4.10: Sexual Selection

As we have already noted, it is not uncommon to see morphological and behavioral differences between the sexes. Sometimes the sexual dimorphism and associated behavioral differences between the sexes are profound; they can even obscure the fact that the two sexes are actually members of the same species. In some cases, specific traits associated with one sex can appear to be maladaptive, that is, they might be expected to reduce rather than enhance an organism's reproductive potential. The male peacock's tail, the gigantic antlers of male moose, or the bright body colors displayed by some male birds are classic examples. Darwin recognized the seriousness of this problem for evolutionary theory and addressed it in his book *The Descent of Man and Selection in Relation to Sex* (1871). Where the investment of the two sexes in successful reproduction is not the same, as is often the case, the two sexes may have different and potentially antagonistic reproductive strategies. Organisms of different sexes may be "looking" for different traits in their mates. In general, the larger parental investment in the production and rearing of offspring, the less random is mating and the more prominent are the effects of sexual selection. It is difficult not to place these behaviors in the context of conscious behaviors, (looking, wanting, etc.), in fact these are generally the result of evolved behaviors and do not imply self-conscious decision making. This may even be the case among organisms, like humans, who are self-conscious. What exactly is happening is an interaction between costs, benefits, and specific behaviors is complex.

Consider an example in which the female does not require help in raising offspring but in which the cost to the female is high. Selection would be expected to favor a behavior in which females mate preferentially with the most robust males available. Females will select their mates based on male phenotype on the (quite reasonable) assumption that the most robust appearing male will be the most likely to produce the most robust offspring. In the context of this behavior, the reproductive success of a male would be enhanced if they could advertise their genetic robustness, generally through visible and unambiguous features. To be a true sign of the male's robustness, this advertisement needs to be difficult to fake and so accurately reflects the true state of the male. For example consider scenarios involving territoriality. Individuals, typically males, establish and defend territories. Since there are a limited number of such territories and

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females only mate with males that have established and can defend such a territory, only the most robust males are reproductively successful. An alternative scenario involves males monopolizing females sexually. Because access to females is central to their reproductive success, males will interact with one another to establish a dominance hierarchy, typically in the form of one or more alpha males. Again, the most robust males are likely to emerge as alpha males, which in turn serves the reproductive interests of the females. This type of dominance behavior is difficult or impossible to fake. But, cooperation between non-alpha males can be used to thwart the alpha male’s monopolization of females.

Now consider how strategies change if the odds of successful reproduction are significantly improved if the male can be counted on to help the female raise their joint offspring. In this situation, there is a significant reproductive advantage if females can accurately identify those males who will, in the future, display this type of reproductive loyalty. Under these conditions (the shared rearing of offspring with a committed male) females will be competing with other females for access to such loyal males. Moreover, it is in the male’s interest to cooperate with fertile females, and often females (but not human females) advertise their state of fertility, that is the probability that mating with them will produce offspring through external signals.

There are of course, alternative strategies. For example, groups of females (sisters, mothers, daughters, aunts, and grandmothers) can cooperate with one another, thereby reducing the importance of male cooperation. At the same time, there may be what could be termed selection conflicts. What happens if the most robust male is not the most committed male? A female could maximize their reproductive success by mating with a robust male and bonding with a committed male, who helps rear another male’s offspring. Of course this is not in the committed male’s reproductive interest. Now selection might favor male’s that cooperate with one another to ward off robust but promiscuous and transient males. Since these loyal males already bond and cooperate with females, it may well be a simple matter for them to bond and cooperate with each other. In a semi-counter intuitive manner, the ability to bond with males could be selected for based on its effect on reproductive success with females. On the other hand, a male that commits himself to a cooperative (loyal and exclusive) arrangement with a female necessarily limits his interactions with other females. This implies that he will attempt to insure that the offspring he is raising are genetically related to him.

The situation quickly gets complex and many competing strategies are possible. Different species make different choices depending upon their evolutionary history and environmental constraints. As we noted above, secondary sexual characteristics, that is, traits that vary dramatically between the two sexes, serve to advertise various traits, including health, loyalty, robustness, and fertility. The size and symmetry of a beetle’s or an elk’s antlers or a grasshopper’s song communicate rather clearly their state of health. The tail of the male peacock is a common example, a male either has large, colorful and symmetrical tail, all signs of a health or it does not – there is little room for ambiguity. These predictions have been confirmed experimentally in a number of systems; the robustness of offspring does correlate with the robustness of the male, a win for evolutionary logic.

It is critical that both females and males correctly read and/or respond to various traits, and this ability is likely to be selected for. For example, males that can read the traits of other males can determine whether they are likely to win a fight with another male; not being able to make such an accurate determination could result in crippling injuries. A trickier question is how does a female or a male determine whether a possible mate will be loyal? As with advertisements of overall robustness, we might expect that traits that are difficult or expensive to generate will play a key role. So how does one unambiguously signal one’s propensity to loyalty and a willingness to cooperate? As noted above, one could use the size and value of nuptial gifts. The more valuable (that is, the more expensive and difficult the
gift is to attain), the more loyal the giver can expect the gift giver to be. On the other hand, once valuable gift-giving is established, one can expect the evolution of traits in which the cost of the gift given is reduced and by which the receiver tests the value of gift, a behavior we might term rational skepticism, as opposed to naive gullibility.

This points out a general pattern. When it comes to sexual (and social) interactions, organisms have evolved to “know” the rules involved. If the signs an organism must make to another are expensive, there will be selective pressure to cheat. Cheating can be suppressed by making the sign difficult or impossible to fake, or by generating counter-strategies that can be used to identify fakes. These biological realities produce many behaviors, some of which are disconcerting. These include sexual cannibalism and male infanticide, both mentioned above. What we have not considered as yet is the conflict between parents and offspring. Where the female makes a major and potentially debilitating investment in its offspring, there can be situations where continuity a pregnancy could threaten the survival of the mother. In such cases, spontaneous abortion could save the female, who can go on and mate again. In a number of organisms, spontaneous abortion occurs in response to signs of reproductive distress in the fetus. Of course, spontaneous abortion is not in the interest of the offspring and we can expect that mechanisms will exist to maintain pregnancy, even if it risks the life of the mother, in part because the fetus and the mother, which related are not identical; there can be a conflict of interest between the two.

There are many variations of reproductive behavior to be found in the biological world and a full discussion is beyond the scope of this course, but it is a fascinating subject with often disconcerting implications for human behavior. Part of the complexity arises from the fact that the human brain (and the mind it generates) can respond in a wide range of individualistic behaviors, not all of which seem particularly rational. It may well be many of these are emergent behaviors; behaviors that were not directly selected for but emerged in the course of the evolution of other traits, and that once present, play important roles in subsequent organismic behavior (and evolution).

Contributors and Attributions

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