Book Reviews

Problems in Marine Biogeography

Zoogeography and Diversity of Plankton. S. VAN DER SPOEL and A. C. PIERROT-BULTS, Eds. Halsted (Wiley), New York, 1979. viii, 410 pp., illus. $69.95.

This book deals with the biogeography of marine planktonic organisms including phytoplankton, but the emphasis is on zooplankton. By choice of topics and authors, the editors aspire to the traditional objectives of biogeography, namely, description of distribution patterns of organisms and explanations of how present ranges of organisms originated and are maintained. In fact, only the first objective is attained, but the book very clearly demonstrates why pelagic biogeography is today constrained to mere description of distributions.

All the major ocean basins are to some extent interconnected, so that even planktonic genera tend to be cosmopolitan. Present distributions of higher taxa therefore tell very little about centers of speciation, if any, or past dispersal routes. Moreover, basic biogeographic methods, such as establishing the ranges of species, interpreting disjunct geographic distributions, and documenting intrataxon variation and morphological divergence within and between oceans, depend on sound taxonomic studies that emphasize modern procedures and utilize large, geographically extensive collections. Yet major groups of planktonic animals (for example copepod crustaceans) are still poorly known taxonomically, which accounts for numerous ambiguous interpretations, particularly in the chapters that treat geographical variation in morphology of species, neritic-oceanic zonation, and modes of speciation in the oceanic pelagial. Throughout the book the plea is made for more and better taxonomic work on plankton, but there is a paucity of practicing taxonomists today.

Hypotheses concerning the origins of present ranges of most planktonic species will be speculative at best and never open to refutation because only a small fraction of planktonic organisms leave fossilizable remains. The lack of fossils is regrettable since past fluctuations in global climate and the tectonically driven changing configuration of ocean basins may have dramatically influenced the distributions of planktonic species. Plausible effects of both processes are reviewed in the two chapters contributed by paleontologists. Both chapters are based on information for the few groups of planktonic organisms whose inorganic tests, shells, or skeletal components are preserved in deep sea sediments. One chapter outlines the possible development globally of oceanic epipelagic faunal zones from Paleozoic time to the present but is sadly lacking in specific illustrations of past distributions. The other chapter deals briefly with changes in distributions of Antarctic planktonic species during the Cenozoic. There is an extensive literature on this subject, including the CLIMAP studies, to which the book provides a good entry. The chapter on speciation also contains a brief illustrated account of the trend toward "oceanic provincialism" in present-day planktonic species from a pattern of apparently much broader geographical distributions in the early Cenozoic. Plankton biogeographers will depend heavily on this information gleaned from a fossil record of an unfortunately selective and possibly not representative group of organisms.

A major conclusion to be drawn from the book is that biologists still do not understand what determines present limits of geographical distributions of planktonic species. Even in the surface layer of the sea, where ocean circulation is most intense, planktonic species have geographically restricted distributions. In the Pacific Ocean, for example, major faunal boundaries extend across the ocean at about 20° and 40° latitude in both hemispheres. The existence of boundaries in mid-ocean, where physical barriers to dispersal are lacking, is a biogeographical mystery the solution of which will at least require detailed study of the physiology and population biology of species near the edges of their ranges. This point, not sufficiently strongly made in the book, should be a cause for reflection among those marine paleontologists who infer ocean paleoclimates (essentially temperature) from changes in distributions of species or composition of plankton assemblages. Indeed, a conspicuous omission from the book is critical assessment by biologists of the assumptions, procedures, and results of the CLIMAP investigations.

Besides extensive discussions of global biogeographic patterns, there are chapters specifically covering each of the major ocean basins—the Atlantic (including Arctic), Indian, Pacific, and Antarctic seas—and a somewhat tedious chapter on the Mediterranean. Because of the diversity of interests among the authors of these chapters the treatment is uneven, making comparisons of oceans difficult. In this respect the book reflects Dunbar's complaint that "there are as many [biogeographic] methods as there are biogeographers."

Given the limitations of the taxonomy, fossil record, and ecology of plankton noted earlier, it is not surprising that a unified theory of pelagic biogeography does not emerge in this book. Nevertheless, the book provides an up-to-date, comprehensive compilation of the literature, integrates better than any recent book the historical perspective with present conditions, and clearly points to matters in need of further investigation.

BRUCE W. FROST
Department of Oceanography, University of Washington, Seattle 98195

Invertebrate Behavior

Comparative Studies of the Courtship and Mating Behavior of Tropical Araneid Spiders. MICHAEL H. ROBINSON and BARBARA ROBINSON. Bishop Museum Department of Entomology, Honolulu, 1980 (distributor, Bishop Museum Press, Honolulu). 218 pp., illus. Paper, $22.50. Pacific Insects Monograph 36.

Most members of the large and diverse spider family Araneidae spin vertical orb-webs and live in a world perceived largely through touch and air- and web-borne vibrations. Upon reaching maturity a male abandons his own web to search for that of a female. When successful, this quest transforms the female's web from a prey capture device to an arena where both predatory and courtship activities occur. To reduce

predatory tendencies, effect mutual arousal, and eliminate or reduce interspecific mating, the male (usually much smaller than the female) initiates an elaborate courtship. When successful, this induces female participation and eventual submission to copulation.

In their monograph the Robinsons present the synthesis of nearly a decade of field studies in the African, American, and Pacific tropics. After describing in detail the courtship, copulatory, and postcopulatory behavior of 53 araneid species belonging to 15 genera, the authors characterize three major patterns of araneid courtship, discuss the origin, modification, and function of constituent behavioral units, and suggest probable evolutionary trends.

At a time when the related problems of araneid phylogeny and classification (both traditionally based largely on morphology) are far from resolved, it is exciting to find ethologists suggesting a credible solution based firmly on analysis of 21 behavioral characters. In testing their hypothesis systematists will be challenged to consider many new kinds of evidence. For example, the Robinsons' description of differences in orientation and insertion of male pedipalpi (copulatory organs) suggests that the functional morphology of these complex appendages should be more carefully investigated.

This study will prove useful both to those interested in spider behavior and evolution and to those concerned with the general topic of animal communication. Although the authors remain true to their major objective of evaluating macrobehavioral differences and trends they provide many useful observations and comments on such topics as postcopulatory cannibalism of males, competition between males for a female, species-specific mating behavior, and the function of courtship. By so doing they offer implicitly and explicitly a number of hypotheses for future ethological and evolutionary studies.

The text is supported by nearly a hundred illustrations, half being close-up photographs of mating sequences and the remainder being drawings and tables depicting components of courtship and copulatory behavior. Despite its technical nature this monograph is both easily read and efficiently used as a reference. Without being anthopomorphic the authors communicate their patient fascination with spider behavior.

BRENT D. OPELL
Department of Biology, Virginia Polytechnic Institute and State University, Blacksburg 24061

Plant Biochemistry

Secondary Plant Products. E. A. BELL and B. V. CHARLWOOD, Eds. Springer-Verlag, New York, 1980. xvi, 676 pp., illus. $108.90. Encyclopedia of Plant Physiology, New Series, vol. 8.

This volume is a compilation of authoritative reviews of secondary natural products, the aim of which is to present updated accounts of this rapidly expanding field. The book contains a large amount of theoretical and practical material concerning the chemistry, biochemistry, taxonomic significance, and ecological roles of secondary products. The careful organization, systematic approach, and comprehensiveness of the volume make it a valuable resource for both graduate students and investigators in the biological sciences.

Of special interest is the historical introduction by K. Mothes, which gives the reader an understanding of the many roles secondary products play in nature (a protective function, both past and present, may be the raison d'être for most of them) and in applications in such fields as agriculture and medicine. The possible significance of secondary products in plants and the control of secondary metabolism are discussed by E. A. Bell and M. Luckner respectively. Regulatory mechanisms have been studied very little for secondary metabolites, but Luckner has done a thorough job of presenting selected data from bacteria, fungi, and higher plants that show how the formation of different types of secondary products may be controlled. There are, in addition, five chapters each on alkaloids and isoprenoids and single chapters on plant phenolics, nonprotein amino acids, amines, cyanogenic glycosides, glucosinolates, betalaines, carbohydrates, and plant lipids of taxonomic significance—enough to whet the appetite of any plant scientist.

All the chapters are quite readable. Most of the chapters on alkaloids have been written by organic chemists (the one exception is a chapter on isoprenoid alkaloids by J. G. Roddick, who is a biologist). As a result they are chemically oriented, discussing alkaloids as derivatives of a particular amino acid, with emphasis on biosynthetic pathways, and have considerably less treatment of biology than biological scientists would have desired. The other chapters present more general information on such topics as distribution, localization, isolation, characterization, and quantitative measurement and offer some speculation on function. The book could have been improved tremendously if each chapter had had a section on environmental influences and catabolism of secondary natural products. The old belief that secondary natural products are inert end products of plant metabolism is erroneous; they undergo a variety of degradations, some at appreciable rates.

Some 99 of the book's 676 pages are devoted to author, species, and subject indexes. The book is amply illustrated with many structures; unfortunately a few are incorrect. The literature coverage generally extends only through 1977, with the latest references dated 1978.

GEORGE R. WALLER
Department of Biochemistry, Oklahoma State University, Stillwater 74074

Symbiosis

Cellular Interactions in Symbiosis and Parasitism. Papers from a colloquium, Columbus, Ohio, Sept. 1978. CLAYTON B. COOK, PETER W. PAPPAS, and EMANUEL D. RUDOLPH, Eds. Ohio State University Press, Columbus, 1980. xiv, 306 pp., illus. $25. Ohio State University Biosciences Colloquia, No. 5.

Particular aspects of lichens, malaria parasites, cestodes, trypanosomes, mycorrhizas, and algal-invertebrate associations are covered in this book. The individual contributions, which focus on the cellular aspects of symbiotic and parasitic interactions, deal with four general themes: initiation and establishment of relationships, cellular mechanisms for nutrient uptake and translocation, defense mechanisms of host cells, and genetic and metabolic integration. For the most part the papers are written in such a way as to facilitate comparison of the relationships between partners in various host-symbiont or host-parasite systems and comparison of the techniques that have been used to elucidate them. The candor of many of the contributors in describing the limitations of the methodologies and the gaps in present knowledge will make their chapters excellent points of departure for new research.

A number of papers are particularly noteworthy. A paper by Aikawa, for example, is a gem. He assumes that the reader has little or no familiarity with *Plasmodium*, the malaria parasite. After describing the parasite he analyzes the evidence for recognition sites on the parasite and the process of invagination of the erythrocyte membrane, leaving the reader with little doubt that this aspect of malaria is fairly well understood.