Book Reviews

Contributions to the Modern Synthesis

Evolution and the Diversity of Life. Selected Essays. ERNST MAYR. Belknap Press of Harvard University Press, Cambridge, Mass., 1976. xii, 722 pp., illus. $20.

The idea that the diversity of nature could be dealt with in a comprehensive manner was 250 years old by the 1930's when the efforts of men like Theodosius Dobzhansky, Julian Huxley, Bernhard Rensch, George Gaylord Simpson, and G. Ledyard Stebbins began to forge a powerful new synthesis between genetics and systematics. In the formation of this synthesis, which had a profound conceptual effect upon biology as a whole, Ernst Mayr played a key role. It is therefore notable that some 45 of his essays, somewhat revised and occasionally abridged, and accompanied by a small amount of introductory and explanatory material, have been reprinted.

The ways in which evolving populations should be classified, and the processes that go within them, have occupied Mayr's attention from the time of his extensive studies of Melanesian and Polynesian birds nearly 50 years ago. He has long been a champion of the "biological species concept," which states that species are "groups of interbreeding natural populations that are reproductively isolated from other such groups" and that they are the "real units of natural selection" (essay 35). His rigorous application of the polytypic or multidimensional species concept to the classification of birds has made possible a much more useful classification of this group of animals than any that was possible earlier. He has also applied these concepts to the classification of fossil man (essay 36) and has attacked those zealous partisans who see cladism as the unique answer to all problems in population biology (essay 30).

The so-called "biological" species definitions have undeniably been useful as a yardstick against which to measure the observed patterns, but many scientists today feel that they have limited applicability to most groups of organisms. Mayr himself (essay 13) has remarked on the very limited information available concerning gene flow, a phenomenon that is a cornerstone of the "biological" species concept. The efforts currently under way to measure gene flow and to evaluate its role in natural populations owe much to the development and forceful presentation of this concept, however. Taking up Mayr's own emphasis on the diversity of life, we would now say that we would like to understand in detail the genetic and ecological characteristics of the units that we recognize as species in many groups; in my opinion, they may have little in common. If species are in fact diverse in origin and in the factors that lead to their maintenance, this fact has profound implications not only for taxonomy and evolution but also for ecology and especially theoretical population biology.

Systematic biologists owe much to Mayr for his development of concepts such as that of sibling species (essay 34) and his clear recognition of the importance of the sympatric maintenance of differences between populations as a key to understanding the structure of nature (section 6). By his development of the "founder principle," he drew attention to the important role of the genetic structure of populations in determining the rates at which they could change (essay 15). His relentless arguments against the notion that speciation could be sympatric (essay 13) helped greatly to clarify thinking in this area, hitherto vague and indecisive. Above all, his consistent recognition of the diversity of organisms and the importance of this diversity in the philosophy of biology and the theory of systematics has had an important salutary effect.

In addition to significant essays in each of these areas, the book contains a useful section on the history of evolutionary biology, including analyses of aspects of the contributions of Jean Lamarck, Louis Agassiz, Karl Jordan, and Charles Darwin. Particularly informative is the essay that outlines the development of this area, and of genetics, in the decades that preceded the revolutionary 1930's (essay 22). Nine of the essays and about a fifth of the book are devoted to biogeography and include discussions of the avifaunas of the Western Hemisphere, the southwestern Pacific, and the Hawaiian Islands, partly updated with information from plate tectonics. These remain largely valid and are useful source materials for further studies of the respective areas.

Mayr clearly recognizes his role as a player in an endless game of synthesis, explanation, and apology. At present, we are experiencing a revolution in population biology similar to that of the 1930's. The role of ecological concepts is becoming increasingly important; ecology may well dominate the whole field for the next half century, as genetics has during the past one. Questions about the numbers of species that can coexist and the ways in which they divide up the habitat are being asked with increasing precision.

The puzzle of change in populations—the factors that control it or make it possible—may prove capable of analysis by new biochemical tools that enable us to work with groups of genes acting as units and that already have revealed a degree of heterozygosity in natural populations that was largely unsuspected until the past decade. Mathematical analysis is also giving us new ways of dealing with the integration of the genotype and may enable us to understand, for example, why marginal populations often change so rapidly. Even more interesting is the question why species remain more or less constant in their characteristics and recognizable, since we now know that "gene flow" cannot in most cases provide the answer. The answer is clearly ecological in part, but what does the integration of the genotype really mean? Why do some populations change readily, others remain constant? We seem to have come full circle and arrived at a partial vindication of Darwin's view that species hang together because their members play a particular ecological role.

By these essays, as by his well-known books, Ernst Mayr has shown himself to be a true follower of Darwin, Wallace, and Huxley. His writings are lively and critical, and they provide remarkable insight into the development of the field over the past 50 years. The book should be valuable for those who, building upon the foundations established by Mayr and his contemporaries, seek to extend our understanding of the properties of populations and the ways they are viewed within the disciplines of evolution, genetics, taxonomy, and ecology.

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