Eberhard, W. G. 1985. Sexual Selection and Animal Genitalia. Harvard University Press, Cambridge, Massachusetts and London, England. 244 pp. (Price $25.00).

Why are genitalia, particularly male genitalia, so useful as taxonomic characters for distinguishing closely related species? Most of us probably assume that animals evolve genital differences to prevent interspecific mating. Or put another way, animals other than arachnologists also use genitalia for species identification. W. G. Eberhard's provocative new book contends that this traditional interpretation is erroneous, and elaborates a new hypothesis, namely that male genitalia have evolved so rapidly and divergently in response to female mate preference among males of the same species.

In form, the book is an extended argument. Chapter 1 documents the phenomenon. Male intromittant organs are useful in species-level taxonomy in animals ranging from arthropods, planarians and nematodes to sharks, snakes and rodents. Rapid evolution of male genitalia may therefore be one of the most ubiquitous patterns in nature. Chapters 2-4 consider several previous hypotheses, including the species identification hypothesis, and explains why none of these hypotheses adequately explains observed patterns of genital diversity.

Chapter 5 outlines Eberhard's female choice hypothesis. Briefly, the hypothesis assumes that females prefer as mates certain conspecific males on the basis of some genital trait. Even if there is no other adaptive advantage associated with this trait, the fact that females prefer males exhibiting the trait gives those males a fitness advantage, and the trait will spread. If females prefer a more elaborate form of the trait, then the trait will become more and more elaborate until its advantage relative to mating is balanced by its disadvantage relative to survival. A key feature of this argument is that females will prefer traits which are arbitrary with respect to other aspects of male fitness. Thus male genitalia can be expected to evolve the elaborate and bizarre morphology with which arachnologists are so familiar.

Chapters 6-11 consider arguments and evidence for and against Eberhard's hypothesis. Among other things, he demonstrates convincingly that numerous mechanisms exist by which females might influence which of several mates actually succeed in fertilizing her eggs—a necessity for the theory to work. Both in these, and previous, chapters Eberhard uses his extensive knowledge of the arachnid literature to support his arguments. Of more than 700 references cited, nearly 100 pertain to arachnids.

Perhaps the most impressive aspect of this book, aside from the exciting new idea presented, is the creativity with which Eberhard milks the existing literature for information bearing on his, and competing, hypotheses. For instance, he reasons that if genitalia diverged because of their use in species identification, then species which have little opportunity to make species identification errors would be expected to show less divergence than species which frequently contact close relatives. He tests this prediction by examing divergence and elaboration of genitalia in geographically isolated species (island endemics and host-specific parasites, for which hosts are habitat islands) compared with divergence in nonisolated near relatives.

In compiling his arguments, Eberhard by necessity also compiles a fascinating survey of the diversity of animal mating mechanisms. We learn of such phenomena as hypodermic insemination (males insert their genitalia through the female body wall and deposit sperm in the body cavity), exploding spermatophores, and genital scoops for removing females' stored sperm. Therefore, even if the book weren't so well written, so excellently illustrated, and so imaginatively conceived, it would still be worth owning.

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