

THE RÔLE OF ANGER IN EVOLUTION WITH
PARTICULAR REFERENCE TO THE COLORS
AND SONGS OF BIRDS.

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THE problems connected with the origin and uses of the colors of animals and the songs of birds have been a fascinating and puzzling subject of research and speculation from the beginning of evolutionary science, and perhaps will remain unsolved to the end of zoölogical inquiry. There has been a marked tendency of late to set up theories opposed—at least on their faces—to the Darwinian theory of sexual selection. Some of these new theories postulate rivalry and even antagonism as the keynote to the evolution of bright color, display, and bird-song. One of these is set forth in an interesting and suggestive book by Major R. W. G. Hingston,¹ an Englishman who has had a considerable field experience in India and South America in the observation of mammals, birds, and insects and who has read rather widely, though apparently without giving much attention to recent American authors. Another is outlined in Dr. Arthur A. Allen's recent paper on 'Sex Rhythm in the Ruffed Grouse (*Bonasa umbellus* Linn.) and Other Birds.'² It seems worth while to examine both of these theories rather carefully, and though they are by no means identical, they have enough in common to warrant considering them in a single paper. I shall take up Major Hingston's book first because it was the first to appear, and I shall discuss some of the broader aspects of the general subject before taking up Dr. Allen's paper.

To give the substance of his book in very brief form, it may be said that Hingston attributes all conspicuous color and all conspicuous appendages, such as horns, crests, manes, and tufts of hair or feathers, to a need for their use in combat. He shows that animals in fighting erect their crests, elevate their tails, spread their manes, and otherwise make themselves as large and conspicuous as possible, and he argues, with some show of reason,

¹ *The Meaning of Animal Colour and Adornment* (London, 1933).

² *Auk*, vol. 51, pp. 180-199, April, 1934.

that their crests, manes, and large tails or tail-tufts have been evolved for that express purpose. He shows that in many cases color has emphasized these features. As he puts it (page 12), "Conspicuous colour intensifies emotional expression, and this I believe is its consistent use all through the animal kingdom." (Emotion to this author, I must add, means anger only, for he admits the existence of no other—except fear.)

The color of every animal, according to Major Hingston, is the resultant of a conflict between a factor making for concealing coloration and another making for that conspicuous coloration that would be of use to it in combat. The environment and the physical equipment and habits of the animal fix the point at which a compromise is reached. Thus an animal living in the open without convenient cover, without weapons of defense, and without extraordinary powers of locomotion would of necessity be concealingly colored, the "fear" coloration overcoming the natural tendency that Hingston finds everywhere prevalent to develop a strong "anger" coloration. Such is a brief statement of what the author calls his "principle of colour conflict."

Moreover he extends his theory of the universality of the combat motive to cover the relations between the sexes—and in this rather ingenious, but possibly far-fetched way: What in birds we have been accustomed to call courtship—display, antics, song—is all directed, not towards the female, but against a rival male, and even in the final act of mating, the emotion of the male is that of triumph over his rivals rather than that of any purely sexual satisfaction, while a similar triumphal anger against all other females animates the female in this final act. Anger, thus, and fear, according to Major Hingston, are the only emotions that the lower animals ever experience.

Our author adduces some evidence to show that combat among birds is largely or almost entirely psychological, and to his mind that accounts for the enormous development of color in the plumage of birds, where it takes the place of the actual weapons of warfare.

To sum up Major Hingston's conclusions, I can do no better than quote a few passages. "All growth and development, whether of the individual or of the species, is based upon one common principle, namely the urge inherent within life itself to express

that force which for want of a better term we must call its emotional content" (page 378). He thinks all differences between species—not color alone—are due to conflict. "I hold the cause of evolution to be the conflict that exists in the vital forces inherent in life itself" (page 395). "The generating force [in speciation] is the vital influence in the species itself, and the track is one or other of the various outlets through which that impulse finds expression" (page 398). Naturally, he rejects natural selection as anything more than "the favouring or unfavouring influence of the environment"—"a collaborating influence." As for sexual selection, the whole book is, of course, an argument against it, and frequently the reader encounters such bald statements as "This is quite inapplicable on sexual selection."

As I intimated at the beginning, this is an interesting and suggestive book. Perhaps one ought not to quarrel with Major Hingston for leaving us at the end with another mysterious "vital influence" to account for—or to accept without accounting for. Perhaps one ought only to be grateful to him for amassing so great an array of evidence on the methods and machinery of combat among animals. But one cannot help suspecting that here is another case of a theory stretched beyond the snapping point. Why will not theorists be content with lesser conquests and not try to use their theories to account for everything in nature, and then in the end present us with new problems, so that new theories must be evolved to account for the working of those just presented? Not that I deprecate the formulation of theories. Science would be dry and profitless without them. But why not try to apply the old and fairly workable theories before starting new ones that end nowhere in particular?

Among these old and fairly workable theories I place that of sexual selection. It may be admitted that there is less in the nature of *active* selection on the part of the female than Darwin supposed, but the theory does not demand that. All that is necessary to make it valid is to show that males better equipped in any way than their rivals—in weapons, courage, strength, attractiveness of coloration, or the power or beauty of their vocal utterances—get mates more readily and hence leave more offspring. I am not going to make any attempt to do this in the present paper. I

simply want to call attention to the fact that much that is said against the theory is really beside the mark, and I suspect that some of the critics—not the more serious ones, of course—may have been misled by the term “sexual selection” into thinking that deliberate selection of mates by the females was implied, whereas it is just as much nature that does the selecting by this process as in the case of what Darwin called natural selection as opposed to artificial selection.

As a matter of fact, in the case of the book now under review, many of the facts adduced by the author—perhaps most or even all of them—can be accounted for on the sexual-selection theory, in spite of Major Hingston’s frequent statements to the contrary. Indeed, I had read a considerable distance into the book before I discovered that he supposed his combat principle to be contrary to that theory. What he shows in his first chapter as to the coloration of the lion—black or blackish on mane, ears, and tail-tuft, which are displayed in fighting—the strongest and most convincing part of his book, seems to be an excellent argument for sexual selection, since obviously the lion best equipped for terrorizing his rivals would most easily win mates. Natural selection, too, may have helped to perpetuate the terrorizing equipment of the lion and other mammals, since the individuals best equipped to frighten animals of other species that dispute their territory might enjoy longer lives and hence leave more descendants. Whether the terror coloration would help by intimidating prey, as Hingston believes, is, on the other hand, open to serious question.

To go at all minutely into Major Hingston’s instances and arguments would take altogether too much time. I may mention a few of his points, however, and give what I conceive to be the answers. He believes that “animals have their upper surfaces darker than their under surfaces because it is the upper surface that is visible to the enemy while the under surface is hidden from view” (page 28). He makes no mention at all of Thayer’s principle of counter-shading for concealment, which is, I believe, pretty generally accepted.

He makes a distinction between warning and threatening colors, denying the existence of the former. To him the skunk’s white is for purposes of active threat rather than to warn its enemies away.

This looks a little like a distinction without a difference. White rump and tail patches are, he thinks, primarily for the purpose of startling carnivores, though he admits that warning the rest of the herd may have come to be the more important function.

The brilliant naked posteriors of certain monkeys also have a threatening function, and he likens the red to that of the flushing of the human face in anger. Just why nature should have chosen this particular part of the monkey for threatening purposes he does not make clear. One would think its exposure might put the animal at a disadvantage in an attack.

Man's hair, wherever placed, is for threat, not adornment, according to Hingston. As to the hair of the head, his entire argument concerns men's hair, and he overlooks the fact that women's hair has long been considered ornamental. The beard, similarly, has a threatening function, and one can understand on that theory why women are unprovided with beards, but when we come to consider axillary and pubic hair, we encounter again the difficulty that women as well as men are provided with those appendages. Major Hingston thinks that man's erect posture and his habit of raising his arms in fighting makes it appropriate, if not inevitable, that these particular regions develop these terrorizing tufts.

I wonder if this might not be a better guess as to the origin and purpose of these specialized developments of the hair: Axillary and pubic hair in primitive man gave notice that their possessors were ready for reproduction. The lack of a well-developed sense of smell in man made some visual notice necessary in order that men and women might not waste their time on immature members of the opposite sex. Beards, coming to full growth later than pubic and axillary hair, indicated virility and complete maturity. They were adapted to the patriarchal system. The head of the family would have the largest beard. Not so long ago many doctors cultivated beards as a mark of maturity, and *not*, I think, for the purpose of terrifying their patients—or even rival practitioners.

Coming to the birds, our author avers that feathers are primarily for purposes of threat. He sees no value in them as preservers of the body-temperature. Similarly their colors, when not concealing, are for combat. The colors are brighter and more varied than

mammalian colors because their battles are chiefly psychological and the colors have become weapons of themselves. He calls attention to the fact that crests, plumes, combs, and other such ornaments tend to assume conspicuous colors which call attention to them.

All is grist that comes to Hingston's mill. Thus the wide opening of the mouth by nestlings has a secondary use in frightening away small enemies. As to white in a bird's tail, "The exposure is a gesture of avian defiance, and secondarily a signal to mate or young or other members of the flock" (page 146).

On page 153 he makes the rather astonishing statement: "If bright colour is an ornament, and the females choose the most ornamented males, then the offspring ought to be intermediate in ornament between that of the male and female parent . . . But it is not so." It is difficult to follow this argument.

He considers spots and stripes on young birds concealing, but bars on the wings and tails of hawks and owls threatening, but does not explain why the latter should be any more threatening than the former.

On page 226 we read: "If these bright colours were intended for beauty, then beauty would be the test of mating and the necessity for pugnacity would not arise. The more beautiful the animal was, the less it would need to fight with rivals." To this we might reply, "No! the more it would invite attack from the less beautiful, and the more it would need to fight to defend itself."

Speaking of domestic animals, he says: "The theory of colour-conflict is likely to serve as a useful instrument for explaining the colour-patterns of domesticated animals. While on the view that colour is an adornment, no light whatever can be thrown on this interesting and complicated subject" (page 243). I should suppose that no other agency than artificial selection was necessary to account for these colour-patterns—working, of course, in conjunction with purely physiological laws.

Here is a rather characteristic *nonsequitur* in argument: Speaking of the use by man of imitations of the tusks of animals, he says: "Man does this solely for psychological reasons. Hence there can be little doubt that the phenomenon he has copied possesses an identical function." That is, the fact that a savage wears a mask

with prominent tusks to scare his enemies is *prima facie* evidence that the wild boar's tusks are chiefly for intimidation instead of for actual combat.

And now we come to bird-song. Hingston thinks song cannot be for the purpose of charming the female because the male sings from a high perch instead of seeking her out to pour it into her ear. The obvious answer is, of course, that the male has to advertise himself in order to attract the female. He adduces the loudness of song as indicating its combative character, but birds do not always sing loud. I quote again: "The more terrific it can make the utterance, the more clearly it will demonstrate to possible rivals the aggressive force that it can bring against them" (page 274). Is it possible that what we commonly call bird-song can be terrific to any creature? It may dishearten rivals, but actually terrifying them is another matter. We shall come back to this subject later.

The gesticulations of the male, he thinks, cannot be made for the benefit of the female because she is where she cannot see them. This seems a curious notion. On page 276 he says: "It might be said that the males were competing with each other in order that the female might choose the most melodious. But that is impossible, for they are almost always far apart." (Note the "impossible" here, a favorite word with Major Hingston.) On the other side, supporters of the sexual-selection theory have repeatedly pointed out that a deliberate choice between males seen or heard at the same time was not at all necessary to the theory.

Discussing mimicry among birds, our author considers that imitations are challenges to the birds imitated. But that does not account for the restriction of the habit to a comparatively few species.

On pages 288, 289, we read: "No bird of the ocean has a good song. Singing is decidedly a land accomplishment. Why is this? No explanation is possible on sexual selection." The answer, of course, is that they are unprovided with the proper vocal organs and that, like many families of land-birds, they have developed other ways of making themselves attractive to the opposite sex.

In treating of mating flights and dances he says they are explicable only on his theory and cannot be explained on sexual selection (292-97). Of course, he fails to prove his point. In fact,

he offers no evidence whatever against the sexual-selection explanation; he simply makes the bald statement.

Perhaps I have said enough to indicate the nature of Major Hingston's evidence and arguments in favor of his theory of the rôle of anger in the development of color, display, and song in birds.¹ Let us now consider the subject more generally. And let me begin by admitting that in certain cases, especially in certain mammals, as in the lion, color may have great threatening value, particularly in conjunction with such appendages as manes and ear and tail tufts. It seems very probable that these colors and these appendages may actually have been developed through their usefulness in combat by supplying a psychological reinforcement to the physical powers of their possessor. For the machinery by which the development is brought about, I think we may still look to sexual selection, aided by natural selection as at least a part of the motive power. To attribute it all to some mysterious newly conceived force in nature seems to me to get us nowhere in particular. But the color that seems most threatening in mammals is black, and human psychology will readily admit the possibility that black in general may operate effectively in combat. Similarly red, the color of blood, may be admitted to have terrifying possibilities. Among birds, however, we find a great variety of bright and, to us, pleasing colors and color-patterns, many of which it is difficult for human beings to conceive of as in themselves suggesting anger or intimidation. Such are the blue of the Bluebird, the crimson of the Purple Finch, the rich attire of the Wood Duck. Of course, Abbott Thayer has shown the possibility that many of these bright colors may be actually concealing under certain circumstances in the bird's natural haunts, but for the moment we may ignore that possibility and consider them simply as bright and pleasing colors. And it is difficult to escape the conviction that they have some purpose to fulfill and are not purely fortuitous. Some have thought that they were simply expressions of their wearers' vigor, but it is hard to see how a green pigment that gives

¹ I have omitted mention of Hingston's evidence drawn from reptiles, amphibians, insects, etc., because a consideration of this would widen too much the scope of this paper. I have also refrained from calling attention to a number of errors of fact concerning American species. The detection of such errors does not increase the reader's confidence, but neither does it of itself invalidate the author's generalizations.

a blue color by means of refraction or reflection or both can indicate greater vigor than a brown or black pigment. At any rate, mere vigor can hardly account for the great variety in color and pattern to be seen in birds. It seems much more reasonable to assume that such colors and patterns have been produced and developed by some definite evolutionary process to serve some end that is useful to the bird.

Now, Howard and others have shown that many species of birds do actually use, in fighting, display very similar to, or even identical with, that used in courtship. I do not think, however, that we are warranted in assuming, as Hingston does, that the emotion that animates the birds in both cases is the same. Birds are limited in their means of showing emotion, and it does not seem at all strange that a male bird should "show off" before a prospective mate in much the same way he would before a rival. We can readily admit, too, that a feeling of rivalry may prompt a bird to show another male all his magnificence of coloration and his proficiency as a songster. It is not the *use* of color and song for the purpose of discouraging rivals that I am disputing; it is that they could have originated in that way and for that purpose.

It should also be noted that there are many courtship actions between birds that are not used in combat and that could not conceivably have arisen as forms of offensive or defensive behavior. Such are the feeding and nest-building actions that some birds use in courtship.

It seems to me that Major Hingston and others who emphasize the rôle of anger in evolution have failed to go back to first principles and have allowed themselves to become sidetracked. Now, the one great aim of all life is self-perpetuation. For unisexual animals this aim is served by two fundamental instincts—that of self-preservation and that of reproduction. The first of these fundamental instincts is served by the appetites hunger and thirst and the reactions that accompany the emotion of fear. The reproductive instinct is served by the sex-urge. The reactions that accompany the emotion of anger can in turn serve any one of the three appetites—hunger, thirst, and sex—or the fear reactions. That is, an animal can make an effective use of anger against another that is threatening its food-supply or that monopolizes its

drinking-pool or that comes between it and a desired mate or that threatens it with bodily injury. But in all such cases anger is only a tool in the service of more fundamental appetites and emotions.

To ascribe to anger—and this includes pugnacity and the desire for dominance—to ascribe to anger the leading rôle in the life of the individual or the race seems to imply the ignoring of two much more important factors. It is certainly more reasonable to look for an explanation of the evolution of any unisexual animal in the fundamental instincts that provide for the preservation of the individual and of the race than in any such subsidiary emotion as anger.

If we admit this, we must, of course, fall back upon the sexual urge to account for any revealing coloration we find among birds. We may admit that anger and pugnacity may play their part in connection with the sexual urge, but we can hardly grant it a leading part, and that because the one important thing is to bring the sexes together, not to keep individual males apart. The chief importance of territory to a male bird is that its possession enables him to provide for the next generation. That is his purpose—unrecognized by him, of course—in defending it against his rivals. In other words, the instinct to acquire and defend a particular territory has arisen because it is of use to the species. It must not be forgotten that this territorial instinct derives its importance solely from the end it serves—that of perpetuating the species.

Now, of course, there are two ways in which Darwin's sexual selection is supposed to work. One is through the preferences of the female. The other is through the superiority of the male in combat with rivals. Exponents of the anger theory might contend that the latter method was the only important one in all animals. We may admit that it is the more important way in many animals—perhaps in most mammals—those that depend upon strength and fighting-equipment to overpower their rivals. When we come to birds, however, we find quite a different state of things. We find beauty¹ of color, color-pattern, form, and vocal utterance developed to an extraordinary degree. It is hard to believe that this beauty can have been developed purely for combat purposes. If produced by selection at all, how could the rose of the Grosbeak's

¹ The word "beauty" is here used as equivalent to pleasingness.

breast, the ocelli of the Peacock's tail-coverts, the tones of the Hermit Thrush's song be the products of an ascending series of angry conflicts? If psychological combat had operated on the Thrush's voice—to take but one of these examples—why did it not grow harsher and harsher, more and more truly terrifying?

The obvious reply of Hingston's supporters will be that for all we know the Hermit Thrush's song, though pleasing to our ears, is actually disagreeable to birds. It may be difficult to prove that this is not the case. On the other hand, I suspect it would be still more difficult to prove that these melodious sounds, pleasing to us because of their mathematical regularity, are not for the same reason pleasing to the birds belonging to that suborder the Passeres which has developed the voice to an extent exceeded only, if at all, by man. It is surely not unreasonable to assume that birds experience sensations of pleasure upon hearing bird-songs. These pleasurable sensations might be neutralized and yield to other emotions if the song came from a recognized rival, but a female bird could hardly fail to be pleased by a good song of the type to which her nature compelled her to react, and pleased in proportion to its quality. And all I have said of song is equally applicable to the evolution of pleasing colors and color-patterns.

Much of the foregoing is equally applicable in a discussion of Dr. Arthur A. Allen's views as set forth in his paper "Sex Rhythm in the Ruffed Grouse and Other Birds." This important paper is based on a long series of careful experiments and observations on Grouse and birds of other species and reaches some very interesting conclusions. With some of these conclusions probably few if any ornithologists are in a position to disagree. The theories have been very carefully worked out and do not lay themselves open to attack all along the line, as does Major Hingston's thesis. But, though some of the conclusions are, perhaps, unassailable, others do not appear to be entirely convincing.

The evidence may be adequate to support four of the eight conclusions enumerated at the end of Dr. Allen's paper: that (4) "female birds have a short oestrus period during which fertilization must take place"; (5) "male birds have a similar short mating period during which they are able to fertilize eggs"; (7) "in order

to insure the propagation of the strongest birds, the virile male must keep all the other males out of his territory and must drive out all females that are not in the same reproductive cycle [= stage] as himself lest another male mate with his female, or lest he waste his energy on a female that does not synchronize with him"; and (8) "the stage of the reproductive cycle each spring is determined primarily by the vigor of the bird . . . and secondly by the *mental state* of the individual, and this is determined largely by the results of his conflicts with others of his kind."

The other four conclusions we may consider one by one.

"1. Birds are not sex conscious, that is, they do not discriminate between the sexes as such." In one sense few would dispute this. Probably no serious student believes that birds can be sex-conscious in the sense in which man is sex-conscious. We cannot believe that birds have any conception of maleness or femaleness in the abstract, or that any bird *thinks* of such a thing as sex-difference or even recognizes another bird of its species as likely to become at some future time a mate or a rival or to have been such in the past. It is doubtless all a matter of reaction to stimuli. Doubtless mates get accustomed to each other *as individuals*, and their companionship may last long beyond the breeding season, as it appears to do in the case of the White-breasted Nuthatch, for instance. This does not mean, however, that they have any sense of being mated one to the other. In this sense birds are not sex-conscious, and no new experiments were needed to prove it. But in spite of the individual instances to the contrary that Dr. Allen cites, we must believe that *in the long run* males react as males and females react as females—that males react in the male manner to feminine behavior in the females and females react femininely to masculine behavior in the males. That, I take it, is *all* there is to 'cognizance of sex' in birds, but that would seem to be enough.

Dr. Allen has seen one of his captive female Ruffed Grouse go through actions of coition with "a small *male* that had been completely subjugated by a larger companion and lay flat in a corner of the pen." In this case, though the female played the male's part so far as she was able, it is clear that the subjugated male was entirely passive and did not *play* the part of the female. It seems also extremely unlikely that such an incident could have happened

in a state of nature. We must not lose sight of the fact that the Grouse under observation were confined in pens where it was impossible for the subjugated birds to save their self-respect by escaping into a different territory.

It seems probable, too, that the Ruffed Grouse has a peculiar psychology of its own that lends itself to abnormal behavior in unusual situations. There are many cases on record, for instance, of wild Ruffed Grouse becoming friendly and familiar with men, women, and children out of doors. An instance came under my own observation in February, 1924. I heard of a Grouse that had approached neighbors of mine who lived near the woods and had been fed by them. One morning I carried some scratch feed to the road leading into the woods. The bird, a female, approached me and, walking up within a yard of my feet, began feeding on the scratch feed I had scattered. She fed for some time, but when I started off to catch my morning train, she left the food and followed me, crossing in front of me only a yard away and walking round me till the approach of another person sent her walking off. It seemed clear that, as in other such cases, it was human companionship the bird wanted more than the food. I have supposed that this sort of behavior was due to an abnormal development of the herd instinct, the bird transferring to man the allegiance normally due to the flock just as dogs have done from time immemorial. But I know of no other species of bird with a similar kink in its mental make-up, and it may be of some significance in connection with Dr. Allen's observations.

At all events, one can hardly escape the conviction that the male Grouse that displayed before women and children but not before men must have been an abnormal bird.

"2. Courtship displays, including song, are one form of intimidation and the stronger bird, irrespective of sex, is the more active performer." Here I suppose it is through inadvertence that Dr. Allen states that *in song* the stronger bird, irrespective of sex, is the more active performer. Probably his "including song" was intended to apply only to the first part of the sentence. Even with this emendation this conclusion needs further qualification, I think, before it can be universally accepted. It leads, however, to the next conclusion:

"3. Domination and fear are the important principles in the development of secondary sexual characters . . ." For the reasons given in the discussion of Hingston's book it would seem that this conclusion is open to grave question.

Dr. Allen says of the male Grouse that "if he is able to prove his superiority—and a female is strong enough to resist or elude his attacks until they are both in the same mating cycle—fertilization takes place and the world is assured of the reproduction of the strongest individuals. The Survival of the Fittest still seems to be the strongest law of Nature." But, is not this a case of the *mating* of the fittest, and is it not sexual selection, pure and simple?

Dr. Allen tells of capturing a male Song Sparrow and confining it in a cage $4 \times 4 \times 12$ inches and exposing it to a rival, which tried to attack it through the wires of the cage. The captive bird, though apparently not alarmed at finding itself in captivity, did display extreme fear of the attacking Sparrow, and when the latter got hold of one of its primaries, quivered and died from the shock. He regards this as evidence that the fear of rivals on the part of weaker birds may be the activating principle "in developing the ornamental or conspicuous plumes, or bright colors or loud songs of male birds" through natural selection. It seems probable, however, that it was not simply the fear of its rival that killed the Song Sparrow but, in addition, its sense of its own helplessness in so small a cage. Doubtless if the affair had taken place in the open, the weaker bird would have flown away and 'lived to fight another day'; so that here again *natural* selection, or the *survival* of the fittest, would not be brought into play.

Dr. Allen admits that "it is difficult sometimes to understand how little differences in color or song can have much survival value," but he considers that "*if their presence indicates greater strength to rival males* and therefore helps to produce fear or inferiorism, then their value cannot be measured by their slightness. They have real value in the eyes or ears of rival males and therefore real significance in the action of natural selection." I must still insist that the case for *sexual* selection, even through the "eyes and ears of rival males," is much stronger than that for natural selection. But for reasons adduced in an earlier part of this paper the case for sexual selection operating through the preferences of the female seems to me stronger still.

"6. Bird behavior, including the earlier arrival of males than of females on the nesting ground, and of adults than first year birds; selection of territory, song, fighting, and display of plumage are explainable on the basis of the necessity for synchronizing the mating cycles of male and female."

But would it not have been a more direct method of synchronizing the mating cycles to lengthen the periods of potency in both male and female through other and more economical processes of natural selection? Why should we assume that the sex rhythm is immutable and that all else must conform to that? As it is, in the light of Dr. Allen's discoveries we may agree that nature used an agency she had at hand to bring about this synchronism—the combativeness of males not yet ready for mating—but to go farther and say that the combativeness arose from the necessity for its use in that particular connection, and that all ornament and song were caused by the need for the use of combativeness in mating, would seem to be something like employing a high-power tractor to drag a baby-carriage.

Here we have two supremely important phases of the evolution of bird life—the development of that vast range of varied and beautiful colors and color-patterns and ornamental plumes on the one hand, and, on the other, the development of all that infinite variety of rhythm and tone and melody that we know in bird-song. Can we believe that all this hinges on so comparatively trivial a thing as a few days of advancement or delay in the development of the gonads? Is it not more reasonable to attribute ornament and song to something deep-seated in the psychology of the birds—a peculiar sensitiveness to bright colors and melodious sounds—a psychological concomitant of that sexual urge which is absolutely necessary to the continuation of bird-life on the globe? And especially when we consider that it is *pleasing* colors and sounds that we have to account for, not such as we should expect to be evolved by processes that aim at producing more and more terrifying effects.

For without denying the importance of intimidation in keeping away weaker rivals and in discouraging all but the strong females, we may point out that the males that are most attractive, in color or in song, will naturally attract the largest number of females,

and so have an advantage over their rivals and leave more progeny.

Our examination of these two studies thus brings us back to Darwin's theory of sexual selection substantially as he left it, though with some interesting corollaries supplied by recent investigators. It seems to show that anger has had a rôle in evolution, especially in that of the carnivorous mammals, acting through both natural selection and sexual selection; but that sexual selection by means of the conscious or unconscious preferences of the female has played a much more important part in the evolution of color, song, and display.

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