

THE ROLE OF SEX IN THE EVOLUTION OF MIND

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The reason for the existence of sex is one of those biological problems which has long perplexed the scientific world, and to-day its solution seems as remote as it did a century ago. Many remarkable discoveries have been made in regard to the microscopic structure and development of the germ cells. We have learned much of the general biology of sex, and the probable evolution of sex in the organic world. And substantial progress has been made in respect to the old problem of the determination of sex. But to the question, Why came there to be two sexes at all? or, in other words, Why did not organisms continue to reproduce asexually as it is probable they once did? we can only offer answers that, at best, are very hypothetical. The bacteria and the blue-green algæ, so far as careful investigation has yet ascertained, reproduce exclusively by the asexual method, usually by fission or the formation of spores. But among the higher plants and in nearly all animals we find the existence of two sexes of very general occurrence. While the fact that sex is absent in the lowest forms of life indicates that evolution has proceeded, at least a certain distance, without its aid, and suggests the possibility of the evolution of sexless forms of a high degree of organization, yet the general prevalence of sex in all but the most primitive organisms points to the conclusion that sex has played a fundamental role in the evolution of the organic world. There are many theories as to the part which sex has played, but the profound disagreement among several of these which have secured the widest following is significant of how little is positively established in regard to this subject. While the cause of the development of sex may remain obscure, it is not difficult to point out some of its consequences, although it would be futile to attempt a very accurate picture of what the organic world would be had sex never been evolved. Even if the processes of variation and selection had gone on to the same extent—which is scarcely probable—the absence of sex would have given a very different direction to evolution from that which was actually followed. Many of the most complex structural arrangements of organisms have especial reference to the union of the germ cells. The color and scent of flowers, and their many and beautiful adaptations to secure cross-fertilization would never have appeared if plants were propagated exclusively by the asexual method, and this would doubtless have entailed more or less extensive changes in other parts of the organism. In animals the structural peculiarities associated with sex are as a rule among the most complex features of the body. Some animals, to be sure, simply discharge their sex cells into the water, leaving their union to chance, but in the majority of cases, especially in higher forms, there exist elaborate mechanisms to insure the meeting of these cells. Correlated with these structures we find mating instincts which frequently manifest themselves in complex modes of behavior. More acute senses have been evolved in many cases very largely for effecting the meeting of the sexes. The large antennæ of male moths, the large eyes of the common drone bee, and the auditory apparatus of the male mosquito are a few of the countless illustrations of this fact. The various apparatus in insects for making sounds which are found in crickets, locusts, cicadas, etc., are devices for securing the meeting of the sexes, and the complementary development of the auditory apparatus in the same insects has doubtless

been furthered through the evolution of these structures.

Much of the elaborate organizations of the imago stage of insects has reference, directly or indirectly, to activities concerned in mating and depositing the eggs in the proper environment for the development of the young. There is a relatively long larval or nymphal period chiefly devoted to the vegetative functions of assimilating nutriment and growth; in many cases the imago takes no food, or need take none, before the eggs are fertilized and laid; and in several species the mouthparts have become so completely atrophied that food taking is impossible. Mating not infrequently occurs soon after the insects emerge from the pupal covering. In the may-flies, which live but a short time in the winged state, in order to mate and deposit their eggs it is probable that the imago stage would long ago have disappeared were it not retained as a means of effecting the union of the sexes. The same is doubtless true of many other insects. The activities of the imago state, broadly speaking, are primarily altruistic; they are concerned mainly with the welfare of other members of the species. They are also expensive. In the winged state, numerous new enemies are encountered and many lives are lost. In the pupa stage which prepares for it there is commonly an extensive tearing down of old structures and the building up of new ones, during which the insect is helpless against many enemies.

Mating activities are almost everywhere among the most complex performances of an animal's life. The opposite sex must be distinguished from all other creatures and responded to accordingly. Often pursuit and capture or winning over are the necessary preliminaries to sexual union. All this puts a premium, so to speak, on the sharpening of the senses, the development of strength and activity, and the evolution of the higher psychical qualities. Consider the mating activities of crustaceans, the courtship of spiders, the breeding habits of fishes, and still more the elaborate wooing of male birds, and it will become manifest how greatly the institution of sex has stimulated the evolution of complex modes of behavior.

All the facts here cited are trite enough, even to the non-biological reader. But while it is sufficiently evident that the differentiation of the sexes has promoted the development of behavior in relation to mating, it may be well to point out the enormous indirect consequences of this development in respect to the evolution of mind in general. In the evolution of behavior one kind of instinct grows out of another just as new organs are usually formed through the elaboration of some preexisting structure. A general elaboration of instinctive reactions in regard to anyone sphere of activity affords, therefore, a basis for the differentiation of more complex and specialized behavior in respect to other activities. To take a concrete illustration: The primary function of the voice in the vertebrates was to serve as a sex call, as is now its exclusive function among the Amphibia. Later and secondarily it came to be employed in relation to the protection of the young (through various instinctive calls) and as a means of communication with other members of the species. Finally, in man it afforded the means of articulate language. It is not improbable, therefore, that the evolution of the voice, with all its tremendous consequences

with respect to the evolution of mind, is an outgrowth of the differentiation of sex. Were it not for its value in effecting the mating of the lower vertebrates the voice might never have been evolved and man never have become man.

While the specialization of senses which in certain cases at least has been carried on mainly for sexual purposes has doubtless afforded the basis for the elaboration of many instincts, it is practically impossible to trace in detail how various instincts, sexual and other, have acted and reacted on one another's development. But we can discern enough of the influence of sex differentiation on the evolution of behavior to feel assured of its importance. The necessity for solving the one problem that confronts all diœcious animals which do not simply shed their sexual products at random into the water, has tended to keep behavior in one sphere up to a certain minimum standard. The male must find and impregnate the female, and this fact sets a certain limit to his degeneration, at least in some period of his life, because any further degeneration would involve fundamental changes in the method of reproduction which may not be possible. But besides acting as a check to degeneration, the necessity for mating has in general been a constant force making for the evolution of activity, enterprise, acuity of sense, prowess in battle, and the higher psychic powers. One can not pretend, except in the most general terms, to gauge its role in the evolution of mind, but it has evidently been a factor of enormous potency.



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