

Explaining the Peacock's Tail

Sexual Selection. Testing the Alternatives. J. W. BRADBURY and M. B. ANDERSSON, Eds. Wiley-Interscience, New York, 1987. xii, 308 pp., illus. \$81.95. Dahlem Workshop Life Science Research Reports, vol. 39. From a workshop, Berlin, F.R.G., Aug. 1986.

In 1871 Darwin began a controversy that has not abated by suggesting that apparently maladaptive, sexually dimorphic traits, such as the peacock's "tail," have often evolved because they permitted their bearers to attract more mates than less well-endowed competitors. Regarded for many years as the least credible part of the theory of sexual selection, this idea has attracted renewed interest in the last 15 years with proliferation of field studies of social behavior and the development of formal theory on the origin and evolution of mating preferences for sexually selected traits. Vigorous debate has ensued over the merits of rival theories and the nature of the data needed to discriminate between them, raising wider issues of the degree to which social behavior is adaptive and the role of theory in evolutionary biology. In 1986, 48 researchers in the field met in Berlin to discuss the topic and to outline priorities for future research. This well-produced volume records their deliberations in a series of position papers and four group reports.

Perhaps the most complex and contentious issue in sexual selection theory is the role of female choice in the evolution of extravagant male courtship traits. It is the first topic considered, and its influence pervades the entire volume. Extreme sexual dimorphism is most obvious in species in which males provide their mates with neither resources nor assistance in parental care, but in such species females appear unlikely to gain direct benefits from mate choice. If female choice has caused the evolution of dimorphic traits, what forces have propelled it? One solution, proposed by Fisher, relies on a positive genetic correlation between preference and preferred male trait, set up through assortative mating. As a result of the correlation, the preference will evolve simply as a nonadaptive side effect of sexual selection on the male trait. A popular alternative hypothesis is that the preference is selected because chosen traits indicate genetically determined components of male viability that are transmitted to offspring.

Maynard Smith lucidly places these models of female choice within the full range of mechanisms of sexual selection, identifying theoretical problems that others take up. Fisher thought that preferences would originally be favored through the viability-indicator mechanism. For this to occur there must be heritable variation in total fitness among potential mates, but natural selection is expected to eliminate such variation. The genetic data relating to this question are carefully considered by Charlesworth, who concludes that recurrent mutation may maintain some additive genetic variation in fitness; whether it is sufficient to warrant female choice remains open. Kirkpatrick considers a range of alternative origins for mating preferences, including the idea that they arise simply as a consequence of sensory biases. Fisherian models have shown how subsequent evolution of trait and preference are strongly affected by genetic correlations between the preference and the chosen trait or indeed other characters, a theme explored by Kirkpatrick and Lande. Kirkpatrick also shows, in a new model, how the imposition of search costs on choosing females can constrain the broad range of evolutionary equilibria characteristic of Fisherian models to a single outcome.

Although genetic models of the Fisher process have greatly expanded our understanding of how sexual selection could operate, not all field workers are convinced that the peacock's tail is thereby explained. In this vein Andersson suggests that current models are primarily guides to thought rather than prescriptions for detailed empirical study. Borgia reminds us that the formal working out of a theory is no guarantee of its correctness and makes a plea for the study of plausible alternatives. The state of this debate is ably summarized in Heisler's group report, together with suggestions for distinguishing between alternative views. Among the main conclusions are the potential value of comparative studies in testing the past importance of particular mechanisms of selection and the need for genetical studies that examine critical assumptions of the different models in contemporary populations. One overriding impression, however, is that the similarities of Fisherian and viability-indicator models are at least as interesting as their differences. Moreover, the two mechanisms may operate together.

The remaining three sections offer a more varied menu, including discussion of the relative importance of female choice and male competition, the factors that constrain opportunities for sexual selection to occur and curb the elaboration of affected traits, and the nature of inferences that can be drawn from field studies that measure variation in reproductive success in natural populations. Many of the position papers cover familiar ground. Among the exceptions, Hammerstein and Parker explore, using game-theoretic models, the degree to which males and females respectively are expected to search for mates, yield in conflicts of interest over incestuous mating, and provide parental care. Their conclusions include the provocative suggestion that inbreeding avoidance is an unlikely cause of sex-biased breeding dispersal: were it the cause female dispersal would be more prevalent than is actually the case. Queller considers how sexual selection theory applies to flowering plants and finds that opportunities for mate choice differ in important ways from those available to animals. Halliday surveys data (mainly from insects and Amphibia) on physiological costs of male courtship and asks whether elaboration of courtship traits might be limited by physiological trade-offs rather than mortality costs. A recurrent theme of the group reports is the need for more data on all aspects of sexual selection. A lengthy shopping list of projects is provided for the aspiring researcher.

In keeping with the goal of the conference on which it is based, this book emphasizes conceptual issues and unsolved problems. Readers hoping for a tidy summary of all that is known about sexual selection may be disappointed. But for anyone who wants to know why Darwin's views still raise hackles after more than a century, as well as for those attempting to find out whether he was correct, it will be an essential reference.

ROBERT GIBSON,
Department of Biology,
University of California,
Los Angeles CA 90024-1606

From Cabot to Shelton

The Cold Light of Dawn. A History of Canadian Astronomy. RICHARD A. JARRELL. University of Toronto Press, Toronto, 1988. xii, 251 pp. + plates. \$35.

This history begins with explorer John Cabot's arrival in Newfoundland in 1497 and extends down to Ian Shelton's discovery of supernova 1987A in the Large Magellanic Cloud with the University of Toronto's