Book Reviews

The Generative Process

Gametes and Spores. Ideas about Sexual Reproduction, 1750–1914. JOHN FARLEY. Johns Hopkins University Press, Baltimore, 1982. xii, 300 pp., illus. $24.50.

Why do some animals and plants reproduce sexually whereas others do not? How does reproduction happen in both cases? And why does sex exist at all? These are some of the questions that John Farley traces from the mid-18th to the early 20th century in this informative and well-organized book. Because the problem of reproduction has been fundamental throughout the history of biology, Farley's study touches on many of the biological disciplines, techniques, and theories of the last two centuries. His narrative encompasses three periods: 1750 to the 1830's, when sexual reproduction was the principal focus of naturalists' attention; the middle decades of the 19th century, when asexual reproduction became the paradigm of generation; and the period from the 1870's to the 1910's, when sexual reproduction reemerged as a unique process and took on a new evolutionary significance.

Because there are so many topics and individuals covered in this book (nearly 300 biologists are listed in the index), only a few subjects can be highlighted here. During the 18th century, Farley recounts, most naturalists believed in the preexistence of all living things since the Creation; and controversies arose over whether the preformed organism is carried by the female parent (ovism) or the male (animalculism). Sexual reproduction was seen as universal among living things, and the vertebrate animal and flowering plant provided the model for all organisms. Much discussion, among naturalists like Linnaeus, Buffon, Haller, Bonnet, and Spallanzani—whether pro or con preexistence—centered on fecundation, that is, on the problem of what each sex contributed to the generative process. Ovism became the dominant doctrine, and by the end of the century spermatic animalcules had been demoted to the status of parasites, as von Baer's term *spermatozoa* ("animals of the semen") denotes. One impact of Schleiden and Schwann's cell theory in the 19th century was to reinstate the status of spermatozoa, principally as a trigger to initiate the egg's development.

By the 1840's and 1850's, Farley shows, asexual reproduction had been found to be widespread among lower animals and plants. Additionally, alternation of generations was discovered by Steenstrup, although it was not fully understood for decades. Asexual reproduction became so much the focus of attention that, in Farley's words, "Sex no longer occupied center stage." Schleiden's and Hoffmeister's work on plant life cycles and the research of Owen, von Siebold, and Lubbock on parthenogenesis contributed to the belief that no fundamental difference existed between sexual and asexual reproduction and that only the stimulus required—soil or sperm—separated the spore from the egg. These ideas were mirrored in the development of Charles Darwin's views on reproduction, as can be seen in his early transmutation notebooks and in his later publications.

In the final chapters of his book, Farley documents the phenomenal impact that cytology had on reproduction studies, which resulted in the chromosome theory and in the discovery of mitosis and meiosis. Such figures as O. Hertwig, Weismann, Boveri, Roux, Driesch, E. B. Wilson, Bateson, and Morgan are discussed; and the merging of evolutionary theory, cytology, and the Mendelian theory of inheritance is traced through all its complexities. The chromosomal theory of sex determination arose as the paradigm case of the cytologists' reduction of sexual reproduction to identifiable cellular events—a viewpoint, Farley notes, that is still presented to biology students even though the actual picture is much more complex both genetically and environmentally. Farley ends his study by discussing the many fundamental problems still unsolved in reproductive biology, concluding that "ninety-nine percent of the world's species reproduce sexually, and we still do not understand how that came to be."

Much of this book is taken up with the presentation and analysis of scientific material. One subtheme is the relationship between improvements in observational techniques and scientific advance, which Farley discusses in two contexts: the development of achromatic lenses in the 1820's, with subsequent claims that one could see the sperm penetrate the egg; and parallel advances in staining and fixing techniques in the 1880's that led to observations of nuclear division. Rejecting the explanation that new techniques simply enabled investigators to see unambiguous new facts that necessarily generated advances in theory, Farley stresses the interpretative context in which such new evidence was received, as well as the controversies that ensued and that in turn generated further observational investigations.

A second attempt to offer a wider framework for his study can be found in the chapter "The sexless age," where Farley correlates the biological de-emphasis on sexual reproduction in the mid-19th century with Victorian attitudes toward sex and toward the place of women in society. The argument presented here is suggestive, yet it is not pressed too far (we are shown a "reflection" of social values in science rather than a "causation" of the latter by the former). Indeed Farley's comparison of Victorian sexual attitudes with the 18th-century context might have been strengthened had he not only looked for freer attitudes toward sex in the earlier period, but also noted the social context of the hierarchical and predetermined natural world depicted by 18th-century naturalists.

Farley's study is an important contribution to the history of biology, synthesizing a subject that has generally been treated only in episodic fashion. His ability to write for scientists as well as for historians should make *Gametes and Spores* appealing to both audiences.

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An Ecological Reconstruction

Resource Competition and Community Structure. DAVID TILMAN. Princeton University Press, Princeton, N.J., 1982. xii, 298 pp., illus. Cloth, $27.50; paper, $9.95.

In this book Tilman rebuilds the equilibrium theory of competition in ecological assemblages. The reconstruction includes changes in method, in testing ground, and in starting point. Individually these improvements are not entirely novel. Collectively, though, they allow Tilman to begin from the classical hy-