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THE

DESCENT OF MAN,

AND

SELECTION IN RELATION TO SEX.

By CHARLES DARWIN, M.A., F.R.S., &c.

IN TWO VOLUMES.—Vol. II.

WITH ILLUSTRATIONS.

LONDON:
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1871.

ERRATA.

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31	6	prostratica	prostatica.
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Vol. I. pp. 297-299.—I have fallen into a serious and unfortunate error, in relation to the sexual differences of animals, in attempting to explain what seemed to me a singular coincidence in the late period of life at which the necessary variations have arisen in many cases, and the late period at which sexual selection acts. The explanation given is wholly erroneous, as I have discovered by working out an illustration in figures. Moreover, the supposed coincidence of period is far from general, and is not remarkable; for, as I have elsewhere attempted to show, variations arising early in life have often been accumulated through sexual selection, being then commonly transmitted to both sexes. On the other hand, variations arising late in life cannot fail to coincide approximately in period with that of the process of sexual selection. Allusions to these erroneous views reappear in Vol. II. pp. 161 and 237.

1

SEXUAL SELECTION.

CHAPTER XII.

Secondary Sexual Characters of Fishes, Amphibians, and Reptiles.

Fishes: Courtship and battles of the males—Larger size of the females—Males, bright colours and ornamental appendages; other strange characters—Colours and appendages acquired by the males during the breeding-season alone—Fishes with both sexes brilliantly coloured—Protective colours—The less conspicuous colours 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 colour between the sexes—Vocal organs. Reptiles: Chelonians—Crocodiles—Snakes, colours in some cases protective—Lizards, battles of—Ornamental appendages— Strange differences in structure between the sexes—Colours—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, namely 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 so 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 the 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 inwards and downwards 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] 2

Owing to the element which fishes inhabit, little is known about their courtship, and not much about their battles. 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 endeavours to push her with his snout, and then tries to pull her by the tail and side-spine to the nest."[2] The males are said to be polygamists;[3] they are extraordinarily bold and pugnacious, whilst "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 whilst fighting swim round and round each other, biting and endeavouring to pierce each other with their raised lateral spines. The same writer adds,[4] "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 colours fade away; and he hides his disgrace among his peaceable companions, but is for some time the constant object of his conqueror's persecution." 3

The male salmon is as pugnacious as the little stickleback; and so is the male trout, as I hear from Dr. Günther. Mr. Shaw saw a violent contest between two male salmons 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 whilst 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."[5] The keeper of the Stormontfield breeding-ponds visited, as Mr. Buist informs me, in June, 1868, 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.

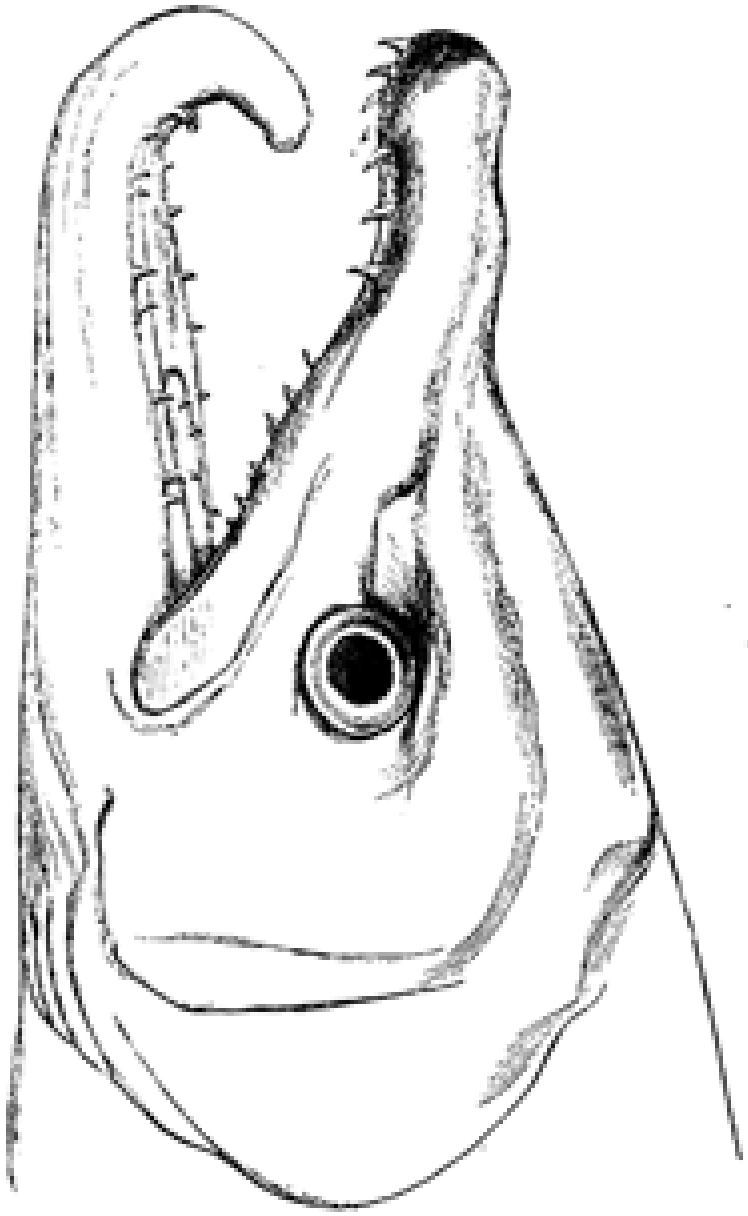

Fig. 26. Head of male of common salmon (*Salmo salar*) during the breeding-season.

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

The most curious point about the male salmon is that during the breeding-season, besides a slight change in colour, "the lower jaw elongates, and a cartilaginous projection turns upwards from the point, which, when the jaws are closed, occupies a deep cavity between the intermaxillary bones of the upper jaw."[6] (Figs. 26 and 27.) In our salmon this change of 4
structure lasts only during the breeding-season; but in the *Salmo lycaodon* of N.W. America
the change, as Mr. J. K. Lord[7] believes, is permanent and best marked in the older males 5
which have previously ascended the rivers. In these old males the jaws become developed into immense hook-like projections, and the teeth grow into regular fangs, often more than half an inch in length. With the European salmon, according to Mr. Lloyd,[8] the temporary 6
hook-like structure serves to strengthen and protect 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 male mammals, and they indicate an offensive rather than a protective purpose.

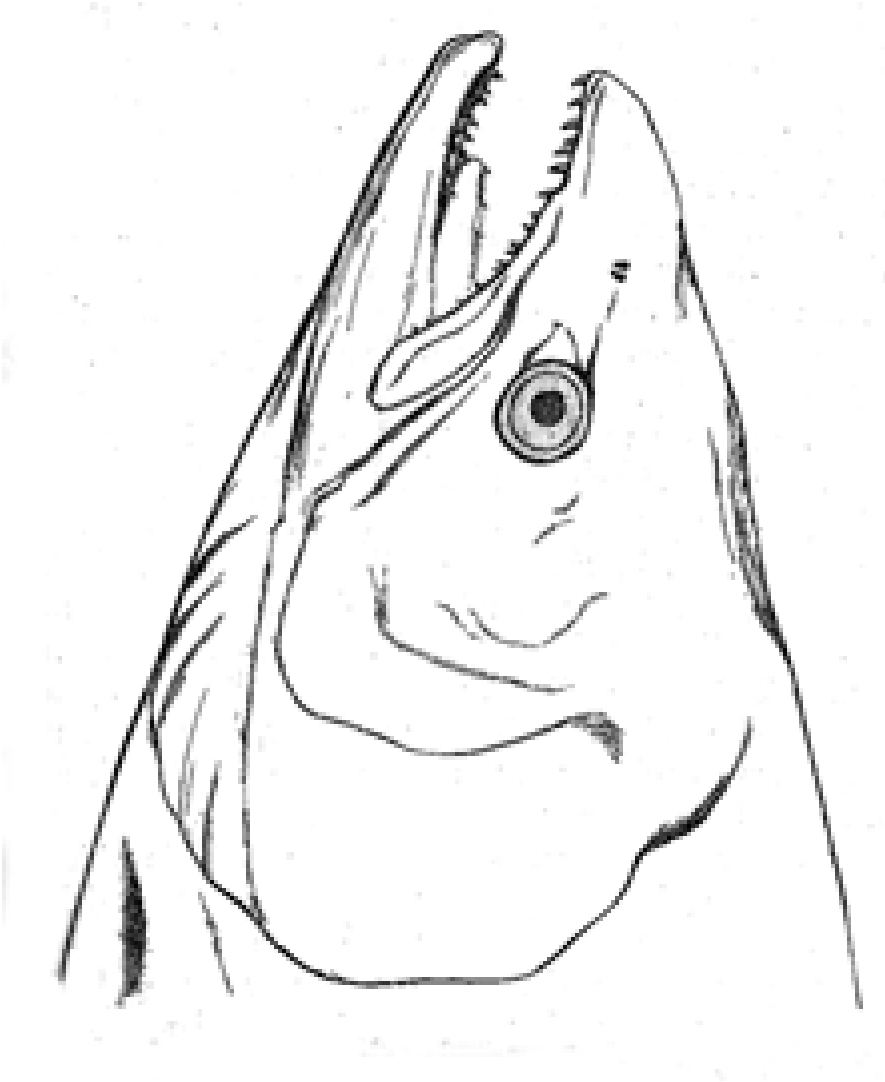

Fig. 27. Head of female salmon.

The salmon is not the only fish in which the teeth differ in the two sexes. This is the case with many rays. In the thornback (*Raia clavata*) the adult male has sharp, pointed teeth, directed backwards, whilst those of the female are broad and flat, forming 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: whilst 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*, possess, when adult, 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 completely adult; the males acquiring them at an earlier age than the females. We shall hereafter meet with analogous cases with certain birds, in which the male acquires the plumage common to both adult sexes, at a somewhat earlier age than the female. With other species of rays the males even when old never possess sharp teeth, and consequently both sexes when adult are provided with broad, flat teeth like those of the young, and of the mature females of the above-mentioned species.[9] As the rays are bold, strong and voracious fishes, 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[10] maintains that with almost all fishes the female is larger than the male; and Dr. Günther does not know of a single instance in which the male is actually larger than the female. With some Cyprinodonts the male is not even half as large as the female. As with many kinds of fishes the males habitually fight together; it is surprising that they have not generally become through the effects of sexual selection larger and stronger than the females. 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.

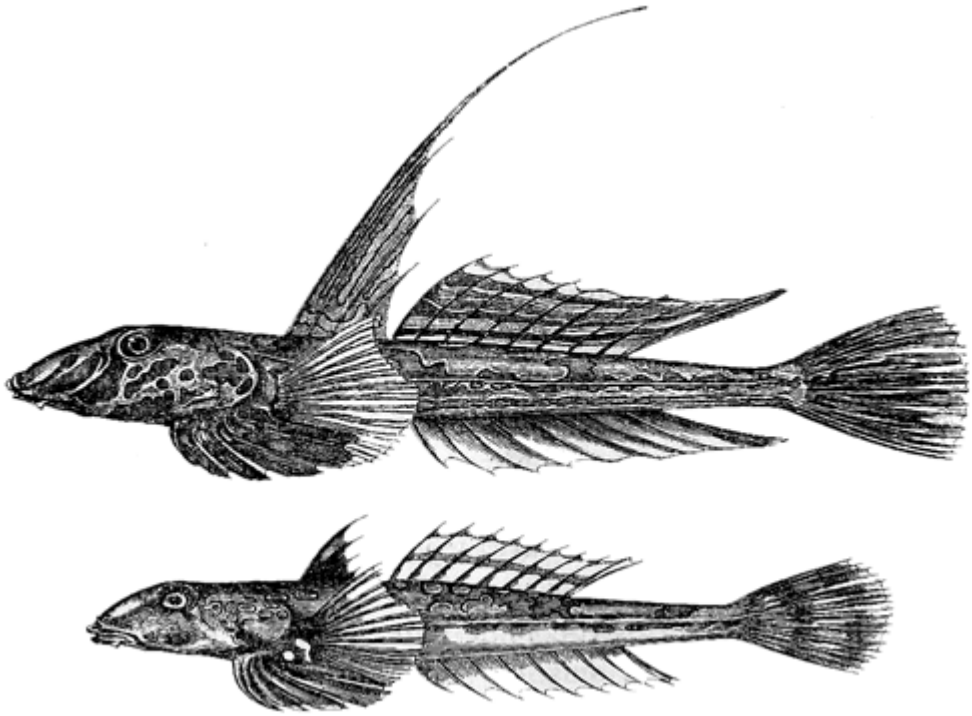

Fig. 28. *Callionymus lyra*. Upper figure, male; lower figure, female.

In many species the male alone is ornamented with bright colours; or these are much brighter in the male than 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 great kindness of Dr. Günther. There is reason to suspect that many tropical fishes differ sexually in colour 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 8
colours." When freshly taken 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 eyes;[11] but the most striking difference is the extraordinary elongation in the male (fig. 28) of the dorsal 9
fin. The young males resemble in structure and colour the adult females. Throughout the genus *Callionymus*,[12] the male is generally much more brightly spotted than the female, and in several species, not only the dorsal, but the anal fin of the male is much elongated.

The male of the *Cottus scorpius*, or sea-scorpion, is more slender and smaller than the female. There is also a great difference in colour between them. It is difficult, as Mr. Lloyd[13]

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 colours with which it, in other respects so ill-favoured, is at that time adorned.” Both sexes of the *Labrus mixtus*, although very different in colour, 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 sometimes differ much in various characters. In the male of the *Mollienesia petenensis*,[14] the dorsal fin is greatly developed and is marked with a row of large, round, ocellated, bright-coloured spots; whilst 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 of the anal fin is also a little produced and dark-coloured. In the male of an allied form, the *Xiphophorus Hellerii* (fig. 29), the inferior margin of the anal fin is developed into a long filament, which is striped, as I hear from Dr. Günther, with bright colours. 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 whilst young resemble in colour and structure the adult females. Sexual differences such as these may be strictly compared with those which are so frequent with gallinaceous birds.[15]

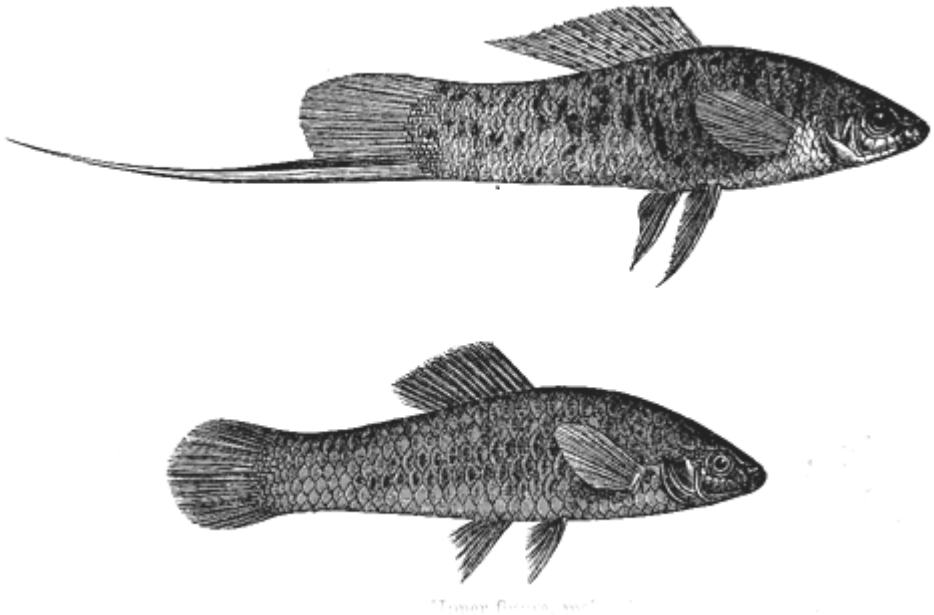

Fig. 29. *Xiphophorus Hellerii*. Upper figure, male; lower figure, female.

Fig. 30. *Plecostomus barbatus*. Upper figure, head of male; lower figure, female.

In a siluroid fish, inhabiting the fresh waters of South America, namely the *Plecostomus barbatus*[16] (fig. 30), the male has its mouth and interoperculum fringed with a beard of stiff hairs, of which the female shews 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. The *Monacanthus scopas*, which was shewn to me in the British Museum by Dr. Günther, presents a nearly analogous case. The male 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 an inch and a half in length; the female has on the same place a cluster of bristles, which may be compared with those of a tooth-brush. In another species, the *M. peronii*, the male has a brush like that possessed by the female of the last species, whilst the sides of the tail in the female are smooth. In some other species the same part of 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. In that strange monster, the *Chimæra monstrosa*, the male has a hook-shaped bone on the top of the head, directed forwards, with its rounded end covered with sharp spines; in the female "this crown is altogether absent," but what its use may be is utterly unknown.[17]

The structures as yet referred to are permanent in the male after he has arrived at maturity; but with some Blennies and in another allied genus[18] a crest is developed on the head of the male only during the breeding-season, and their bodies at the same time become more 13
brightly-coloured. 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 this case and in that of the *Monacanthus*, we have good instances to how great an extent the sexual characters of closely-allied forms may differ. In many of the Chromidæ, for instance in *Geophagus* and especially in *Cichla*, the males, as I hear from Professor Agassiz,[19] have a conspicuous protuberance on the forehead, which is wholly wanting in the females and in the young males. Professor 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 shew 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 in their periodical appearance resemble the fleshy caruncles on the heads of certain birds; but whether they serve as ornaments must remain at present doubtful.

The males of those fishes, which differ permanently in colour from the females, often become more brilliant, as I hear from Professor Agassiz and Dr. Günther, during the breeding-season. This is likewise the case with a multitude of fishes, the sexes of which at all other seasons of the year are identical in colour. The tench, roach, and perch may be given as instances. The male salmon at this season is "marked on the cheeks with orange- 14
coloured stripes, which give it the appearance of a *Labrus*, and the body partakes of a golden-orange tinge. The females are dark in colour, and are commonly called black-fish."[20] 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 rather brighter in colour than the females.[21] The colours of the pike (*Esox reticulatus*) of the United States, especially of the male, become, during the breeding-season, exceedingly intense, brilliant, and iridescent.[22] Another striking instance out of many is afforded by the male stickleback (*Gasterosteus leiurus*), which is described by Mr. Warington,[23] 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 colours all change, the throat and belly become of a paler red, the back more green, and the glowing tints subside.

That with fishes there exists some close relation between their colours and their sexual functions we can clearly see;—firstly, from the adult males of certain species being differently coloured from the females, and often much more brilliantly;—secondly, from these same males, whilst immature, resembling the mature females;—and, lastly, from the 15
males, even of those species which at all other times of the year are identical in colour with the females, often acquiring brilliant tints during the spawning-season. We know that the males are ardent in their courtship and sometimes fight desperately together. If we may assume that the females have the power of exerting a choice and of selecting the more highly-ornamented males, all the above facts become intelligible through the principle of sexual selection. On the other hand, if the females habitually deposited and left their ova to be fertilised by the first male which chanced to approach, this fact would be fatal to the efficiency of sexual selection; for there could be no choice of a partner. But, as far as is known, the female never willingly spawns except in the close presence of a male, and the male never fertilises the ova except in the close presence of a female. It is obviously difficult to obtain direct evidence with respect to female fishes selecting their partners. An excellent observer,[24] who carefully watched the spawning of minnows (*Cyprinus phoxinus*), remarks that owing to the males, which were ten times as numerous as the females, crowding closely round them, he could "speak only doubtfully on their operations. When a female came among a number of males they immediately pursued her; if she was not ready for shedding her spawn, she made a precipitate retreat; but if she was ready, she came boldly in among them, and was immediately pressed closely by a male on each side; and when they had been in that situation a short time, were superseded by other two, who wedged themselves in between them and the female, who appeared to treat all her lovers 16
with the same kindness." Notwithstanding this last statement, I cannot, from the several previous considerations, give up the belief that the males which are the most attractive to the females, from their brighter colours or other ornaments, are commonly preferred by them; and that the males have thus been rendered more beautiful in the course of ages.

We have next to inquire whether this view can be extended, through the law of the equal transmission of characters to both sexes, 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,[25] with pardonable exaggeration, as formed of polished scales of gold encrusting 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 differ greatly in colour. With some fishes, as with many of the lowest animals, splendid colours may be the direct result of the nature of their tissues and of the surrounding conditions, without any aid from selection. The goldfish (*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 colours 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 colours have been intensified through artificial selection, as this species has been carefully bred in China from a remote period.[26] Under natural conditions it does not seem probable that beings so 17
highly organised as fishes, and which live under such complex relations, should become brilliantly coloured without suffering some evil or receiving some benefit from so great a change, and consequently without the intervention of natural selection.

What, then, must we conclude in regard to the many fishes, both sexes of which are splendidly coloured? Mr. Wallace[27] believes that the species which frequent reefs, where corals and other brightly-coloured organisms abound, are brightly coloured in order to escape detection by their enemies; but according to my recollection they were thus rendered highly conspicuous. In the freshwaters of the Tropics there are no brilliantly-coloured corals or other organisms for the fishes to resemble; yet many species in the Amazons are beautifully coloured, and many of the carnivorous Cyprinidæ in India are ornamented with "bright longitudinal lines of various tints."[28] Mr. M'Clelland, in describing these fishes goes

so far as to suppose that "the peculiar brilliancy of their colours" serves as "a better mark 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 18
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 (as explained when treating of caterpillars) that they were unpalatable; but it is not, I believe, known that any fish, at least any freshwater 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 coloured, is that their colours have been acquired by the males as a sexual ornament, and have been transferred in an equal or nearly equal degree to the other sex.

We have now to consider whether, when the male differs in a marked manner from the female in colour or in other ornaments, he alone has been modified, with the variations inherited only by his male offspring; 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 colour has been acquired by many fishes as a protection: no one can behold the speckled upper surface of a flounder, and overlook its resemblance to the sandy bed of the sea on which it lives. One of the most striking instances ever recorded of an animal gaining protection by its colour (as far as can be judged in preserved specimens) and by its form, is that given by Dr. Günther[29] of a pipefish, 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. Fishes offer valuable evidence on this 19
head. We 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 sex; 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 of smaller size, 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 most conspicuously coloured. The ova are fertilised immediately after being deposited, and when this process lasts for several days, as in the case of the salmon,[30] the female, during the whole time, is attended by the male. After the ova are fertilised 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-coloured individuals of either sex would be equally liable to be destroyed or preserved, and both would have an equal influence on the colours of their offspring or the race.

Certain fishes, belonging to several families, make nests; and some of these fishes take care of their young when hatched. Both sexes of the brightly-coloured *Crenilabrus massa* and *melops* work together in building their nests with sea-weed, shells, &c.[31] But the males of certain fishes do all the work, and afterwards take exclusive charge of the young. This is the case with the dull-coloured gobies,[32] in which the sexes are not known to differ in colour, 20
and likewise with the sticklebacks (*Gasterosteus*), in which the males become brilliantly coloured during the spawning-season. The male of the smooth-tailed stickleback (*G. leiurus*) performs during a long time the duties of a nurse with exemplary care and vigilance, 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.[33]

The males of certain other fishes inhabiting South America and Ceylon, and belonging to two distinct orders, have the extraordinary habit of hatching the eggs laid by the females within their mouths or branchial cavities.[34] With the Amazonian species which follow this

habit, the males, as I am informed by the kindness of Professor Agassiz, “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 Professor Agassiz likewise informs me, sexual differences in colour may be observed, “whether they lay their eggs in 21
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 *Promotis* does. It ought also to be observed that these sitters are among the brightest species in their respective families; for instance, *Hygrogonus* 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, has had little or no influence on the differences in colour 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-coloured males would be far more influential on the character of the race, than the destruction of the brighter-coloured females; for the death of the male during the period of incubation or nursing would entail the death of the young, so that these could not inherit his peculiarities; yet, in many of these very cases the males are more conspicuously coloured than the females.

In most of the Lophobranchii (Pipe-fish, Hippocampi, &c.) the males have either marsupial sacks or hemispherical depressions on the abdomen, in which the ova laid by the female are hatched. The males also shew great attachment to their young.[35] The sexes do not commonly differ much in colour; but Dr. Günther believes that the male Hippocampi are rather brighter than the females. The genus *Solenostoma*, however, offers a very curious 22
exceptional case,[36] for the female is much more vividly coloured and spotted than the male, and she alone has a marsupial sack 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 coloured 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 coloured 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 colours of the sex which is the most important of the two for the welfare of the offspring must serve, in some manner, as a protection. But from the multitude of fishes, the males of which are either permanently or periodically brighter than the females, but whose life is not at all more important than that of the female for the welfare of the species, this view can hardly be maintained. When we treat of birds we shall meet with analogous cases in which 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 colour or in other ornamental characters, the males originally varied, with their variations transmitted 23
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 coloured alike for the sake of protection; but in no instance does it appear that the female alone has had her colours or other characters specially modified for this purpose.

The last point which need be noticed is that in many parts of the world fishes are known to make peculiar noises, which are described in some cases as being musical. Very little has been ascertained with respect to the means by which such sounds are produced, and even

less about their purpose. The drumming of the *Umbrinas* in the European seas is said to be audible from a depth of twenty fathoms. 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."[37] If this statement is trustworthy, we have an instance in this, the lowest class of the Vertebrata, of what we shall find prevailing throughout the other vertebrate classes, and which prevails, as we have already seen, with insects and spiders; namely, that vocal and instrumental sounds so commonly serve as a love-call or as a love-charm, that the power of producing them was probably first developed in connection with the propagation of the species.

Fig. 31. *Triton cristatus* (half natural size, from Bell's 'British Reptiles'). Upper figure, male during the breeding-season; lower figure, female.

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Amphibians.

Urodela.—First for the tailed amphibians. The sexes of salamanders or newts often differ much both in colour and structure. In some species prehensile claws are developed on the forelegs of the males during the breeding-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.[38] This structure no doubt aids the male in his eager search and pursuit of the female. 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, being absorbed during the winter. It is not furnished, as Mr. St. George Mivart informs me, with muscles, and therefore 25
cannot be used for locomotion. As during the season of courtship it becomes edged with bright colours, it serves, there can hardly be a doubt, as 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-grey 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 colour with scattered brown dots; and the lower surface is often quite plain.[39] The young are obscurely tinted. The ova are fertilised during the act of deposition and are not subsequently tended by either parent. We may therefore conclude that the males acquired their strongly-marked colours 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 colours 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 coloured toad which I ever saw, namely the *Phryniscus nigricans*[40] 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 26
fail to catch the eye of every passing creature. These colours may be beneficial by making this toad known to all birds of prey as a nauseous mouthful; for it is familiar to every one that these animals emit a poisonous secretion, which causes the mouth of a dog to froth, as if attacked by hydrophobia. I was the more struck with the conspicuous colours of this toad, as close by I found a lizard (*Proctotretus multimaculatus*) which, when frightened, flattened its body, closed its eyes, and then from its mottled tints could hardly be distinguishable from the surrounding sand.

With respect to sexual differences of colour, Dr. Günther knows of no striking instance 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 Dr. Günther 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. The *Megalophrys montana*[41] (fig. 32) offers the best case of a certain amount of structural difference between the sexes; for in the male the tip of the nose and the eyelids are produced into triangular flaps of skin, and there is a little black tubercle on the back—characters which are absent, or only feebly developed, in the females. It is surprising that frogs and toads should not have acquired more strongly-marked sexual differences; for though cold-blooded, their passions are strong. Dr. Günther 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.

Fig. 32. *Megalophrys montana*. The two left-hand figures, the male; the two right-hand figures, the female.

These animals, however, offer one interesting sexual difference, namely in the musical 27
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 de Janeiro I used often to sit in the evening to listen to

a number of little Hylæ, which, perched on blades of grass close to the water, 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.[42] 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 28
into the larynx.[43] 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; whilst that of the female is only a slight groaning noise.[44] The vocal organs differ considerably in structure in the several genera of the family; 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 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.[45] 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.[46]

Crocodilia.—The sexes apparently do not differ in colour; nor do I know that the males 29
fight together, though this is probable, for some kinds make a prodigious display before the females. Bartram[47] 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 his 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 odour is emitted by the submaxillary glands of the crocodile, and pervades their haunts.[48]

Ophidia.—I have little to say about Snakes. Dr. Günther 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 colour, Dr. Günther 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 in the Rattle-snakes of N. America, the male of which, as the keeper in the Zoological Gardens shewed me, can instantly be distinguished from the female by having more lurid yellow about its whole body. In S. Africa the *Bucephalus capensis* presents an analogous difference, for the female "is never so fully variegated with yellow on the sides, as the male."[49] The male of the Indian *Dipsas cynodon*, on the other hand, is blackish-brown, with the belly partly black, whilst 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- 30
coloured.[50] No doubt the colours of some snakes serve as a protection, as 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 colours of many kinds, for instance of the common English snake or viper, serve to conceal them; and this is still more doubtful with the many foreign species which are coloured with extreme elegance.

During the breeding-season their anal scent-glands are in active function;[51] 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.[52] Male snakes, though appearing so sluggish, are amorous; for many have been observed crowding round the same female, and even round the dead body of a female. They are not known to fight together from rivalry. Their intellectual powers are higher than might have been anticipated. An excellent observer in Ceylon, Mr. E. Layard,[53] saw a Cobra thrust its head through a narrow hole and swallow a toad. "With this incumbrance 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 learnt, and the toad was seized by one leg, withdrawn, and then swallowed in triumph." 31

It does not, however, follow because snakes have some reasoning power and strong passions, that they should likewise be endowed with sufficient taste to admire brilliant colours 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 S. 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 coloured in this peculiar manner, as Mr. Wallace states on the authority of Dr. Günther,[54] are found nowhere else in the world except in S. 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 colours as a protection, on the principle of imitation; for they would naturally be thought dangerous by their enemies. The cause, however, of the bright colours of the venomous *Elaps* remains to be explained, and this may perhaps be sexual selection. 32

Lacertilia.—The males of some, probably of many kinds of lizards fight together from rivalry. Thus the arboreal *Anolis cristatellus* of S. 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, 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;[55] and this, as far as Dr. Günther has been able to ascertain, is the general rule with lizards of all kinds.

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 possesses a dorsal crest, though much less developed than in the male; and so it is, as Dr. Günther 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, and is coloured blue, black, and red; but these splendid colours are exhibited only during the pairing-season. The female does not possess even a rudiment of this appendage. In the *Anolis cristatellus*, 33

according to Mr. Austen, the throat-pouch, which is bright red marbled with yellow, is present, though in a rudimental condition, in the female. Again, in certain other lizards, both sexes are equally well provided with throat-pouches. Here, as in so many previous cases, we see with species belonging to the same group, the same character confined to the males, or more largely developed in the males than in the females, or 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 colours 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 in the male when arrived 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.[56]

Fig. 33. *Sitana minor*. Male, with the gular pouch expanded (from Günther's 'Reptiles of India').

There are other and much more remarkable differences between the sexes of certain lizards. The male of *Ceratophora 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 colour, 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 is of quite minute size in the female and in the young. These appendages, as Dr. Günther 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.

Fig. 35. *Chamæleon bifurcus*. Upper figure, male; lower figure, female.

In the genus *Chamæleon* we come to the climax 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 35
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 36
will occur to every one is that they are used by the males for fighting together; but Dr. Günther, to whom I am indebted for the foregoing details, does not believe that such peaceable creatures would ever become pugnacious. Hence we are driven to infer that these almost monstrous deviations of structure serve as masculine ornaments.

With many kinds of lizards, the sexes differ slightly in colour, 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 previously-mentioned *Cophotis* and with the *Acanthodactylus capensis* of S. 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 a greater difference in colour between the sexes; the lips also of the male are black, whilst 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 greyish-green without spots.”[57] We have seen that the males alone of *Sitana* possess a

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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.[58] I collected in S. America fourteen species of this genus, and though I neglected to record the sexes, I observed that certain individuals alone were marked with emerald-like green spots, whilst others had orange-coloured gorges; and these in both cases no doubt were the males.

In the foregoing species, the males are more brightly coloured than the females, but with many lizards both sexes are coloured in the same elegant or even magnificent manner; and there is no reason to suppose that such conspicuous colours are protective. With some lizards, however, the green tints no doubt serve for concealment; and an instance has already been incidently given of one species of *Proctotretus* which closely resembles the sand on which it lives. On the whole we may conclude with tolerable safety that the beautiful colours of many lizards, as well as various appendages and other strange modifications of structure, have been gained by the males through sexual selection for the sake of ornament, and have been 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. But the less conspicuous colours of the females in comparison with those of the males cannot be accounted for, as Mr. Wallace believes to be the case with birds, by the exposure of the females to danger during incubation.

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

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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 females by vocal or instrumental music of the most varied kinds. They are ornamented by all sorts of combs, wattles, protuberances, horns, air-distended sacs, top-knots, 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 coloured. 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 odour which we may suppose serves to charm or excite the female; for that excellent observer, Mr. Ramsay,[59] 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 odour during the pairing-season, that it can be detected long before the bird can be seen.[60] 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 shewn by our enjoyment of the singing of birds, and by our women, both civilised and savage, decking their heads with borrowed plumes, and using gems which are hardly more brilliantly coloured than the naked skin and wattles of certain birds. 39

Before treating of the 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 sexes 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 curious *Neomorpha* of New Zealand, there is a still wider difference in the form of the beak; and Mr. Gould has been informed that the male with his "straight and stout beak" tears off the bark of trees, in order that the female may feed on the uncovered larvæ with her weaker and more curved beak. Something of the same kind may be observed with our 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, as an old and trustworthy bird-catcher asserted, are commonly found feeding on the seeds of the teazle (*Dipsacus*) which they can reach with their elongated beaks, whilst the females more commonly feed on the seeds of the betony or *Scrophularia*. With a slight difference of this nature as a foundation, we can see how the beaks of the two sexes might be made to differ greatly through natural selection. In all these cases, however, especially in that of the quarrelsome humming-birds, it is possible that the differences in the beaks may have been first acquired by the males in relation to their battles, and afterwards led to slightly changed habits of life. 40

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[61] describes a battle, in which a pair of humming-birds 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, says that two males rarely meet without a fierce aerial 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."[62] 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.[63] The males of an allied bird (*Gallicrex cristatus*), as Mr. Blyth informs me, are one 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."[64] 41

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 colours 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.[65] Of the pugnacity of web-footed 42
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 43
occurred the river is covered for some distance with feathers."[66] Birds which seem ill-adapted for fighting engage in fierce conflicts; thus with the pelican the stronger males drive away the weaker ones, snapping with their huge beaks and giving heavy blows with their wings. Male snipes fight together, "tugging and pushing each other with their bills in the most curious manner imaginable." Some few species are believed never to fight; this is the case, according to Audubon, with one of the woodpeckers of the United States (*Picus auratus*), although "the hens are followed by even half a dozen of their gay suitors."[67]

Fig. 37. The Ruff or *Machetes pugnax* (from Brehm's 'Thierteben').

The males of many birds are larger than the females, and this no doubt is an advantage to them in their battles with their rivals, and has been gained through sexual selection. 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.[68] 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[69] 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 following 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 and wild species, the *Gallus Stanleyi*, is known to fight desperately "in defence of his seraglio," so that one of the combatants is frequently found dead.[70] An Indian partridge (*Ortygornis gularis*), 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."[71] 44

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. M. W. Kowalevsky 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-dance and love-song of the Black-cock is called in Germany. The bird utters almost continuously the most strange 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 in the course of one morning several Balz-places, which remain the same during successive years.[72] 45

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 two peacocks became so excited whilst fighting at some little distance from Chester that they flew over the whole city, still fighting, until they alighted on the top of St. John's tower. 46

The spur, in those gallinaceous birds which are thus provided, is generally single; but *Polyplectron* (see fig. 51, p. 90) 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.[73] Hence spurs may safely be considered as a masculine character, though occasionally

transferred in a greater or less degree to the females. Like most other secondary sexual characters, the spurs are highly variable both in number and development in the same species.

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

Various birds have spurs on their wings. But the Egyptian goose (*Chenalopex ægyptiacus*) has only "bare obtuse knobs," and these probably shew us the first steps by which true spurs have been developed in other allied birds. 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 47
sexual weapons; but according to Livingstone, they are chiefly used in the defence of the young. The *Palamedea* (fig. 38) is armed with a pair of spurs on each wing; and these are 48
such formidable weapons that a single blow has driven 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.[74] 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 are known to 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 *Hoplopterus 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 sideways at each other, sometimes with a fatal result. Thus also they drive away other enemies.[75]

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,[76] are ready to fight whenever they meet. The presence of the female is the *teterrima belli causa*. The Bengali baboos 49
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.[77] When many males congregate at the same appointed spot and fight together, as in the case of grouse and various other birds, they are generally attended by the females,[78] which afterwards pair with the victorious combatants. But in some cases the pairing precedes instead of succeeding the combat: thus, according to Audubon,[79] 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 with all their power 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 M. W. Kowalevsky 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 50
trying to distract the peace of an already mated pair.[80]

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 endeavour 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 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[81] 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-51
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."[82]

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 with the hissing noise made by some nestling-birds. Audubon[83] 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 chickens, 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;"[84] 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 well 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. 52

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."[85] 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."[86] 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, 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.[87] 53 Barrington, however, admits that "superiority in song gives to birds an amazing ascendancy 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,[88] 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[89] as singing whilst 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, whilst a stuffed bird, surrounded by limed twigs, is exposed to view. In this manner a man, as Mr. Weir informs me, has caught, in the course of a single day, fifty, and in one instance seventy, male chaffinches. The power and inclination to sing differ so greatly with birds that 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 whilst the cage is swung round the owner's head.

That birds should sing from emulation as well as for the sake of charming the female, is not at all incompatible; and, indeed, might have been expected to go together, like decoration 54

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 the canary, robin, lark, and bullfinch, especially, as Bechstein remarks, when in a state of widowhood, 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,[90] 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.[91] But nothing is more common than for animals to take pleasure in practising 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 males of the capercailzie sometimes hold their *balzens* or *leks* at the usual place of assemblage during 55
the autumn.[92] Hence it is not at all surprising that male birds should continue singing for their own amusement after the season for courtship is over.

Singing is to a certain extent, as shewn in a previous chapter, an art, and is much improved by practice. Birds can be taught various tunes, and even the unmelodious sparrow has learnt to sing like a linnet. They acquire the song of their foster-parents,[93] and sometimes that of their neighbours.[94] 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,[95] though they never sing, and do not naturally modulate their voices to any great extent. Hunter asserts[96] 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.[97] It is also remarkable that the birds 56
which sing are rarely decorated with brilliant colours or other ornaments. Of our British birds, excepting the bullfinch and goldfinch, the best songsters are plain-coloured. The kingfisher, bee-eater, roller, hoopoe, woodpeckers, &c., utter harsh cries; and the brilliant birds of the tropics are hardly ever songsters.[98] Hence bright colours and the power of song seem to replace each other. We can perceive that if the plumage did not vary in brightness, or if bright colours were dangerous to the species, other means would have to be employed to charm the females; and the voice being rendered melodious would offer one such means.

Fig. 39. *Tetrao cupido*; male. (From Brehm.)

In some birds the vocal organs differ greatly in the two sexes. In the *Tetrao cupido* (fig. 39) the male has two bare, orange-coloured sacks, one on each side of the neck; and these are largely inflated when the male, during the breeding-season, makes a 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-sacks on each side of the mouth of certain male frogs, for he found that the sound was much diminished when one of the sacks 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."[99] The male of another kind of grouse (*Tetrao urophasianus*), whilst courting 57
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 58
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.[100]

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 serve, as was formerly supposed, to hold water, but is connected with the utterance during the breeding-season of a peculiar sound resembling "ock." The bird whilst uttering this sound throws himself into the most extraordinary attitudes. It is a singular fact that with the males of the same species the sack is not developed in all the individuals.[101] A crow-like bird inhabiting South America (*Cephalopterus ornatus*, fig. 40) is called the umbrella-bird, from its immense top-knot, 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 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. 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.[102] 59

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

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 embedded in the sternum. In the wild swan (*Cygnus ferus*) it is more deeply embedded in the adult male than in the female or young male. In the male Merganser the enlarged portion of the trachea is furnished with an additional pair of muscles.[103] But the meaning of these differences between the sexes of many Anatidæ is not at all understood; for the male is not always the more vociferous; thus with the common duck, the male hisses, whilst the female utters a loud quack.[104] 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.[105] So that highly important structures have in these cases been modified according to sex. 60

It is often difficult to conjecture whether the many 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 different note from the gobbling noise which he makes, when with erected feathers, rustling wings and distended wattles, he puffs and struts before her.[106] 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 61

passion," we are led to suppose that the females which are already present are thus charmed.[107] The voice of the common rook is known to alter during the breeding-season, and is therefore in some way sexual.[108] 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 colour, judging by the inharmonious contrast of their bright yellow and blue plumage? It is indeed possible that the loud voices of many male birds may be the result, without any advantage being thus gained, of the inherited effects of the continued use of their vocal organs, when they are 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 practise, during their courtship, what may be called instrumental music. Peacocks and Birds of Paradise rattle their quills together, and the vibratory movement apparently serves merely to make a noise, for it can hardly add to the beauty of their plumage. Turkey-cocks scrape their wings against the ground, and some kinds of grouse thus produce a buzzing sound. Another 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 neighbourhood," drums rapidly with his "lowered wings on the trunk of a fallen tree," or, according to Audubon, against his own 62
body; 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." In the Himalayas the male of the Kalij pheasant "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 same season the males of certain nightjars (*Caprimulgus*) make a most strange 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 cause would never be conjectured by any one who heard 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 saw, 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 produces the correct sound." When the male utters its cry without striking his beak the sound is quite different.[109] 63

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

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 the sounds. The drumming, or bleating, or neighing, or thundering noise, as expressed by different observers, which is 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 after zig-zagging about for a time descends in a curved line, with outspread tail and quivering pinions, with surprising velocity to the earth. 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 that by blowing on these feathers, or by fastening them to a long thin stick and waving them rapidly through the air, he could exactly 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 whilst descending rapidly to the earth.[110] 64

Fig. 42. Outer tail-feather of *Scolopax frenata*.

Fig. 43. Outer tail-feather of *Scolopax javensis*.

In the male of the *Chamæpetes unicolor* (a large gallinaceous bird of America) the first primary wing-feather is arched towards the tip and is much more attenuated than in the female. In an allied bird, the *Penelope nigra*, Mr. Salvin observed a male, which, whilst it flew downwards "with outstretched wings, gave forth a kind of crashing, rushing noise," like the falling of a tree.[111] 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 whilst courting the female.[112] In a widely different group of birds, namely the Humming-birds, the males alone of certain kinds have either the shafts of their primary wing-feathers broadly dilated, or the webs abruptly excised towards the extremity. The male, for instance, of *Selasphorus platycercus*, when adult, has the first primary wing-feather (fig. 44), excised in this manner. Whilst flying from flower to flower he makes "a shrill, almost whistling, noise;"[113] but it did not appear to Mr. Salvin that the noise was intentionally made. 65

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

Lastly, in several species of a sub-genus of *Pipra* or Manakin, the males have their *secondary* wing-feathers modified, as described by Mr. Sclater, in a still more remarkable manner. In the brilliantly-coloured *P. deliciosa* the first three secondaries are thick-stemmed and curved towards 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."[114] 66

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 diversity of the sounds, both vocal and instrumental, made by the males of many species 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 same conclusion with respect 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. This is somewhat more difficult in the case of the modified feathers, by which the drumming, whistling, or roaring noises are produced. But we have seen 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 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 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,[115] 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." 68

Love-Antics and Dances.—The curious love-gestures of various birds, especially of the Gallinaceæ, 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 little whitethroat (*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 whilst 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 successively, 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.[116] 69

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 highly 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 practised under confinement, and Mr. Strange has described[117] the habits of some Satin Bower-birds, which he kept in his 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 erect, run round the bower and become so excited that his eyes appear ready to start from his head; he continues opening first one wing, and 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 towards him." Captain Stokes has described the habits and "play-houses" of another species, the Great Bower-bird, which was seen "amusing itself by flying backwards and forwards, taking a shell alternately from each side, and carrying it through the archway in its mouth." These curious structures, formed solely as halls of assemblages, where both sexes amuse themselves and pay their court, must cost the birds much labour. 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. 70 71

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

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-coloured than the male. As with the artificial ornaments used by savage and civilised men, so with the natural ornaments of birds, the head is the chief seat of decoration.[118] 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 colours are fully displayed. Elegant ear-tufts (see fig. 39 ante) are occasionally present. The head is sometimes covered with velvety down like that of the pheasant; or is naked and vividly coloured; or supports fleshy appendages, filaments, and solid protuberances. The throat, also, is sometimes ornamented with a beard, or with wattles or caruncles. Such appendages are generally brightly coloured, and no doubt serve as ornaments, though not always ornamental in our eyes; for whilst the male is in the act of courting the female, they often swell and assume more vivid tints, as in the case of the male turkey. At such 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 top-knot; and these are then coloured of the most intense blue which I have ever beheld. 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."[119] Even the iris of the eye is sometimes more brightly coloured 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 coloured 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."[120]

The males are often ornamented with elongated feathers or plumes springing from almost every part of the body. The feathers on the throat and breast are sometimes developed into beautiful 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 of the Argus pheasant. The body of this latter bird 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.[121] The wing-feathers are not elongated nearly so often as the tail-feathers; for their elongation would impede the act of flight. Yet the 73
beautifully ocellated secondary wing-feathers of the male Argus pheasant are nearly three feet in length; and in a small African nightjar (*Cosmetornis vexillarius*) one of the primary wing-feathers, during the breeding-season, attains a length of twenty-six inches, whilst the bird itself is only ten inches in length. In another closely-allied genus of nightjars, the shafts of the elongated wing-feathers are naked, except at the extremity, where there is a disc.[122] Again, in another genus of nightjars, the tail-feathers are even still more prodigiously developed; so that we see the same kind of ornament gained by the males of closely-allied birds, through the development of widely different feathers.

It is a curious fact that the feathers of birds belonging to distinct groups have been modified in almost exactly the same peculiar manner. Thus the wing-feathers in one of the above-mentioned nightjars are bare along the shaft and terminate in a disc; 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 disc stands vertically), and in the tail of certain Birds of Paradise. In these latter birds, similar feathers, beautifully 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 discs.[123] The barbs of the feathers in various widely-distinct 74
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; and these in the tail of the *Paradisea apoda* attain a length of thirty-four inches.[124] 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 colouring 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 top-knots have appeared in several species. In an extinct variety of the turkey, the top-knot consisted of bare quills surmounted with plumes of down, so that they resembled, to a certain extent, 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 are greatly elongated, curled, or even spirally twisted, with the margins plumose.[125]

Fig. 47. *Paradisea rubra*, male (from Brehm).

Fig. 48. *Lophornis ornatus*, male and female (from Brehm).

In regard to colour hardly anything need here be said; for every one knows how splendid are the tints of birds, and how harmoniously they are combined. The colours are often metallic 75
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 76
differences between the sexes, or of the extreme beauty of the males of many birds. The common peacock offers a striking instance. Female Birds of Paradise are obscurely 77
coloured and destitute of all ornaments, whilst the males are probably the most highly decorated of all birds, and in so many ways, that they must be seen to be appreciated. The elongated and golden-orange plumes which spring from beneath the wings of the *Paradisea* 78
apoda (see fig. 47 of *P. rubra*, a much less beautiful species), 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."[126] In another most beautiful species the head is bald, "and of a rich cobalt blue, crossed by several lines of black velvety feathers."[127]

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

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 the plumage has been taken advantage of and modified; and the modifications have been carried, as Mr. Gould shewed me, to a wonderful extreme in some species belonging to nearly every subgroup. 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 belonging to the same species in other characters; and these have been seized on by man and augmented to an extreme point—as the tail of the fantail-pigeon, the hood of the jacobin, the beak and wattle of the carrier, and so forth. The sole difference between these cases is that in the one the result is due to man's selection, whilst in the other, as with Humming-birds, Birds of Paradise, &c., it is due to sexual selection,—that is to the selection by the females of the more beautiful males.

I will mention only one other bird, remarkable from the extreme contrast in colour between 79
the sexes, namely the famous Bell-bird (*Chasmorhynchus niveus*) of S. America, the note of which can be distinguished at the distance of nearly three miles, and astonishes every one who first hears it. The male is pure white, whilst the female is dusky-green; and the former colour with terrestrial species of moderate size and inoffensive habits is very rare. 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, whilst the females, as described by Mr. Sclater in a most 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 colour. In a third species (*C. tricarunculatus*) the head and neck alone of the male are white, the rest of the body being chesnut-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 two others from the corners of the mouth.[128]

The coloured plumage and certain other ornaments of the males when adult are either 80
retained for life or are periodically renewed during the summer and breeding-season. At this season the beak and naked skin about the head frequently change colour, as with some herons, ibises, gulls, one of the bell-birds just noticed, &c. In the white ibis, the cheeks, the inflatable skin of the throat, and the basal portion of the beak, then become crimson.[129] In one of the rails, *Gallicrex cristatus* a large red caruncle is developed during this same 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 shore of an island in a lake in Nevada was found covered with these curious exuviæ.[130]

Changes of colour in the plumage according to the season depend firstly on a double annual moult, secondly on an actual change of colour in the feathers themselves, and thirdly on their dull-coloured 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 by very young birds of their down; for the down in most cases arises from the summits of the first true feathers.[131]

With respect to the birds which annually undergo a double moult, there are, firstly, some kinds, for instance snipes, swallow-plovers (Glareolæ), and curlews, in which the two sexes resemble each other and do not change colour at any season. I do not know whether the winter-plumage is thicker and warmer than the summer-plumage, which seems, when there 81
is no change of colour, the most probable cause of a double moult. Secondly, there are birds, for instance certain species of *Totanus* and other grallatores, the sexes of which resemble each other, but have a slightly different summer and winter plumage. The difference, however, in colour in these cases is so slight 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 colour; but the females, though moulting twice, retain the same colours throughout the year, whilst the males undergo a change, sometimes, as with certain bustards, a great change of colour. Fifthly and lastly, there are birds the sexes of which differ from each other in 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 colour between the summer and winter plumage, this may in some instances, as with the ptarmigan,[132] 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 82
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, &c., for they acquire their beautiful plumes only during the breeding-season. Moreover, such plumes, top-knots, &c., though possessed by both sexes, are occasionally a little more highly 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.[133]

From the foregoing facts, more especially from neither sex of certain birds changing colour 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 colours throughout the year, we may conclude that the habit of moulting twice in the year has not been acquired in order that the male should assume during the breeding-season an 83
ornamental character; 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 with closely-allied birds, some 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-coloured honey-suckers (Nectariniæ) of India and some sub-genera of obscurely-coloured pipits (*Anthus*) have a double, whilst others have only a single annual moult.[134] But the gradations in the manner of moulting, which are known to occur with various birds, shew us how species, or whole groups of species, 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 colour. 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 alone be added during the spring to the plumage, as occurs with the disc-formed tail-feathers of certain drongos (*Bhringa*) in India, and with the elongated feathers on the back, neck, and crest of certain herons. By such steps as these, the vernal moult might be rendered 84
more and more complete, until a perfect double moult was acquired. A gradation can also be shewn to exist in the length of time during which either annual plumage is retained; so that the one might come to be retained for the whole year, the other being completely lost. Thus the *Machetes pugnax* retains his ruff in the spring for barely two months. The male widow-bird (*Chera progne*) acquires in Natal his fine plumage and long tail-feathers in December or January and loses them in March; so that they are retained during only 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, with respect to part of the plumage, a double moult changed under domestication into a single moult.[135]

The common drake (*Anas boschas*) is well known after the breeding-season to lose his male plumage for a period of three months, during which time he assumes that of the 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 85
extraordinary circumstance, that seems to bid defiance to all human reasoning." But he who believes 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.[136]

Some male birds, as before stated, become more brightly coloured in the spring, not by a vernal moult, but either by an actual change of colour in the feathers, or by their obscurely-coloured deciduary margins being shed. Changes of colour thus caused may last for a longer or shorter time. With the *Pelecanus onocrotalus* a beautiful rosy tint, with lemon-coloured 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-coloured, 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 colours only when the winter is past, whilst our goldfinch, which exactly represents this bird in habits, and our siskin, which represents it still more closely in 86
structure, undergo no such annual change. But a difference of this kind in 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, whilst in Madeira these colours are retained throughout the year.[137]

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, or attract, or charm 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 will shew off his finery, as I have often seen, before poultry or even pigs.[138] 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 delight to display their beauty. Audubon frequently speaks of the male as endeavouring 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[139] insists that the beautiful plumage of the male 87
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 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 gorged 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 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.[140] With Birds of Paradise a dozen or more full- 88
plumaged males congregate in a tree to hold a dancing-party, as it is called by the natives; and here flying about, raising their wings, elevating their exquisite plumes, and making them vibrate, the whole tree seems, as Mr. Wallace remarks, to be filled with waving 89
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.[141]

Fig. 50. *Rupicola crocea*, male (from Brehm).

The gold pheasant (*Thaumalea picta*) during his courtship not only expands and raises his splendid frill, but turns it, as I have myself seen, obliquely towards the female on whichever side she may be standing, obviously in order that a large surface may be displayed before her.[142] Mr. Bartlett has observed a male *Polyplectron* (fig. 51) in the act of courtship, and

has shewn 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 shew off, at the same time, his rich blue throat and breast. But the breast of the *Polyplectron* is obscurely coloured, 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 90
wing on the same side, and raising that on the opposite side. In this attitude the ocelli over the whole body are exposed 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 91
are turned towards 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.

Fig. 51. *Polyplectron chinquis*. male (from Brehm.)

The case of the Argus pheasant is still more striking. The immensely developed secondary wing-feathers, which are confined to the male, are ornamented with a row of from twenty to twenty-three ocelli, each above an inch in diameter. The feathers are also elegantly marked with oblique dark stripes and rows of spots, like those on the skin of a tiger and leopard combined. The ocelli are so beautifully shaded that, as the Duke of Argyll remarks,[143] they stand out like a ball lying loosely within a socket. But when I looked at the specimen in the British Museum, which is mounted with the wings expanded and trailing downwards, I was greatly disappointed, for the ocelli appeared flat or even concave. Mr. Gould, however, soon made the case clear to me, for he had made a drawing of a male whilst he was displaying

himself. At such times the long secondary feathers in both wings are vertically erected and expanded; and these, together with the enormously elongated tail-feathers, make a grand semicircular upright fan. Now as soon as the wing-feathers are held in this position, and the light shines on them from above, the full effect of the shading comes out, and each ocellus at once resembles the ornament called a ball and socket. These feathers have been shewn 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. 92

The primary wing-feathers, which in most gallinaceous birds are uniformly coloured, are in the Argus pheasant not less wonderful objects than the secondary wing-feathers. 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 coloured of a lighter chesnut, and is thickly dotted with minute white points. I have shewn 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 when the long secondary feathers are erected, though in a widely different manner; for they are expanded in front like two little fans or shields, one on each side of the breast near the ground.

The case of the male Argus pheasant is eminently interesting, because it affords good evidence that the most refined beauty may serve as a charm for the female, and for no other purpose. We must conclude that this is the case, as the primary wing-feathers are never displayed, and the ball-and-socket ornaments are not exhibited in full perfection, except when the male assumes the attitude of courtship. The Argus pheasant does not possess brilliant colours, so that his success in courtship appears to have depended 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, though perhaps she admires the general effect rather than each separate detail. 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 ful 93