr. Morgan, Mr. M'Lennan, and Sir J. Lubbock, yet from the foregoing and several other lines of evidence it seems probable[8] that the habit of marriage, in any strict sense of the word, has been gradually developed; and that almost promiscuous or very loose intercourse was once extremely common throughout the world. Nevertheless, from the strength of the feeling of jealousy all through the animal kingdom, as well as from the analogy of the lower animals, more particularly of those which come nearest to man, I cannot believe that absolutely promiscuous intercourse prevailed in times past, shortly before man attained to his present rank in the zoological scale. Man, as I have attempted to show, is certainly descended from some ape-like creature. With the existing Quadrumana, as far as their habits are known, the males of some species are monogamous, but live during only a part of the year with the females; of this the orang seems to afford an instance. Several kinds, for example some of the Indian and American monkeys, are strictly monogamous, and associate all the year round with their

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[7] "Origin of Civilization," 1870, p. 86. In the several works above quoted, there will be found copious evidence on relationship through the females alone, or with the tribe alone.

[8] Mr. C. Staniland Wake argues strongly ("Anthropologia," March, 1874, p. 197) against the views held by these three writers on the former prevalence of almost promiscuous intercourse; and he thinks that the classificatory system of relationship can be otherwise explained.

wives. Others are polygamous, for example the gorilla and several American species, and each family lives separate. Even when this occurs, the families inhabiting the same district are probably somewhat social; the chimpanzee, for instance, is occasionally met with in large bands. Again, other species are polygamous, but several males, each with his own females, live associated in a body, as with several species of baboons.[9] We may indeed conclude, from what we know of the jealousy of all male quadrupeds, armed, as many of them are, with special weapons for battling with their rivals, that promiscuous intercourse in a state of nature is extremely improbable. The pairing may not last for life, but only for each birth; yet if the males which are the strongest and best able to defend or otherwise assist their females and young were to select the more attractive females, this would suffice for sexual selection.

Therefore, looking far enough back in the stream of time, and judging from the social habits of man as he now exists, the most probable view is that he aboriginally lived in small communities, each with a single wife, or, if powerful, with several, whom he jealously guarded against all other men. Or he may not have been a social animal, and yet have lived with several wives, like the gorilla; for all the natives "agree that but one adult male is seen in a band; when the young male grows up, a contest takes place for mastery, and the strongest, by killing and driving out the others, establishes himself as the head of the community." [10] The younger males, being thus expelled and wandering about, would, when at last successful in finding a partner, prevent too close interbreeding within the limits of the same family.

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[9] Brehm ("Illust. Thierleben," B. i. p. 77) says *Cynocephalus hamadryas* lives in great troops containing twice as many adult females as adult males. See Rengger on American polygamous species, and Owen ("Anat. of Vertebrates," vol. iii. p. 746) on American monogamous species. Other references might be added.

[10] Dr. Savage, in "Boston Journal of Nat. Hist.," vol. v. 1845–47, p. 423.

Although savages are now extremely licentious, and although communal marriages may formerly have largely prevailed, yet many tribes practice some form of marriage, but of a far more lax nature than that of civilized nations. Polygamy, as just stated, is almost universally followed by the leading men in every tribe. Nevertheless there are tribes, standing almost at the bottom of the scale, which are strictly monogamous. This is the case with the Veddahs of Ceylon; they have a saying, according to Sir J. Lubbock,[11] "that death alone can separate husband and wife." An intelligent Kandyan chief, of course a polygamist, "was perfectly scandalized at the utter barbarism of living with only one wife, and never parting until separated by death." It was, he said, "just like the Wanderoo monkeys." Whether savages who now enter into some form of marriage, either polygamous or monogamous, have retained this habit from primeval times, or whether they have returned to some form of marriage, after passing through a stage of promiscuous intercourse, I will not pretend to conjecture.

Infanticide.—This practice is now very common throughout the world, and there is reason to believe that it prevailed much more extensively during former times.[12] Barbarians find it difficult to support themselves and their children, and it is a simple plan to kill their infants. In South America some tribes, according to Azara, formerly destroyed so many infants, of both sexes, that they were on the point of extinction. In the Polynesian Islands women have been known to kill from four or five to even ten of their children; and Ellis could not find a single woman who had not killed at least one. Wherever infanticide prevails the struggle for existence will be in so far less severe, and all the members of the tribe will have an almost equally good chance of

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[11] "Prehistoric Times," 1869, p. 424.

[12] Mr. M'Lennan, "Primitive Marriage," 1865. See especially on exogamy and infanticide, pp. 130, 138, 165.

rearing their few surviving children. In most cases a larger number of female than of male infants are destroyed, for it is obvious that the latter are of more value to the tribe, as they will, when grown up, aid in defending it, and can support themselves. But the trouble experienced by the women in rearing children, their consequent loss of beauty, the higher estimation set on them when few, and their happier fate, are assigned by the women themselves, and by various observers, as additional motives for infanticide. In Australia, where female infanticide is still common, Sir G. Grey estimated the proportion of native women to men as one to three; but others say as two to three. In a village on the eastern frontier of India, Colonel MacCulloch found not a single female child.[13]

When, owing to female infanticide, the women of a tribe were few, the habit of capturing wives from neighboring tribes would naturally arise. Sir J. Lubbock, however, as we have seen, attributes the practice, in chief part, to the former existence of communal marriage, and to the men having consequently captured women from other tribes to hold as their sole property. Additional causes might be assigned, such as the communities being very small, in which case marriageable women would often be deficient. That the habit was most extensively practiced during former times, even by the ancestors of civilized nations, is clearly shown by the preservation of many curious customs and ceremonies of which Mr. M'Lennan has given an interesting account. In our own marriages the "best man" seems originally to have been the chief abettor of the bridegroom in the act of capture. Now as long as men habitually procured their wives through violence and craft, they would have been glad to seize on any woman, and would not have selected the more attractive ones. But as soon as the prac-

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[13] Dr. Gerland ("Ueber das Aussterben der Naturvölker," 1868) has collected much information on infanticide, see especially s. 27, 51, 54. Azara ("Voyages," etc., tom. ii. pp. 94, 116) enters in detail on the motives. See, also, M'Lennan (ibid., p. 139) for cases in India.

tice of procuring wives from a distinct tribe was effected through barter, as now occurs in many places, the more attractive women would generally have been purchased. The incessant crossing, however, between tribe and tribe, which necessarily follows from any form of this habit, would tend to keep all the people inhabiting the same country nearly uniform in character; and this would interfere with the power of sexual selection in differentiating the tribes.

The scarcity of women, consequent on female infanticide, leads, also, to another practice, that of polyandry, still common in several parts of the world, and which formerly, as Mr. M'Lennan believes, prevailed almost universally; but this latter conclusion is doubted by Mr. Morgan and Sir J. Lubbock.[14] Whenever two or more men are compelled to marry one woman, it is certain that all the women of the tribe will get married, and there will be no selection by the men of the more attractive women. But under these circumstances the women, no doubt, will have the power of choice, and will prefer the more attractive men. Azara, for instance, describes how carefully a Guana woman bargains for all sorts of privileges before accepting some one or more husbands; and the men in consequence take unusual care of their personal appearance. So among the Todas of India, who practice polyandry, the girls can accept or refuse any man.[15] A very ugly man in these cases would perhaps altogether fail in getting a wife, or get one later in life; but the handsomer men, although more successful in obtaining wives, would not, as far as we can see, leave more offspring to inherit their beauty than the less handsome husbands of the same women.

Early Betrothals and Slavery of Women.—With many savages it is the custom to betroth the females while mere

[14] "Primitive Marriage," p. 208; Sir J. Lubbock, "Origin of Civilization," p. 100. See, also, Mr. Morgan, loc. cit., on the former prevalence of polyandry.

[15] Azara, "Voyages," etc., tom. ii. pp. 92–95; Colonel Marshall, "Among the Todas," p. 212.

infants; and this would effectually prevent preference being exerted on either side according to personal appearance. But it would not prevent the more attractive women from being afterward stolen or taken by force from their husbands by the more powerful men; and this often happens in Australia, America, and elsewhere. The same consequences with reference to sexual selection would to a certain extent follow, when women are valued almost solely as slaves or beasts of burden, as is the case with many savages. The men, however, at all times, would prefer the handsomest slaves according to their standard of beauty.

We thus see that several customs prevail with savages which must greatly interfere with, or completely stop, the action of sexual selection. On the other hand, the conditions of life to which savages are exposed, and some of their habits, are favorable to natural selection; and this comes into play at the same time with sexual selection. Savages are known to suffer severely from recurrent famines; they do not increase their food by artificial means; they rarely refrain from marriage,[16] and generally marry while young. Consequently they must be subjected to occasional hard struggles for existence, and the favored individuals will alone survive.

At a very early period, before man attained to his present rank in the scale, many of his conditions would be different from what now obtains among savages. Judging from the analogy of the lower animals, he would then either live with a single female or be a polygamist. The most powerful and able males would succeed best in obtaining attractive females. They would also succeed best in the general struggle for life, and in defending their females, as well as their offspring, from enemies of all kinds. At this early period

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[16] Burchill says ("Travels in S. Africa," vol. ii., 1824, p. 58), that among the wild nations of Southern Africa, neither men nor women ever pass their lives in a state of celibacy. Azara ("Voyages dans l'Amérique Mérid.," tom. ii., 1809, p. 21) makes precisely the same remark in regard to the wild Indians of South America.

the ancestors of man would not be sufficiently advanced in intellect to look forward to distant contingencies; they would not foresee that the rearing of all their children, especially their female children, would make the struggle for life severer for the tribe. They would be governed more by their instincts and less by their reason than are savages at the present day. They would not at that period have partially lost one of the strongest of all instincts, common to all the lower animals, namely, the love of their young offspring; and consequently they would not have practiced female infanticide. Women would not have been thus rendered scarce, and polyandry would not have been practiced; for hardly any other cause, except the scarcity of women, seems sufficient to break down the natural and widely prevalent feeling of jealousy, and the desire of each male to possess a female for himself. Polyandry would be a natural stepping stone to communal marriages or almost promiscuous intercourse; though the best authorities believe that this latter habit preceded polyandry. During primordial times there would be no early betrothals, for this implies foresight.. Nor would women be valued merely as useful slaves or beasts of burden. Both sexes, if the females as well as the males were permitted to exert any choice, would choose their partners not for mental charms, or property, or social position, but almost solely from external appearance. All the adults would marry or pair, and all the offspring, as far as that was possible, would be reared; so that the struggle for existence would be periodically excessively severe. Thus during these times all the conditions for sexual selection would have been more favorable than at a later period, when man had advanced in his intellectual powers, but had retrograded in his instincts. Therefore, whatever influence sexual selection may have had in producing the differences between the races of man, and between man and the higher Quadrumana, this influence would have been more powerful at a remote period than at the present day, though probably not yet wholly lost.

The Manner of Action of Sexual Selection with Mankind. —With primeval men under the favorable conditions just stated, and with those savages who at the present time enter into any marriage tie, sexual selection has probably acted in the following manner, subject to greater or less interference from female infanticide, early betrothals, etc. The strongest and most vigorous men—those who could best defend and hunt for their families, who were provided with the best weapons and possessed the most property, such as a large number of dogs or other animals—would succeed in rearing a greater average number of offspring than the weaker and poorer members of the same tribes. There can, also, be no doubt that such men would generally be able to select the more attractive women. At present the chiefs of nearly every tribe throughout the world succeed in obtaining more than one wife. I hear from Mr. Mantell that, until recently, almost every girl in New Zealand, who was pretty, or promised to be pretty, was *tapu* to some chief. With the Kaffirs, as Mr. C. Hamilton states,[17] "the chiefs generally have the pick of the women for many miles round, and are most persevering in establishing or confirming their privilege." We have seen that each race has its own style of beauty, and we know that it is natural to man to admire each characteristic point in his domestic animals, dress, ornaments, and personal appearance, when carried a little beyond the average. If, then, the several foregoing propositions be admitted, and I cannot see that they are doubtful, it would be an inexplicable circumstance if the selection of the more attractive women by the more powerful men of each tribe, who would rear on an average a greater number of children, did not, after the lapse of many generations, somewhat modify the character of the tribe.

When a foreign breed of our domestic animals is introduced into a new country, or when a native breed is long and carefully attended to, either for use or ornament, it is found after several generations to have undergone a greater

[17] "Anthropological Review," Jan. 1870, p. xvi.

or less amount of change, whenever the means of comparison exist. This follows from unconscious selection during a long series of generations—that is, the preservation of the most approved individuals—without any wish or expectation of such a result on the part of the breeder. So again, if during many years two careful breeders rear animals of the same family, and do not compare them together or with a common standard, the animals are found to have become, to the surprise of their owners, slightly different.[18] Each breeder has impressed, as Von Nathusius well expresses it, the character of his own mind—his own taste and judgment—on his animals. What reason, then, can be assigned why similar results should not follow from the long-continued selection of the most admired women by those men of each tribe who were able to rear the greatest number of children? This would be unconscious selection, for an effect would be produced, independently of any wish or expectation on the part of the men who preferred certain women to others.

Let us suppose the members of a tribe, practicing some form of marriage, to spread over an unoccupied continent; they would soon split up into distinct hordes, separated from each other by various barriers, and still more effectually by the incessant wars between all barbarous nations. The hordes would thus be exposed to slightly different conditions and habits of life, and would sooner or later come to differ in some small degree. As soon as this occurred, each isolated tribe would form for itself a slightly different standard of beauty;[19] and then unconscious selection would come into action through the more powerful and leading men preferring certain women to others. Thus the differences between the tribes, at first very slight, would gradually and inevitably be more or less increased.

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[18] "The Variations of Animals and Plants under Domestication," vol. ii. pp. 210–217.

[19] An ingenious writer argues, from a comparison of the pictures of Raphael, Rubens, and modern French artists, that the idea of beauty is not absolutely the same even throughout Europe: see the "Lives of Haydn and Mozart," by Bombet (otherwise M. Beyle), English translation, p. 278.

With animals in a state of nature, many characters proper to the males, such as size, strength, special weapons, courage, and pugnacity, have been acquired through the law of battle. The semi-human progenitors of man, like their allies, the Quadrumana, will almost certainly have been thus modified; and, as savages still fight for the possession of their women, a similar process of selection has probably gone on in a greater or less degree to the present day. Other characters proper to the males of the lower animals, such as bright colors and various ornaments, have been acquired by the more attractive males having been preferred by the females. There are, however, exceptional cases in which the males are the selecters, instead of having been the selected. We recognize such cases by the females being more highly ornamented than the males—their ornamental characters having been transmitted exclusively or chiefly to their female offspring. One such case has been described in the order to which man belongs, that of the Rhesus monkey.

Man is more powerful in body and mind than woman, and in the savage state he keeps her in a far more abject state of bondage than does the male of any other animal; therefore it is not surprising that he should have gained the power of selection. Women are everywhere conscious of the value of their own beauty; and when they have the means, they take more delight in decorating themselves with all sorts of ornaments than do men. They borrow the plumes of male birds, with which nature has decked this sex in order to charm the females. As women have long been selected for beauty, it is not surprising that some of their successive variations should have been transmitted exclusively to the same sex; consequently that they should have transmitted beauty in a somewhat higher degree to their female than to their male offspring, and thus have become more beautiful, according to general opinion, than men. Women, however, certainly transmit most of their characters, including some beauty, to their offspring of both sexes; so that the continued preference by the men of each race for

the more attractive women, according to their standard of taste, will have tended to modify in the same manner all the individuals of both sexes belonging to the race.

With respect to the other form of sexual selection (which with the lower animals is much the more common), namely, when the females are the selecters, and accept only those males which excite or charm them most, we have reason to believe that it formerly acted on our progenitors. Man in all probability owes his beard, and perhaps some other characters, to inheritance from an ancient progenitor who thus gained his ornaments. But this form of selection may have occasionally acted during later times; for in utterly barbarous tribes the women have more power in choosing, rejecting, and tempting their lovers, or of afterward changing their husbands, than might have been expected. As this is a point of some importance, I will give in detail such evidence as I have been able to collect.

Hearne describes how a woman in one of the tribes of Arctic America repeatedly ran away from her husband and joined her lover; and with the Charruas of South America, according to Azara, divorce is quite optional. Among the Abipones, a man, on choosing a wife, bargains with the parents about the price. But "it frequently happens that the girl rescinds what has been agreed upon between the parents and the bridegroom, obstinately rejecting the very mention of marriage." She often runs away, hides herself, and thus eludes the bridegroom. Captain Musters, who lived with the Patagonians, says that their marriages are always settled by inclination; "if the parents make a match contrary to the daughter's will, she refuses and is never compelled to comply." In Tierra del Fuego a young man first obtains the consent of the parents by doing them some service, and then he attempts to carry off the girl; "but if she is unwilling, she hides herself in the woods until her admirer is heartily tired of looking for her, and gives up the pursuit; but this seldom happens." In the Fiji Islands the man seizes on the woman whom he wishes for his wife by act-

ual or pretended force; but "on reaching the home of her abductor, should she not approve of the match, she runs to some one who can protect her; if, however, she is satisfied, the matter is settled forthwith." With the Kalmucks there is a regular race between the bride and bridegroom, the former having a fair start; and Clarke "was assured that no instance occurs of a girl being caught, unless she has a partiality to the pursuer." Among the wild tribes of the Malay Archipelago there is also a racing match; and it appears from M. Bourien's account, as Sir J. Lubbock remarks, that "the race 'is not to the swift, nor the battle to the strong,' but to the young man who has the good fortune to please his intended bride." A similar custom, with the same result, prevails with the Koraks of North-eastern Asia.

Turning to Africa: The Kaffirs buy their wives, and girls are severely beaten by their fathers if they will not accept a chosen husband; but it is manifest, from many facts given by the Rev. Mr. Shooter, that they have considerable power of choice. Thus very ugly, though rich, men have been known to fail in getting wives. The girls, before consenting to be betrothed, compel the men to show themselves off, first in front and then behind and "exhibit their paces." They have been known to propose to a man, and they not rarely run away with a favored lover. So again, Mr. Leslie, who was intimately acquainted with the Kaffirs, says, "it is a mistake to imagine that a girl is sold by her father in the same manner, and with the same authority, with which he would dispose of a cow." Among the degraded Bushmen of South Africa, "when a girl has grown up to womanhood without having been betrothed, which, however, does not often happen, her lover must gain her approbation, as well as that of the parents." [20]

[20] Azara, "Voyages," etc., tom. ii. p. 23. Dobrizhoffer, "An Account of the Abipones," vol. ii., 1822, p. 207. Capt. Musters, in "Proc. R. Geograph. Soc.," vol. xv. p. 47. Williams on the Fiji Islanders, as quoted by Lubbock, "Origin of Civilization," 1870, p. 79. On the Fuegians, King and FitzRoy, "Voyages of the Adventure and Beagle," vol. ii., 1839, p. 182. On the Kal-

Mr. Winwood Reade made inquiries for me with respect to the negroes of Western Africa, and he informs me that "the women, at least among the more intelligent Pagan tribes, have no difficulty in getting the husbands whom they may desire, although it is considered unwomanly to ask a man to marry them. They are quite capable of falling in love, and of forming tender, passionate, and faithful attachments." Additional cases could be given.

We thus see that with savages the women are not in quite so abject a state in relation to marriage as has often been supposed. They can tempt the men whom they prefer, and can sometimes reject those whom they dislike, either before or after marriage. Preference on the part of the women, steadily acting in any one direction, would ultimately affect the character of the tribe; for the women would generally choose not merely the handsomest men, according to their standard of taste, but those who were at the same time best able to defend and support them. Such well-endowed pairs would commonly rear a larger number of offspring than the less favored. The same result would obviously follow, in a still more marked manner, if there was selection on both sides; that is if the more attractive and at the same time more powerful men were to prefer, and were preferred by, the more attractive women. And this double form of selection seems actually to have occurred, especially during the earlier periods of our long history.

We will now examine a little more closely some of the characters which distinguish the several races of man from one another and from the lower animals, namely, the greater or less deficiency of hair on the body, and the color of the skin. We need say nothing about the great diversity in the shape of the features and of the skull between the dif-

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mucks, quoted by M'Lennan, "Primitive Marriage," 1865, p. 32. On the Malays, Lubbock, ibid., p. 76. The Rev. J. Shooter, "On the Kafirs of Natal," 1857, pp. 52–60. Mr. D. Leslie, "Kafir Character and Customs," 1871, p. 4. On the Bushmen, Burchell, "Travels in S. Africa," vol. ii., 1824, p. 59. On the Koraks by McKennan, as quoted by Mr. Wake, in "Anthropologia," Oct. 1873, p. 75.

ferent races, as we have seen in the last chapter how different is the standard of beauty in these respects. These characters will therefore probably have been acted on through sexual selection; but we have no means of judging whether they have been acted on chiefly from the male or female side. The musical faculties of man have likewise been already discussed.

Absence of Hair on the Body, and its Development on the Face and Head.—From the presence of the woolly hair or lanugo on the human fœtus, and of rudimentary hairs scattered over the body during maturity, we may infer that man is descended from some animal which was born hairy and remained so during life. The loss of hair is an inconvenience and probably an injury to man, even in a hot climate, for he is thus exposed to the scorching of the sun, and to sudden chills, especially during wet weather. As Mr. Wallace remarks, the natives in all countries are glad to protect their naked backs and shoulders with some slight covering. No one supposes that the nakedness of the skin is any direct advantage to man; his body therefore cannot have been divested of hair through natural selection.[21] Nor, as shown in a former chapter, have we any evidence that this can be due to the direct action of climate, or that it is the result of correlated development.

The absence of hair on the body is to a certain extent a secondary sexual character; for in all parts of the world women are less hairy than men. Therefore we may reasonably suspect that this character has been gained through sexual selection. We know that the faces of several species of monkeys, and large surfaces at the posterior end of the

[21] "Contributions to the Theory of Natural Selection," 1870, p. 346. Mr. Wallace believes (p. 350) "that some intelligent power has guided or determined the development of man"; and he considers the hairless condition of the skin as coming under this head. The Rev. T. R. Stebbing, in commenting on this view ("Transactions of Devonshire Assoc. for Science," 1870), remarks, that had Mr. Wallace "employed his usual ingenuity on the question of man's hairless skin, he might have seen the possibility of its selection through its superior beauty or the health attaching to superior cleanliness."

body of other species, have been denuded of hair; and this we may safely attribute to sexual selection, for these surfaces are not only vividly colored, but sometimes, as with the male mandrill and female rhesus, much more vividly in the one sex than in the other, especially during the breeding season. I am informed by Mr. Bartlett that, as these animals gradually reach maturity, the naked surfaces grow larger compared with the size of their bodies. The hair, however, appears to have been removed, not for the sake of nudity, but that the color of the skin may be more fully displayed. So again with many birds, it appears as if the head and neck had been divested of feathers through sexual selection, to exhibit the brightly-colored skin.

As the body in woman is less hairy than in man, and as this character is common to all races, we may conclude that it was our female semi-human ancestors who were first divested of hair, and that this occurred at an extremely remote period before the several races had diverged from a common stock. While our female ancestors were gradually acquiring this new character of nudity, they must have transmitted it almost equally to their offspring of both sexes while young; so that its transmission, as with the ornaments of many mammals and birds, has not been limited either by sex or age. There is nothing surprising in a partial loss of hair having been esteemed as an ornament by our ape-like progenitors, for we have seen that innumerable strange characters have been thus esteemed by animals of all kinds, and have consequently been gained through sexual selection. Nor is it surprising that a slightly injurious character should have been thus acquired; for we know that this is the case with the plumes of certain birds, and with the horns of certain stags.

The females of some of the anthropoid apes, as stated in a former chapter, are somewhat less hairy on the under surface than the males; and here we have what might have afforded a commencement for the process of denudation. With respect to the completion of the process through

sexual selection, it is well to bear in mind the New Zealand proverb, "There is no woman for a hairy man." All who have seen photographs of the Siamese hairy family will admit how ludicrously hideous is the opposite extreme of excessive hairiness. And the king of Siam had to bribe a man to marry the first hairy woman in the family; and she transmitted this character to her young offspring of both sexes.[22]

Some races are much more hairy than others, especially the males; but it must not be assumed that the more hairy races, such as the European, have retained their primordial condition more completely than the naked races, such as the Kalmucks or Americans. It is more probable that the hairiness of the former is due to partial reversion; for characters which have been at some former period long inherited are always apt to return. We have seen that idiots are often very hairy, and they are apt to revert in other characters to a lower animal type. It does not appear that a cold climate has been influential in leading to this kind of reversion; excepting perhaps with the negroes who have been reared during several generations in the United States,[23] and possibly with the Ainos, who inhabit the northern islands of the Japan archipelago. But the laws of inheritance are so complex that we can seldom understand their action. If the greater hairiness of certain races be the result of reversion, unchecked by any form of selection, its extreme vari-

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[22] "The Variation of Animals and Plants under Domestication," vol. ii., 1868, p. 327.

[23] "Investigations into Military and Anthropological statistics of American Soldiers," by B. A. Gould, 1869, p. 568: Observations were carefully made on the hairiness of 2,129 black and colored soldiers while they were bathing; and by looking to the published table, "it is manifest at a glance that there is but little, if any, difference between the white and the black races in this respect." It is, however, certain that negroes in their native and much hotter land of Africa have remarkably smooth bodies. It should be particularly observed that both pure blacks and mulattoes were included in the above enumeration; and this is an unfortunate circumstance, as, in accordance with a principle the truth of which I have elsewhere proved, crossed races of man would be eminently liable to revert to the primordial hairy character of their early ape-like progenitors.

ability, even within the limits of the same race, ceases to be remarkable.[24]

With respect to the beard in man, if we turn to our best guide, the Quadrumana, we find beards equally developed in both sexes in many species, but in some, either confined to the males, or more developed in them than in the females. From this fact and from the curious arrangement, as well as the bright colors of the hair about the heads of many monkeys, it is highly probable, as before explained, that the males first acquired their beards through sexual selection as an ornament, transmitting them in most cases, equally or nearly so, to their offspring of both sexes. We know from Eschricht[25] that with mankind the female as well as the male fœtus is furnished with much hair on the face, especially round the mouth; and this indicates that we are descended from progenitors of whom both sexes were bearded. It appears, therefore, at first sight probable that man has retained his beard from a very early period, while woman lost her beard at the same time that her body became almost completely divested of hair. Even the color of our beards seems to have been inherited from an ape-like progenitor; for when there is any difference in tint between the hair of the head and the beard, the latter is lighter colored in all monkeys and in man. In those Quadrumana in which the male has a larger beard than that of the female, it is fully developed only at maturity, just as with mankind; and it is possible that only the later stages of development have been retained by man. In opposition to this view of the retention of the beard from an early period is the fact of its great variability in different races, and even within

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[24] Hardly any view advanced in this work has met with so much disfavor (see, for instance, Spengel, "Die Fortschritte des Darwinismus," 1874, p. 80) as the above explanation of the loss of hair in mankind through sexual selection; but none of the opposed arguments seem to me of much weight, in comparison with the facts showing that the nudity of the skin is to a certain extent a secondary sexual character in man and in some of the Quadrumana.

[25] "Ueber die Richtung der Haare am Menschlichen Körpe," in Müller's "Archiv für Anat. und Phys.," 1837, s. 40.

the same race; for this indicates reversion—long lost characters being very apt to vary on reappearance.

Nor must we overlook the part which sexual selection may have played in later times; for we know that, with savages, the men of the beardless races take infinite pains in eradicating every hair from their faces as something odious, while the men of the bearded races feel the greatest pride in their beards. The women, no doubt, participate in these feelings, and, if so, sexual selection can hardly have failed to have effected something in the course of later times. It is also possible that the long-continued habit of eradicating the hair may have produced an inherited effect. Dr. Brown-Séquard has shown that if certain animals are operated on in a particular manner, their offspring are affected. Further evidence could be given of the inheritance of the effects of mutilations; but a fact lately ascertained by Mr. Salvin[26] has a more direct bearing on the present question; for he has shown that the motmots, which are known habitually to bite off the barbs of the two central tail feathers, have the barbs of these feathers naturally somewhat reduced.[27] Nevertheless, with mankind, the habit of eradicating the beard and the hairs on the body would probably not have arisen until these had already become by some means reduced.

It is difficult to form any judgment as to how the hair on the head became developed to its present great length in many races. Eschricht[28] states that in the human fœtus the hair on the face during the fifth month is longer than that on the head; and this indicates that our semi-human progenitors were not furnished with long tresses, which must therefore have been a late acquisition. This is likewise indicated by the extraordinary difference in the length

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[26] "On the tail feathers of Momotus," "Proc. Zoolog. Soc.," 1873, p. 429.

[27] Mr. Sproat has suggested ("Scenes and Studies of Savage Life," 1868, p. 25) this same view. Some distinguished ethnologists, among others M. Gosse of Geneva, believe that artificial modifications of the skull tend to be inherited.

[28] "Ueber die Richtung," ibid., s. 40.

of the hair in the different races; in the negro the hair forms a mere curly mat; with us it is of great length, and with the American natives it not rarely reaches to the ground. Some species of Semnopithecus have their heads covered with moderately long hair, and this probably serves as an ornament and was acquired through sexual selection. The same view may perhaps be extended to mankind, for we know that long tresses are now, and were formerly, much admired, as may be observed in the works of almost every poet. St. Paul says, "if a woman have long hair, it is a glory to her"; and we have seen that in North America a chief was elected solely from the length of his hair.

Color of the Skin.—The best kind of evidence that in man the color of the skin has been modified through sexual selection is scanty; for in most races the sexes do not differ in this respect, and only slightly, as we have seen, in others. We know, however, from the many facts already given, that the color of the skin is regarded by the men of all races as a highly important element in their beauty; so that it is a character which would be likely to have been modified through selection, as has occurred in innumerable instances with the lower animals. It seems at first sight a monstrous supposition that the jet-blackness of the negro should have been gained through sexual selection; but this view is supported by various analogies, and we know that negroes admire their own color. With mammals, when the sexes differ in color, the male is often black or much darker than the female; and it depends merely on the form of inheritance whether this or any other tint is transmitted to both sexes or to one alone. The resemblance to a negro in miniature of *Pithecia satanas*, with his jet-black skin, white rolling eyeballs, and hair parted on the top of the head, is almost ludicrous.

The color of the face differs much more widely in the various kinds of monkeys than it does in the races of man; and we have some reason to believe that the red, blue,

orange, almost white and black tints of their skin, even when common to both sexes, as well as the bright colors of their fur, and the ornamental tufts about the head, have all been acquired through sexual selection. As the order of development during growth generally indicates the order in which the characters of a species have been developed and modified during previous generations; and as the newly born infants of the various races of man do not differ nearly as much in color as do the adults, although their bodies are as completely destitute of hair, we have some slight evidence that the tints of the different races were acquired at a period subsequent to the removal of the hair, which must have occurred at a very early period in the history of man.

Summary.—We may conclude that the greater size, strength, courage, pugnacity, and energy of man, in comparison with woman, were acquired during primeval times, and have subsequently been augmented, chiefly through the contests of rival males for the possession of the females. The greater intellectual vigor and power of invention in man is probably due to natural selection, combined with the inherited effects of habit, for the most able men will have succeeded best in defending and providing for themselves and for their wives and offspring. As far as the extreme intricacy of the subject permits us to judge, it appears that our male ape-like progenitors acquired their beards as an ornament to charm or excite the opposite sex, and transmitted them only to their male offspring. The females apparently first had their bodies denuded of hair, also as a sexual ornament; but they transmitted this character almost equally to both sexes. It is not improbable that the females were modified in other respects for the same purpose and by the same means; so that women have acquired sweeter voices and become more beautiful than men.

It deserves attention that with mankind the conditions were in many respects much more favorable for sexual

selection, during a very early period, when man had only just attained to the rank of manhood, than during later times. For he would then, as we may safely conclude, have been guided more by his instinctive passions, and less by foresight or reason. He would have jealously guarded his wife or wives. He would not have practiced infanticide; nor valued his wives merely as useful slaves; nor have been betrothed to them during infancy. Hence we may infer that the races of men were differentiated, as far as sexual selection is concerned, in chief part, at a very remote epoch; and this conclusion throws light on the remarkable fact that at the most ancient period of which we have as yet any record the races of man had already come to differ nearly or quite as much as they do at the present day.

The views here advanced, on the part which sexual selection has played in the history of man, want scientific precision. He who does not admit this agency in the case of the lower animals will disregard all that I have written in the later chapters on man. We cannot positively say that this character, but not that, has been thus modified; it has, however, been shown that the races of man differ from each other and from their nearest allies, in certain characters which are of no service to them in their daily habits of life, and which it is extremely probable would have been modified through sexual selection. We have seen that with the lowest savages the people of each tribe admire their own characteristic qualities—the shape of the head and face, the squareness of the cheek-bones, the prominence or depression of the nose, the color of the skin, the length of the hair on the head, the absence of hair on the face and body, or the presence of a great beard, and so forth. Hence these and other such points could hardly fail to be slowly and gradually exaggerated, from the more powerful and able men in each tribe, who would succeed in rearing the largest number of offspring, having selected during many generations for their wives the most strongly

characterized and therefore most attractive women. For my own part, I conclude that of all the causes which have led to the differences in external appearance between the races of man, and to a certain extent between man and the lower animals, sexual selection has been the most efficient.

CHAPTER XXI

GENERAL SUMMARY AND CONCLUSION

Main conclusion that man is descended from some lower form—Manner of development—Genealogy of man—Intellectual and moral faculties —Sexual selection—Concluding remarks

A BRIEF summary would be sufficient to recall to the reader's mind the more salient points in this work. Many of the views which have been advanced are highly speculative, and some no doubt will prove erroneous; but I have in every case given the reasons which have led me to one view rather than to another. It seemed worth while to try how far the principle of evolution would throw light on some of the more complex problems in the natural history of man. False facts are highly injurious to the progress of science, for they often endure long; but false views, if supported by some evidence, do little harm, for every one takes a salutary pleasure in proving their falseness; and when this is done, one path toward error is closed and the road to truth is often at the same time opened.

The main conclusion here arrived at, and now held by many naturalists who are well competent to form a sound judgment, is that man is descended from some less highly organized form. The grounds upon which this conclusion rests will never be shaken, for the close similarity between man and the lower animals in embryonic development, as well as in innumerable points of structure and constitution, both of high and of the most trifling importance—the rudi-

ments which he retains, and the abnormal reversions to which he is occasionally liable—are facts which cannot be disputed. They have long been known, but until recently they told us nothing with respect to the origin of man. Now when viewed by the light of our knowledge of the whole organic world, their meaning is unmistakable. The great principle of evolution stands up clear and firm, when these groups of facts are considered in connection with others, such as the mutual affinities of the members of the same group, their geographical distribution in past and present times, and their geological succession. It is incredible that all these facts should speak falsely. He who is not content to look, like a savage, at the phenomena of nature as disconnected, cannot any longer believe that man is the work of a separate act of creation. He will be forced to admit that the close resemblance of the embryo of man to that, for instance, of a dog—the construction of his skull, limbs, and whole frame on the same plan with that of other mammals, independently of the uses to which the parts may be put—the occasional reappearance of various structures, for instance of several muscles, which man does not normally possess, but which are common to the Quadrumana—and a crowd of analogous facts—all point in the plainest manner to the conclusion that man is the co-descendant with other mammals of a common progenitor.

We have seen that man incessantly presents individual differences in all parts of his body and in his mental faculties. These differences or variations seem to be induced by the same general causes, and to obey the same laws as with the lower animals. In both cases similar laws of inheritance prevail. Man tends to increase at a greater rate than his means of subsistence; consequently he is occasionally subjected to a severe struggle for existence, and natural selection will have effected whatever lies within its scope. A succession of strongly marked variations of a similar nature is by no means requisite; slight fluctuating differences in the individual suffice for the work of natural selection;

not that we have any reason to suppose that, in the same species, all parts of the organization tend to vary to the same degree. We may feel assured that the inherited effects of the long-continued use or disuse of parts will have done much in the same direction with natural selection. Modifications formerly of importance, though no longer of any special use, are long inherited. When one part is modified, other parts change through the principle of correlation, of which we have instances in many curious cases of correlated monstrosities. Something may be attributed to the direct and definite action of the surrounding conditions of life, such as abundant food, heat, or moisture; and lastly, many characters of slight physiological importance, some indeed of considerable importance, have been gained through sexual selection.

No doubt man, as well as every other animal, presents structures which seem to our limited knowledge not to be now of any service to him, nor to have been so formerly, either for the general conditions of life or in the relations of one sex to the other. Such structures cannot be accounted for by any form of selection, or by the inherited effects of the use and disuse of parts. We know, however, that many strange and strongly marked peculiarities of structure occasionally appear in our domesticated productions, and if their unknown causes were to act more uniformly, they would probably become common to all the individuals of the species. We may hope hereafter to understand something about the causes of such occasional modifications, especially through the study of monstrosities; hence the labors of experimentalists, such as those of M. Camille Dareste, are full of promise for the future. In general we can only say that the cause of each slight variation and of each monstrosity lies much more in the constitution of the organism than in the nature of the surrounding conditions; though new and changed conditions certainly play an important part in exciting organic changes of many kinds.

Through the means just specified, aided perhaps by oth-

ers as yet undiscovered, man has been raised to his present state. But since he attained to the rank of manhood, he has diverged into distinct races, or, as they may be more fitly called, sub-species. Some of these, such as the Negro and European, are so distinct that, if specimens had been brought to a naturalist without any further information, they would undoubtedly have been considered by him as good and true species. Nevertheless all the races agree in so many unimportant details of structure and in so many mental peculiarities, that these can be accounted for only by inheritance from a common progenitor; and a progenitor thus characterized would probably deserve to rank as man.

It must not be supposed that the divergence of each race from the other races, and of all from a common stock, can be traced back to any one pair of progenitors. On the contrary, at every stage in the process of modification, all the individuals which were in any way better fitted for their conditions of life, though in different degrees, would have survived in greater numbers than the less well fitted. The process would have been like that followed by man, when he does not intentionally select particular individuals, but breeds from all the superior individuals, and neglects the inferior. He thus slowly but surely modifies his stock, and unconsciously forms a new strain. So with respect to modifications acquired independently of selection, and due to variations arising from the nature of the organism and the action of the surrounding conditions, or from changed habits of life, no single pair will have been modified much more than the other pairs inhabiting the same country, for all will have been continually blended through free intercrossing.

By considering the embryological structure of man—the homologies which he presents with the lower animals—the rudiments which he retains—and the reversions to which he is liable, we can partly recall in imagination the former condition of our early progenitors; and can approximately place them in their proper place in the zoological series.

We thus learn that man is descended from a hairy, tailed quadruped, probably arboreal in its habits, and an inhabitant of the Old World. This creature, if its whole structure had been examined by a naturalist, would have been classed among the Quadrumana, as surely as the still more ancient progenitor of the Old and New World monkeys. The Quadrumana and all the higher mammals are probably derived from an ancient marsupial animal, and this through a long line of diversified forms, from some amphibian-like creature, and this again from some fish-like animal. In the dim obscurity of the past we can see that the early progenitor of all the Vertebrata must have been an aquatic animal, provided with branchiæ, with the two sexes united in the same individual, and with the most important organs of the body (such as the brain and heart) imperfectly or not at all developed. This animal seems to have been more like the larvæ of the existing marine Ascidians than any other known form.

The high standard of our intellectual powers and moral disposition is the greatest difficulty which presents itself, after we have been driven to this conclusion on the origin of man. But every one who admits the principle of evolution must see that the mental powers of the higher animals, which are the same in kind with those of man, though so different in degree, are capable of advancement. Thus the interval between the mental powers of one of the higher apes and of a fish, or between those of an ant and scale-insect, is immense; yet their development does not offer any special difficulty; for, with our domesticated animals, the mental faculties are certainly variable, and the variations are inherited. No one doubts that they are of the utmost importance to animals in a state of nature. Therefore the conditions are favorable for their development through natural selection. The same conclusion may be extended to man; the intellect must have been all-important to him, even at a very remote period, as enabling him

to invent and use language, to make weapons, tools, traps, etc., whereby, with the aid of his social habits, he long ago became the most dominant of all living creatures.

A great stride in the development of the intellect will have followed, as soon as the half art and half instinct of language came into use; for the continued use of language will have reacted on the brain and produced an inherited effect; and this again will have reacted on the improvement of language. As Mr. Chauncey Wright[1] has well remarked, the largeness of the brain in man, relatively to his body, compared with the lower animals, may be attributed in chief part to the early use of some simple form of language—that wonderful engine which affixes signs to all sorts of objects and qualities, and excites trains of thought which would never arise from the mere impression of the senses, or if they did arise could not be followed out. The higher intellectual powers of man, such as those of ratiocination, abstraction, self-consciousness, etc., probably follow from the continued improvement and exercise of the other mental faculties.

The development of the moral qualities is a more interesting problem. The foundation lies in the social instincts, including under this term the family ties. These instincts are highly complex, and in the case of the lower animals give special tendencies toward certain definite actions; but the more important elements are love, and the distinct emotion of sympathy. Animals endowed with the social instincts take pleasure in one another's company, warn one another of danger, defend and aid one another in many ways. These instincts do not extend to all the individuals of the species, but only to those of the same community. As they are highly beneficial to the species, they have in all probability been acquired through natural selection.

A moral being is one who is capable of reflecting on

[1] "On the Limits of Natural Selection," in the "North American Review," Oct. 1870, p. 295.

his past actions and their motives—of approving of some and disapproving of others; and the fact that man is the one being who certainly deserves this designation, is the greatest of all distinctions between him and the lower animals. But in the fourth chapter I have endeavored to show that the moral sense follows, first, from the enduring and ever-present nature of the social instincts; secondly, from man's appreciation of the approbation and disapprobation of his fellows; and thirdly, from the high activity of his mental faculties, with past impressions extremely vivid; and in these latter respects he differs from the lower animals. Owing to this condition of mind, man cannot avoid looking both backward and forward, and comparing past impressions. Hence after some temporary desire or passion has mastered his social instincts, he reflects and compares the now weakened impression of such past impulses with the ever-present social instincts, and he then feels that sense of dissatisfaction which all unsatisfied instincts leave behind them; he therefore resolves to act differently for the future—and this is conscience. Any instinct permanently stronger or more enduring than another gives rise to a feeling which we express by saying that it ought to be obeyed. A pointer dog, if able to reflect on his past conduct, would say to himself, I ought (as indeed we say of him) to have pointed at that hare and not have yielded to the passing temptation of hunting it.

Social animals are impelled partly by a wish to aid the members of their community in a general manner, but more commonly to perform certain definite actions. Man is impelled by the same general wish to aid his fellows; but has few or no special instincts. He differs also from the lower animals in the power of expressing his desires by words, which thus become a guide to the aid required and bestowed. The motive to give aid is likewise much modified in man: it no longer consists solely of a blind instinctive impulse, but is much influenced by the praise or blame of his fellows. The appreciation and the bestowal of praise

and blame both rest on sympathy; and this emotion, as we have seen, is one of the most important elements of the social instincts. Sympathy, though gained as an instinct, is also much strengthened by exercise or habit. As all men desire their own happiness, praise or blame is bestowed on actions and motives according as they lead to this end; and as happiness is an essential part of the general good, the greatest-happiness principle indirectly serves as a nearly safe standard of right and wrong. As the reasoning powers advance and experience is gained, the remoter effects of certain lines of conduct on the character of the individual, and on the general good, are perceived; and then the self-regarding virtues come within the scope of public opinion, and receive praise, and their opposites blame. But with the less civilized nations reason often errs, and many bad customs and base superstitions come within the same scope, and are then esteemed as high virtues, and their breach as heavy crimes.

The moral faculties are generally and justly esteemed as of higher value than the intellectual powers. But we should bear in mind that the activity of the mind in vividly recalling past impressions is one of the fundamental, though secondary, bases of conscience. This affords the strongest argument for educating and stimulating in all possible ways the intellectual faculties of every human being. No doubt a man with a torpid mind, if his social affections and sympathies are well developed, will be led to good actions, and may have a fairly sensitive conscience. But whatever renders the imagination more vivid, and strengthens the habit of recalling and comparing past impressions, will make the conscience more sensitive, and may even somewhat compensate for weak social affections and sympathies.

The moral nature of man has reached its present standard partly through the advancement of his reasoning powers, and consequently of a just public opinion, but especially from his sympathies having been rendered more tender and

widely diffused through the effects of habit, example, instruction, and reflection. It is not improbable that after long practice virtuous tendencies may be inherited. With the more civilized races, the conviction of the existence of an all-seeing Deity has had a potent influence on the advance of morality. Ultimately man does not accept the praise or blame of his fellows as his sole guide, though few escape this influence, but his habitual convictions, controlled by reason, afford him the safest rule. His conscience then becomes the supreme judge and monitor. Nevertheless the first foundation or origin of the moral sense lies in the social instincts, including sympathy; and these instincts no doubt were primarily gained, as in the case of the lower animals, through natural selection.

The belief in God has often been advanced as not only the greatest, but the most complete of all the distinctions between man and the lower animals. It is, however, impossible, as we have seen, to maintain that this belief is innate or instinctive in man. On the other hand, a belief in all-pervading spiritual agencies seems to be universal; and apparently follows from a considerable advance in man's reason, and from a still greater advance in his faculties of imagination, curiosity, and wonder. I am aware that the assumed instinctive belief in God has been used by many persons as an argument for His existence. But this is a rash argument, as we should thus be compelled to believe in the existence of many cruel and malignant spirits, only a little more powerful than man; for the belief in them is far more general than in a beneficent Deity. The idea of a universal and beneficent Creator does not seem to arise in the mind of man until he has been elevated by long-continued culture.

He who believes in the advancement of man from some low organized form will naturally ask, How does this bear on the belief in the immortality of the soul? The barbarous races of man, as Sir J. Lubbock has shown, possess no

clear belief of this kind; but arguments derived from the primeval beliefs of savages are, as we have just seen, of little or no avail. Few persons feel any anxiety from the impossibility of determining at what precise period in the development of the individual, from the first trace of a minute germinal vesicle, man becomes an immortal being; and there is no greater cause for anxiety because the period cannot possibly be determined in the gradually ascending organic scale.[2]

I am aware that the conclusions arrived at in this work will be denounced by some as highly irreligious; but he who denounces them is bound to show why it is more irreligious to explain the origin of man as a distinct species by descent from some lower form, through the laws of variation and natural selection, than to explain the birth of the individual through the laws of ordinary reproduction. The birth both of the species and of the individual are equally parts of that grand sequence of events which our minds refuse to accept as the result of blind chance. The understanding revolts at such a conclusion, whether or not we are able to believe that every slight variation of structure—the union of each pair in marriage—the dissemination of each seed—and other such events, have all been ordained for some special purpose.

Sexual selection has been treated at great length in this work; for, as I have attempted to show, it has played an important part in the history of the organic world. I am aware that much remains doubtful, but I have endeavored to give a fair view of the whole case. In the lower divisions of the animal kingdom, sexual selection seems to have done nothing: such animals are often affixed for life to the same spot, or have the sexes combined in the same individual, or, what is still more important, their perceptive and intellectual faculties are not sufficiently advanced to

[2] The Rev. J. A. Picton gives a discussion to this effect in his "New Theories and the Old Faith," 1870.

allow of the feelings of love and jealousy, or of the exertion of choice. When, however, we come to the Arthropoda and Vertebrata, even to the lowest classes in these two great Sub-Kingdoms, sexual selection has effected much.

In the several great classes of the animal kingdom—in mammals, birds, reptiles, fishes, insects, and even crustaceans—the differences between the sexes follow nearly the same rules. The males are almost always the wooers; and they alone are armed with special weapons for fighting with their rivals. They are generally stronger and larger than the females, and are endowed with the requisite qualities of courage and pugnacity. They are provided, either exclusively or in a much higher degree than the females, with organs for vocal or instrumental music, and with odoriferous glands. They are ornamented with infinitely diversified appendages, and with the most brilliant or conspicuous colors, often arranged in elegant patterns, while the females are unadorned. When the sexes differ in more important structures, it is the male which is provided with special sense organs for discovering the female, with locomotive organs for reaching her, and often with prehensile organs for holding her. These various structures for charming or securing the female are often developed in the male during only part of the year, namely, the breeding season. They have in many cases been more or less transferred to the females; and in the latter case they often appear in her as mere rudiments. They are lost or never gained by the males after emasculation. Generally they are not developed in the male during early youth, but appear a short time before the age for reproduction. Hence in most cases the young of both sexes resemble each other; and the female somewhat resembles her young offspring throughout life. In almost every great class a few anomalous cases occur, where there has been an almost complete transposition of the characters proper to the two sexes; the females assuming characters which properly belong to the males. This surprising uniformity in the laws regulating the dif-

ferences between the sexes in so many and such widely separated classes is intelligible if we admit the action of one common cause, namely, sexual selection.

Sexual selection depends on the success of certain individuals over others of the same sex, in relation to the propagation of the species; while natural selection depends on the success of both sexes, at all ages, in relation to the general conditions of life. The sexual struggle is of two kinds: in the one it is between the individuals of the same sex, generally the males, in order to drive away or kill their rivals, the females remaining passive; while in the other, the struggle is likewise between the individuals of the same sex, in order to excite or charm those of the opposite sex, generally the females, which no longer remain passive, but select the more agreeable partners. This latter kind of selection is closely analogous to that which man unintentionally, yet effectually, brings to bear on his domesticated productions, when he preserves during a long period the most pleasing or useful individuals, without any wish to modify the breed.

The laws of inheritance determine whether characters gained through sexual selection by either sex shall be transmitted to the same sex, or to both, as well as the age at which they shall be developed. It appears that variations arising late in life are commonly transmitted to one and the same sex. Variability is the necessary basis for the action of selection, and is wholly independent of it. It follows from this, that variations of the same general nature have often been taken advantage of and accumulated through sexual selection in relation to the propagation of the species, as well as through natural selection in relation to the general purposes of life. Hence secondary sexual characters, when equally transmitted to both sexes, can be distinguished from ordinary specific characters only by the light of analogy. The modifications acquired through sexual selection are often so strongly pronounced that the two sexes have frequently been ranked as distinct species, or even as

distinct genera. Such strongly marked differences must be in some manner highly important; and we know that they have been acquired in some instances at the cost not only of inconvenience, but of exposure to actual danger.

The belief in the power of sexual selection rests chiefly on the following considerations: Certain characters are confined to one sex; and this alone renders it probable that in most cases they are connected with the act of reproduction. In innumerable instances these characters are fully developed only at maturity, and often during only a part of the year, which is always the breeding season. The males (passing over a few exceptional cases) are the more active in courtship; they are the better armed, and are rendered the more attractive in various ways. It is to be especially observed that the males display their attractions with elaborate care in the presence of the females, and that they rarely or never display them excepting during the season of love. It is incredible that all this should be purposeless. Lastly, we have distinct evidence, with some quadrupeds and birds, that the individuals of one sex are capable of feeling a strong antipathy or preference for certain individuals of the other sex.

Bearing in mind these facts, and the marked results of man's unconscious selection, when applied to domesticated animals and cultivated plants, it seems to me almost certain that if the individuals of one sex were during a long series of generations to prefer pairing with certain individuals of the other sex, characterized in some peculiar manner, the offspring would slowly but surely become modified in this same manner. I have not attempted to conceal that, excepting when the males are more numerous than the females, or when polygamy prevails, it is doubtful how the more attractive males succeed in leaving a larger number of offspring to inherit their superiority in ornaments or other charms than the less attractive males; but I have shown that this would probably follow from the females—especially the more vigorous ones, which would be the first to

breed—preferring not only the more attractive, but at the same time the more vigorous and victorious males.

Although we have some positive evidence that birds appreciate bright and beautiful objects, as with the bower-birds of Australia, and although they certainly appreciate the power of song, yet I fully admit that it is astonishing that the females of many birds and some mammals should be endowed with sufficient taste to appreciate ornaments, which we have reason to attribute to sexual selection; and this is even more astonishing in the case of reptiles, fish, and insects. But we really know little about the minds of the lower animals. It cannot be supposed, for instance, that male birds of paradise or peacocks should take such pains in erecting, spreading, and vibrating their beautiful plumes before the females for no purpose. We should remember the fact, given on excellent authority in a former chapter, that several peahens, when debarred from an admired male, remained widows during a whole season rather than pair with another bird.

Nevertheless I know of no fact in natural history more wonderful than that the female Argus pheasant should appreciate the exquisite shading of the ball-and-socket ornaments and the elegant patterns on the wing feathers of the male. He who thinks that the male was created as he now exists must admit that the great plumes which prevent the wings from being used for flight, and which are displayed during courtship and at no other time in a manner quite peculiar to this one species, were given to him as an ornament. If so, he must likewise admit that the female was created and endowed with the capacity of appreciating such ornaments. I differ only in the conviction that the male Argus pheasant acquired his beauty gradually, through the preference of the females during many generations for the more highly ornamented males; the æsthetic capacity of the females having been advanced through exercise or habit, just as our own taste is gradually improved. In the male, through the fortunate chance of a few feathers being left

unchanged, we can distinctly trace how simple spots with a little fulvous shading on one side may have been developed by small steps into the wonderful ball-and-socket ornaments; and it is probable that they were actually thus developed.

Every one who admits the principle of evolution, and yet feels great difficulty in admitting that female mammals, birds, reptiles, and fish could have acquired the high taste implied by the beauty of the males, and which generally coincides with our own standard, should reflect that the nerve cells of the brain in the highest as well as in the lowest members of the Vertebrate series, are derived from those of the common progenitor of this great Kingdom. For we can thus see how it has come to pass that certain mental faculties, in various and widely distinct groups of animals, have been developed in nearly the same manner and to nearly the same degree.

The reader who has taken the trouble to go through the several chapters devoted to sexual selection will be able to judge how far the conclusions at which I have arrived are supported by sufficient evidence. If he accepts these conclusions, he may, I think, safely extend them to mankind; but it would be superfluous here to repeat what I have so lately said on the manner in which sexual selection apparently has acted on man, both on the male and female side, causing the two sexes to differ in body and mind, and the several races to differ from each other in various characters, as well as from their ancient and lowly organized progenitors.

He who admits the principle of sexual selection will be led to the remarkable conclusion that the nervous system not only regulates most of the existing functions of the body, but has indirectly influenced the progressive development of various bodily structures and of certain mental qualities. Courage, pugnacity, perseverance, strength and size of body, weapons of all kinds, musical organs, both vocal and instrumental, bright colors and ornamental appendages, have all been indirectly gained by the one sex or the other,

through the exertion of choice, the influence of love and jealousy, and the appreciation of the beautiful in sound, color, or form; and these powers of the mind manifestly depend on the development of the brain.

Man scans with scrupulous care the character and pedigree of his horses, cattle, and dogs before he matches them; but when he comes to his own marriage he rarely, or never, takes any such care. He is impelled by nearly the same motives as the lower animals, when they are left to their own free choice, though he is in so far superior to them that he highly values mental charms and virtues. On the other hand, he is strongly attracted by mere wealth or rank. Yet he might by selection do something not only for the bodily constitution and frame of his offspring, but for their intellectual and moral qualities. Both sexes ought to refrain from marriage if they are in any marked degree inferior in body or mind; but such hopes are Utopian, and will never be even partially realized until the laws of inheritance are thoroughly known. Every one does good service who aids toward this end. When the principles of breeding and inheritance are better understood, we shall not hear ignorant members of our legislature rejecting with scorn a plan for ascertaining whether or not consanguineous marriages are injurious to man.

The advancement of the welfare of mankind is a most intricate problem: all ought to refrain from marriage who cannot avoid abject poverty for their children; for poverty is not only a great evil, but tends to its own increase by leading to recklessness in marriage. On the other hand, as Mr. Galton has remarked, if the prudent avoid marriage, while the reckless marry, the inferior members tend to supplant the better members of society. Man, like every other animal, has no doubt advanced to his present high condition through a struggle for existence consequent on his rapid multiplication; and if he is to advance still higher, it is to be feared that he must remain subject to a severe

struggle. Otherwise he would sink into indolence, and the more gifted men would not be more successful in the battle of life than the less gifted. Hence our natural rate of increase, though leading to many and obvious evils, must not be greatly diminished by any means. There should be open competition for all men; and the most able should not be prevented by laws or customs from succeeding best and rearing the largest number of offspring. Important as the struggle for existence has been, and even still is, yet, as far as the highest part of man's nature is concerned, there are other agencies more important. For the moral qualities are advanced, either directly or indirectly, much more through the effects of habit, the reasoning powers, instruction, religion, etc., than through natural selection; though to this latter agency may be safely attributed the social instincts which afforded the basis for the development of the moral sense.

The main conclusion arrived at in this work, namely, that man is descended from some lowly organized form, will, I regret to think, be highly distasteful to many. But there can hardly be a doubt that we are descended from barbarians. The astonishment which I felt on first seeing a party of Fuegians on a wild and broken shore will never be forgotten by me, for the reflection at once rushed into my mind—such were our ancestors. These men were absolutely naked and bedaubed with paint, their long hair was tangled, their mouths frothed with excitement, and their expression was wild, startled, and distrustful. They possessed hardly any arts, and, like wild animals, lived on what they could catch; they had no government, and were merciless to every one not of their own small tribe. He who has seen a savage in his native land will not feel much shame if forced to acknowledge that the blood of some more humble creature flows in his veins. For my own part, I would as soon be descended from that heroic little monkey who braved his dreaded enemy in order to save the

life of his keeper, or from that old baboon, who, descending from the mountains, carried away in triumph his young comrade from a crowd of astonished dogs—as from a savage who delights to torture his enemies, offers up bloody sacrifices, practices infanticide without remorse, treats his wives like slaves, knows no decency, and is haunted by the grossest superstitions.

Man may be excused for feeling some pride at having risen, though not through his own exertions, to the very summit of the organic scale; and the fact of his having thus risen, instead of having been aboriginally placed there, may give him hope for a still higher destiny in the distant future. But we are not here concerned with hopes or fears, only with the truth as far as our reason permits us to discover it; and I have given the evidence to the best of my ability. We must, however, acknowledge, as it seems to me, that man, with all his noble qualities, with sympathy which feels for the most debased, with benevolence which extends not only to other men but to the humblest living creature, with his godlike intellect which has penetrated into the movements and constitution of the solar system—with all these exalted powers—Man still bears in his bodily frame the indelible stamp of his lowly origin.

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DARWIN, CHARLES ROBERT

The descent of mand & selection according to sex.


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