Another impressive evolution is seen in Krebs and R. Dawkins's lively chapter on communication. In the first edition of the book they argued that because the reproductive interests of signalers and receivers usually differ, the entire concept of communication is antiquated since "if information is shared at all it is likely to be false information." In the new version the authors still believe that they are dealing with a "coevolutionary arms race" between "manipulators" (signalers) and "mind readers" (receivers), but now they clearly distinguish signals among genetic competitors from communication between cooperators. In the former case, Krebs and Dawkins hypothesize the evolution of exaggerated, conspicuous, repetitive (for example, ritualized) signals that are basically "dishonest." On the other hand, when individuals' reproductive interests coincide, so that manipulators benefit from having their minds read, more "honest" communication will occur. In this situation the signals will be muted and inconspicuous ("conspiratorial whispers," the authors call them), both to minimize signaling costs and to prevent eavesdropping.

Overall this volume is a clearly written, well-produced, and reasonably priced guide to the hot topics in behavioral ecology. It will make for informative reading and spirited discussion among practitioners, graduate students, and others hoping to keep up with this exciting, fast-moving field. On the other hand, the book's long-term value hinges largely on whether parameters of the various models can be measured in nature and, if so, on the correspondence between theoretical predictions and reality.

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The Invertebrate Integument

Biology of the Integument. Vol. 1, Invertebrates. J. BEREITER-HAHN, A. G. MATOLTSY, and K. SYLVIA RICHARDS, Eds. Springer-Verlag, New York, 1984. xvi, 841 pp., illus. $111.

This volume provides a comprehensive examination of the integumentary features of the major invertebrate phyla, with some review of the more limited information available on the minor phyla. For many invertebrate phyla (for example, Cnidaria, Turbellaria), the dominant feature of the integument is its transporting function. For other invertebrates, especially the Arthropoda, its salient feature is its barrier function. The integument of insects is skeleton as well as skin and serves very well in protecting the terrestrial insect from desiccation while limiting the respiratory surface (the tracheal system).

The great variety of integumental innovations among the various invertebrate phyla is covered by 45 chapters organized into 12 sections including Acoelomata (Turbellaria, Trematoda, Nemertea), Pseudocoelomata (Nematoda, Acanthocephala), Annelida, Mollusca, Arthropoda, Echinodermata, and Protochordata. The sections on the Annelida and the Mollusca are about 100 pages each; that on the Arthropoda is over 200 pages. A scientist with a special interest in one of these groups would find a detailed treatment in *Biology of the Integument*. (Porifera are omitted.)

The exclusive use of ciliated surfaces by certain invertebrate groups justifies an introductory chapter on cilia. Cilia are found at specialized sites on the external epithelium of the Ctenophora. On the other hand, the Turbellaria are characterized by an extensive ciliated epithelium. Similarly, the reader is prepared for later reference to epithelial cell interactions by an introductory chapter on intercellular junctions. Both sealing functions and gap junctions between epithelial cells appear in the Coelenterata and provide both the necessary restrictions on "leakage" and the basis for an integument that is both environmental barrier and selective transporter. These cellular interactive features are missing in the Porifera.

I found the discussions of cuticle in the various phyla to be of considerable interest. The primitive origin of cuticular coverings is emphasized by Rieger, who states that "cuticles are likely to be as old as flagellated epithelia in the Eumetazoa and are likely to be a primitive feature of the adult organization of Eumetazoa." The primitive cuticle was probably a simple surface coat of mucoproteins or mucopolysaccharides. The collagenous cuticle of the Annelida is considered in detail by Richards. There is also a careful treatment of Nematoda cuticle by Bird. The most extensive discussion of cuticle occurs in five chapters in the section on the Arthropoda. These cover the biochemistry (Hackman), structure (Neville), mechanical properties (Hillerton), molting (Gnatry and Romer), and ecological significance (Hadley) of cuticles. An additional chapter (Gilby) treats insect cuticle in relation to penetration by insecticides but does not consider the pesticides that are thought to inhibit chitin synthesis. All of this is introduced by an excellent overview of the cell biology of cuticle formation in a chapter by Locke.

Although the organization of the book is phylogenetic, the subchapter headings are detailed enough that a reader interested in such topics as sensory cells and structures on the integument or permeability and transport functions can quickly find the appropriate sections for review and comparison. Readers will be aided by a substantial list of references that covers the literature through at least 1982 as well as a detailed index of genera covered in the book.

Throughout the work there are numerous drawings, histological photos, and electron micrographs. There are few tables, and few data *per se* are provided. Nevertheless, scientists with an interest in a specific phylum or in physiological, biochemical, or structural features of invertebrate integument will find that the book is an excellent resource.

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Primordial Germ Cells

Current Problems in Germ Cell Differentiation. A. MCLAREN and C. C. WYLIE, Eds. Cambridge University Press, New York, 1983. x, 401 pp., illus. $79.50. From a symposium, London, Sept. 1982.

This book emerges from the seventh international symposium of the British Society for Developmental Biology. It contains 19 contributions that evaluate some of the major research involving primordial germ cells and animal eggs; the species covered include representatives of amphibians, insects, birds, and mammals.

The book is divided into six parts. In the first part, Mahowald and Boswell, Smith *et al.*, and Eddy and Hahnel analyze the nature of the evidence that primordial germ cells are determined through the action of cytoplasmic molecules. The authors go back and wrestle with dogma from the older literature. The papers are lucid and scholarly reviews of a fascinating subject that has not been critically assessed in recent years.

Part 2 addresses the most important recent findings on the control of the migration of primordial germ cells toward the gonads. Excellent papers by Heasman and Wylie, England, and Snow and Monk carefully detail and analyze recent progress on the roles of the cytoskeleton, the extracellular matrix, and chemotaxis in the migratory process. Evidence has accumulated that sulfated glycosamines, fibronectin, and collagen type I play important roles in guiding primordial germ cells to the gonads. These informative and timely papers are valuable sources of references.

Part 3 reviews our current knowledge concerning the embryonic origin of teratocarcinoma cells and the nature of the cell surface molecules as evidenced by serological and cellular immune responses. Although these papers tend to be descriptive, they do include new insights and show in particular how monoclonal antibodies have expanded our knowledge of germ cell tumors.

In recent years there has emerged a large body of evidence that the differentiation of the germ cell is directly controlled by information supplied by somatic cells. Parts 4 and 5 of this book feature seven formidable papers that critically review this evidence. These papers bring together a wide spectrum of knowledge on subjects ranging from a self-fertilizing hermaphrodite (*Cenorhabditis elegans*) to germ cell development in humans. This part of the book is particularly strong, and the questions and problems confronted in it are intriguing and thought-provoking. Although the papers are written from a developmental point of view, researchers interested in aspects of intragonadal regulatory mechanisms will find them interesting and rewarding.

Part 6 reviews our knowledge of gene expression in oocytes in relation to embryonic development. Papers by Dreyer *et al.* on the fate of oocyte nuclear proteins during development, by Woodland *et al.* on the strategy of histone gene expression, and by De Robertis *et al.* on the control of nucleocytoplasmic transport of macromolecules are well written and provide excellent overviews of the authors' research.

Overall, I found this to be a stimulating and provocative book whose quality is impressive. In the past two decades, a vast amount of new information has accumulated on the biology of the germ cell, and it is useful to have work on the female germ line brought together in one up-to-date volume. The book, however, is by no means complete. The subject is enormous, and the editors have limited themselves to a relatively unified portion of it that reflects their own research interests. Regardless of its limitations, the book will be of interest to a wide range of researchers in endocrinology, developmental biology, oncology, and cell biology.

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Volcanoes and the Maya

Archeology and Volcanism in Central America. The Zapotitán Valley of El Salvador. PAYSON D. SHEETS, Ed. University of Texas Press, Austin, 1984. x, 307 pp., illus. $35. The Texas Pan American Series.

Questions about the impact of volcanic eruptions on human society were central to the University of Colorado's "Protoclassic Project" when, in 1975, its investigators began their study of regional prehistory in highland El Salvador. Indeed, one of the fundamental accomplishments of the project has been to document the local chronology of Holocene volcanism. The resulting geological sequence dates five sizable eruptions, beginning with one estimated between 800 and 600 B.C., followed by others at about A.D. 260, 590, 800 to 1300, and, most recently, a historically witnessed episode in 1658.

As a point of embarcation for the archeological research, Sheets and his associates ran a 100-kilometer-long survey transect across the western half of El Salvador. The results of this initial reconnaissance hinted at the particularly catastrophic effects of the flare-up of A.D. 260, identified as emanating from Mount Ilopango, on what was shown to be a densely populated area of Protoclassic Maya settlement. Thus inspired, the investigators turned their attention toward human ecology as it was affected by the deep and widespread ash deposition following the eruption. The designated locus of this effort was an environmentally diverse 546-square-kilometer area in the intermontane Zapotitán basin, lying barely 30 kilometers west of Ilopango, where geological sampling, a settlement pattern survey, and excavation at two archeological sites were carried out over a half-year field season in 1978 and two short periods in 1979 and 1980.

Most of the book under review is devoted to 11 papers reporting on the field and laboratory results of these interdisciplinary activities. In addition, Sheets includes introductory and concluding chapters that provide a background to the project, highlight the reports of his colleagues, and detail his research conclusions to date. A couple of short appendixes dealing with the analyses of recovered faunal and palynological remains round out the contributions.

Considering that only an 82-square-kilometer surface area of the valley was sampled in the course of survey, that subsurface investigation was limited to the digging of test pits at one archeological site and partial excavation of a domestic compound at another, and that as a consequence the quantity of archeological material analyzed was relatively modest, the project has achieved about as much in terms of archeological inference as could be expected of it. For the most part, the fieldwork that was carried out seems good, and some of the laboratory analyses, which include studies of soil and tephra deposits, ceramic remains, lithic artifacts, obsidian trace-element content and hydration, pollen, and fauna, are quite informative, small-scale though they may be. Out of all these, the well-documented region-wide stratigraphic linkage of geological and cultural history will likely prove one of the more widely referred to products of the investigation. Excavations at a Late Classic household complex at the Cerén site add some interesting and well-preserved if not terribly exciting evidence about highland Maya village life and material culture. I do find it curious why, with subsistence and human ecology central to the avowed research objectives of the project, excavation fill was left unscreened and no mention is made of any flotation to recover smaller organic remains. Many of the other deficiencies in data acquisition and analysis are acknowledged by the investigators, whose reports are peppered with extenuations related to inadequate sampling fractions and the restricted scale of excavations, all understandable given the time constraints and the deep volcanic overburden.

The most controversial thesis these data address has to do with the role of migration in the development of Classic Maya civilization. Along with a number of other Mesoamerican prehistorians, Sheets had argued previously that the florescence of lowland Maya culture was not the result of indigenous development, as is commonly accepted, but rather was sparked by the mass move-