the interaction of that cosmological duality the *yin-yang*, the functioning of the five elements, and the circulation of *ch'i* (pneuma) within the human body. The latter is of a more practical nature, with long discussions of the therapeutic art of acupuncture.

Veith's translation is limited to about the first third of the *Su Wen* section, which does indeed "contain nearly all the basic ideas of the *Nei Ching*." She explains these ideas in a 76-page introduction indispensable for the reader's first encounter with traditional Chinese medicine and philosophy.

The book, then, provides a ground-level entrance into the thought behind one of the world's great medical traditions, a tradition which (as the new preface notes) is still very much alive. The real regret must be not just that the bulk of the *Nei Ching* remains untranslated and its text not yet subjected to thorough philological analysis, but that the entire field of Chinese medicine has been so neglected. The original appearance of this translation was, Veith acknowledges, largely due to the inspiration of Henry Sigerist. The book remains a tribute to his efforts to break medical history out of its Western cultural boundaries, and a reminder of how much yet needs to be done.

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Echinoderms

Physiology of Echinodermata. RICHARD A. BOOLOOTIAN, Ed. Interscience (Wiley), New York, 1966. 840 pp., illus. $45.

The echinoderms are a distinctive group of marine invertebrates whose relationships, both among themselves and to other phyla, have long been perplexing to zoologists. They were once placed in the biological limelight as ancestors of the vertebrates. This was based on the presence of the vertebrate muscle phosphagen, creatine phosphate, in a few species belonging to the Echinoidea and Ophiuroidea. The subsequent identification of creatine in other invertebrate phyla caused the validity of such biochemical evidence of vertebrate ancestry to be questioned, and for this as well as more sound phylogenetic reasons the idea of a direct origin of the vertebrates from the echinoderms has generally been discarded. Echinoderms are well known to developmental biologists because of the extensive use of their gametes in research and laboratory exercises on fertilization and early embryogenesis.

This book is an attempt to bring together what is known of the biology (and not necessarily physiology, as the title would imply) of echinoderms. As in most multi-authored volumes, the actual degree of attainment of the stated objective, "to summarize our knowledge to date and attempt to indicate the direction in which research appears to be heading," is as varied as the information in each area and each contributor's skill in assembling it. The book is, however, an up-to-date compilation of a great deal of information.

The introductory chapter appropriately presents the morphological diversity of the echinoderms and gives one view of their evolution. A recently proposed classification scheme for the Echinodermata is included in this chapter. Because the more familiar taxonomic scheme of L. H. Hyman is generally used throughout the remainder of the book, one cannot help feeling that a comparison of the different views of taxonomy and phylogeny would have served a better purpose. The ecology and biology of crinoids, holothurians, echinoids, asteroids, and ophiuroids are treated in a series of five chapters which are surprisingly uniform in their coverage and include aspects of growth, age, population dynamics, feeding habits and mechanisms, locomotion, predation, and so on, and the responses of the members of each group to environmental factors such as light, salinity, temperature, and depth and pressure. There is also a chapter dealing with the symbioses in which echinoderms participate.

With the exception of the nervous system and its integration, the more classical areas of echinoderm physiology are more or less restricted to single chapters. For the nervous system, the topics covered include aspects of its functional morphology, neurohumors and neurosecretion, coordination of spine movement, photosensitivity and reception, and behavior. There are also chapters on the specialized physiology of the water-vascular system, external respiration, the coelomic fluids and coelomocytes, salinity tolerance and ion regulation, bioluminescence, muscle physiology, nutrition, and the pharmacology of substances isolated from echinoderms. A chapter on the chemical composition and structure of the endoskeleton might also be included in this category. In general, these chapters present a balanced and comprehensive coverage of each topic.

In spite of the early interest in the comparative biochemistry of the echinoderms, there have been surprisingly few studies of their biochemistry, and the dearth of information is obvious from this book. The echinoderms are among the more brightly colored invertebrates, and they present a diverse array of distinctive pigments such as the spinochromes and echinochromes. The comparative biochemistry of these quinone pigments, the carotenoids, melanins, and some miscellaneous pigments occurring in echinoderms is covered in two chapters. There is a chapter on the gross chemical composition of various echinoderms, their tissues and organs, and the variations therein. The chapter on amino acid metabolism is mainly concerned with the amino acid and nitrogen composition of sea urchin eggs and the utilization of the amino acid pool for protein synthesis during early development. Brief discussions of other facets of echinoderm biochemistry are found in several other chapters. Little is known of the basic metabolism of either carbohydrates, lipids, or amino acids in these organisms.

Two chapters on reproduction and development are perhaps among the more valuable contributions. In one, lucid instructions are given for acquiring and handling echinoderm gametes for experimental purposes, and in the other there is an up-to-date review of knowledge of fertilization and development. These chapters are destined to be well thumbed by developmental biologists. The other topics covered in this general area include autotomy and regeneration, sex determinism, and reproductive cycles.

The book is relatively free of typographic errors. The illustrations, although scarce in some chapters, are for the most part adequate. Much of the information is presented in table form. According to the editor's preface, the manuscripts were returned to the contributors for updating just prior to publication, and some chapters include 1966 citations. An author index and a very essential species index

are included. The subject index is relatively poor. A weakness of the book is that the subject matter of many chapters is rather ill-defined, so that there are numerous scattered discussions, varying in scope, of the same material. The book thus leaves an impression of diffuseness. Because it does represent a modern treatment of much of what is known of echinoderm biology, it is too bad that its prime purpose, that is, providing quick reference to specific information, has been weakened by the redundancy in coverage and the inadequate indexing.

The price of the book will seriously limit its use. The main value of a specialized volume on the biology of a group of organisms is in its use by graduate and postdoctoral students working with such organisms and by teachers of comparative physiology and zoology. At $45 a copy, it is likely that many will feel the book is not worth the price.

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Concepts of Geometry

A New Look at Geometry. IRVING ADLER. John Day, New York, 1966. 414 pp., illus. $7.95.

In recent years there has been a considerable increase in the number of books on geometry for the high school mathematics teacher. They differ from those of a generation ago in seeking to emphasize the evolution of geometric thought and to portray the concept of geometric structure rather than to present a mass of geometrical detail. Adler is more conscious of the overall objective than are some other writers. The first half of his book presents Euclidean geometry from four points of view. Two of these are traditional: the axiomatic point of view as initiated by Euclid and made rigorous by Hilbert, and the coordinate point of view based on the work of Descartes. It is less common to present the Euclidean plane as a vector space over the reals, and it is distinctly uncommon in elementary literature to include Adler's fourth look at the plane, as an algebraic structure whose points and lines are defined as involutory subsets of an abstract group. The second half of the book is largely concerned with the development of the newer geometric structures. The chapters on non-Euclidean and on projective geometry are the longest in the book, each taking about 65 pages. In both of these chapters, as indeed throughout the book, there is considerable historical material. Moreover, one finds in this book more on Riemannian geometry, on topological spaces, and on measure spaces than in comparable books. There is greater concern with interrelations between the evolution of geometric thought and the growth of physics and philosophy. It is a good book for the bright high school student and his teacher to read and to ponder over, but its usefulness as a textbook in college classes is impaired by the lack of a sufficient number of nontrivial exercises.

The book is not altogether free of errors. A cardinal number is defined as a symbol (p. 48) and the Playfair axiom is stated incorrectly (p. 76). The proof on page 82 disregards the author's warnings against adding lengths of segments without considering order relations. The figure on page 272 exhibits an exceptional situation rather than the normal one called for by the text material. The present reviewer cannot accept the author's conclusion (p. 369) that "while the problem of identifying which of the three [classical] geometries is true of physical space has not yet been solved, it is in principle solvable." Geometry, as Poincaré wrote, is not true, it is advantageous.

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Island Biology

The Galápagos. Proceedings of the symposia of the Galápagos International Scientific Project, 1964. ROBERT I. BOWMAN, Ed. University of California Press, Berkeley, 1966. 336 pp., illus. $10.

Research on geographic areas of biological interest is often hindered by the dispersion of background information through a great variety of often lesser-known or older publications. The main purpose of the Galápagos International Scientific Project was, as the editor of its symposium proceedings writes, to "assess our scientific knowledge" of one such area. *The Galápagos* is therefore not a series of papers presenting new detailed information about the archipelago, nor is it a series of reviews of well-known biological groups. But it is a useful source book, and one which shows how unevenly previous research on the area has been carried out.

The volume contains 40 papers. The first seven are grouped under the heading General Scientific Studies. As is true throughout the volume, some of the papers in this section deal with topics pertaining directly to the Galápagos (for example, "Variation and adaptation in Galápagos plants," by G. L. Stebbins), while others deal with broader topics pertaining to problems of insular biology ("Insular adaptive radiation among birds," by D. Amadon) and a few with topics only incidentally related to the Islands ("Behavior studies of animals in their natural environment," by N. Tinbergen). This broad coverage will make *The Galápagos* useful not only to students of these particular islands but to anyone interested in insular biology.

The section entitled Specialized Scientific Studies has four subdivisions. The first subunit, The Physical Environment, will be useful to biologists generally. The next two subunits, Marine Biology and Terrestrial Biology, deal with the taxonomy, origin, distribution, physiology, and ecology of the flora and fauna. That many of these studies are at the level of alpha taxonomy indicates how limited previous work has been. Biogeographic relationships, not only between the Galápagos and the South American mainland but also between the Islands and Mexico, the West Indies, and other areas, are discussed. One interesting point brought out by several authors was that the degree of endemism on the Islands is less than was previously believed. For example, more detailed investigations of plant distribution on the opposite mainland have shown that a number of supposed endemic species are also to be found in the arid parts of Ecuador and Peru. In the chapter by D. Abbott, "Factors influencing the zoo-geographic affinities of Galápagos inshore marine fauna," there is a great deal of useful information concerning ocean currents that influence the Galápagos. Two chapters discuss Cocos Island, Costa Rica. The final subunit, Applied Science, is composed of three papers dealing with conservation and economic resources.

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