brics, such as religion, myth, ritual, economics, and so forth" are poor guides to research and analysis since they do not represent the realities of integrated systems of symbols and meanings.

The last paper in the book also concerns the realities of meaning and symbol, but it asks how these are experienced by the people who live in the societies studied. Clifford Geertz argues that anthropologists cannot perceive the world as the people they study do ("What happens to *verstehen* when *einfuhlen* disappears?") but what they can and should do is find out "what they perceive 'with'—or 'by means of' or 'through.' " Doing this entails discovering and understanding the "symbolic forms—words, images, institutions, behaviors—in terms of which people actually represent themselves to themselves and each other." Geertz presents these forms of self-representation for the people of each of the three societies he has studied, but the contrast in his description between the fascinating and gracefully integrated self-representations of the peoples of Bali and Java and the incomplete and broadly drawn self-representation of Moroccans raises some questions about his approach. One of these is whether it might not be that only some cultures provide the means for a uniform, neat self-representation while others provide only scraps and pieces that are variously stuck together by individuals in idiosyncratic ways. It is true that "no society consists of anonymous eccentrics bouncing off one another like billiard balls," but the symbolic means by which people represent themselves surely need not in all cases be as complete and uniform as those in Bali and Java.

The volume as a whole lacks any tight integration, but I have always been puzzled at reviewers' displeasure at "nonbooks." A collection of strong papers makes, for me at least, a worthwhile volume. The one criticism I have of this one as a whole is that it lacks papers representing the important work still being done in the traditionally central fields of religion, ritual, art, myth, and folklore. These fields were once very nearly the only ones in which there was a consistent concern with symbols and meanings. It is useful to be reminded that important work is now going on in other areas, but the more traditional ones are still vital, and it is a pity to have nothing at all from them.

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Arthropod Biology

The Insect Integument. H. R. HEPBURN, Ed. Elsevier, New York, 1976. xx, 572 pp., illus. $63.50.

This volume is dedicated to A. Glenn Richards on the eve of his retirement and on the anniversary of the publication of his *The Integument of Arthropods*. It is intended, according to the preface, as a "compilation of those areas of insect integumental biology which have been developing most rapidly over the last few years." An introductory chapter by Rockstein traces the life and career of Glenn Richards and includes many personal accounts and tributes from his former students and colleagues. It concludes with a classified bibliography of his publications covering the years 1931–1975. From this bibliography and from the many citations of his work elsewhere in the book it is clear that Richards has contributed much to our knowledge of the insect integument.

The remaining chapters of the book are organized into two sections dealing with the basic properties and the versatility of the integument. The papers attest to "the need for bringing together erstwhile disparate fields of science in the resolution of biological problems" (preface) emphasized by Richards in his book. The first part includes reviews by Rudall on the molecular structure as determined by x-ray diffraction and sodium dodecyl sulfate (SDS) gel electrophoresis; by Muzzarelli on the biochemical modification in chitin, with emphasis on the variety of technical approaches; and by Hackman on the interactions of cuticular proteins, with comments on adaptation to function. Anderson deals with the cuticular enzymes involved in sclerotization, and Karlson reviews, with Sekeris, the work done over the last two decades, for the most part in his laboratory, on the control of tyrosine metabolism and sclerotization by ecdysone. Furneaux and Mackay present a comprehensive review of the structure and mechanism of formation of the insect eggshell. Such work combines SDS gel electrophoresis, amino acid analysis, and electron microscopy. Hepburn and Joffe relate the mechanical properties of the cuticle to the properties of the matrix, of which there are three kinds: plastically deformable, brittle, and a hybrid. The other papers of part 1 deal with more specific topics. Strout, Lipke, and Geoghegan, using molecular sieving and sedimentation analysis, determine the changes in molecular weight of formic-acid-soluble chitin during pupariation in *Sarcophaga bullata*; Wigglesworth, using histochemistry, examines the distribution of lipids in *Rhodnius*; electron microscopy is used to describe the arrangement of chitin fibers in phasmid cuticle (Dennell), the formation of the epicuticle of *Boophilus* (Filshie), and the role of the plasma membrane and the Golgi complex in cuticle deposition (Locke). Finally, Caveney shows the insect epidermis to be a functional syncytium.

Part 2 covers a variety of topics that attest to the versatility of the integument. These chapters are more variable in their aims and are not all equally up to date. Three are concerned largely with water relations; Beament deals with waterproofing; Nemenz deals with water uptake but is very selective in his aim of presenting "a speculative account" of the relative importance of the cuticle (and epidermis) in osmoregulation; Ebeling describes water loss caused by insecticides and dusts, abrasive and nonabrasive. The recent interest in peritrophic membranes is represented by discussions of their adaptability to form cocoons (Kenchington) and of their resemblance, structural and chemical, to surface coats and basement membranes (Peters). The mechanical role of the cuticle is considered in four contributions. The contribution of the cuticle to color and color change is reviewed by Hinton, and Vincent, on the basis of his own work on the highly elastic locust intersegmental membrane, presents a naïve model of the "soft biological tissues as filled rubber composites." Bennet-Clark discusses the various sorts of cuticle as energy stores in jumping insects, and Barth describes the spider slit sense organ in detail in discussing problems relevant to measurement of strains in the cuticle.

Zacharuk, in a rather disjointed chapter, describes the changes in the structure of the cuticle associated with moulting. It is not so easy to discern the versatility of the integument in the molting and development of undersized fly larvae as described by Fraenkel. I found the most interesting contribution in this part of the book to be that of Whitten, who points out the basic hexagonal pattern that pervades not only the cuticle but also the epidermis. She also describes her initial attempts at finding an intracellular, structural, organizational basis for this pattern in *Sciara* tenent cells. Finally, the very recent advances in the use of synthetic hormones in organ culture are described by Marks and Sowa.

Although this volume undoubtedly bears evidence that a number of different disciplines and techniques have contributed and are continuing to contribute to our understanding of the insect integument, the claim that it covers those areas which have developed most rapidly in the last few years does not entirely stand up. Understanding of waterproofing has advanced little, and in his treatment of the subject Nemenz fails to consider some of the recent work on the structure of osmoregulatory organs, for example rectum and anal papillae, which supports the importance of epidermis in water balance. There are several obvious omissions: the lipids in the cuticle are considered only histochemically, and glands, of which there are a great variety producing a very large number of different substances, are not considered at all.

Perhaps the most intriguing idea posed is Karlson's suggestion that the reason why insects develop in discrete moulting steps "should be sought elsewhere, not in the molecular organization of the cuticle."

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Algal Genetics

The Genetics of Algae. RALPH A. LEWIN, Ed. University of California Press, Berkeley, 1976. x, 360 pp., illus. $26.75. Botanical Monographs, vol. 12.

The algae, a peerless group of organisms that are nutritious, esthetically pleasing, and amenable to laboratory experimentation, have been remarkably neglected by scientists in search of superior organisms for fundamental biological research. Perhaps the old institutionalized split between botanists and zoologists, further rigidified in medical research, has effectively kept the algae out of the minds and the hands of most research scientists. Still, the neglect is surprising if one recalls that genetics was initiated by plant breeders and developed in a lively interplay between *Drosophila* and plant geneticists. Thus the science of genetics led the way in showing that phylogenetic boundaries are irrelevant in the investigation of fundamental principles of cell and molecular biology, but that lesson is still incompletely learned, as is evidenced by the withholding of National Institutes of Health funds from plant scientists.

The Genetics of Algae, edited by Ralph A. Lewin, presents the current status of research in algal genetics: which species are under investigation, and more or less what sort of knowledge is extant. Most of the chapters have struck what I take to be the right note: clear, informative, and interesting. The blue-green algae, valuable organisms for the study of nitrogen fixation and photosynthesis, are included, although as phage-carrying prokaryotes they are more similar to bacteria than to the eukaryotic green algae. There are a thoughtful chapter on approaches to the genetics of *Acetabularia* and a helpful synthesis of recent genetically oriented studies in *Euglena*. Other chapters introduce the reader to genetic studies, mostly rather primitive, of marine algae, filamentous algae, desmids, and charophytes.

Approximately half of the book deals with *Chlamydomonas*, an alga whose attributes for genetic analysis were first noted in a 1916 paper by A. Pascher, a foremost European botanist of the time. Appendix A contains translations of two of Pascher's fascinating short 1918 papers on the advantages of *Chlamydomonas* and other algae for genetic research. On a less felicitous note, Gowans performs a valuable service in Appendix B by reviewing the partially fictitious publications of Franz Moewus, warning the unwary against this tragic melange of fact and fancy.

The six chapters that discuss various aspects of recent genetic research with *Chlamydomonas* are all informative, but are somewhat uneven. Some are too brief, such as those on flagella and on cell wall synthesis, and leave the reader thirsting for more details, and others, such as the chapter on plastid inheritance, are too detailed and include some material that is inappropriate for a book of this kind. Nonetheless, this set of chapters does introduce the reader to some of the many areas of the cellular and molecular genetic research now in progress with this increasingly popular and versatile organism.

All in all, Ralph Lewin has given us a book that is useful, readable, and attractive. I recommend *The Genetics of Algae* to anyone who desires an overview of the present state of the field, though I would have liked to see a final chapter in which the special assets of the algae were evaluated within the framework of present and future directions of genetic research.

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Mollusk Biology

Marine Mussels. Their Ecology and Physiology. B. L. BAYNE, Ed. Cambridge University Press, New York, 1976. xviii, 506 pp., illus. $49.50. International Biological Programme 10.

Organisms useful for food and those useful for research have some attributes in common: abundance; availability; ease of gathering; and hardiness, which facilitates shipment, maintenance, and cultivation. Thus, edible species are often widely used experimental objects as well. *Mytilus edulis* is such an organism. It has a circumpolar distribution in the boreal and temperate zones and has been cultivated and eaten for hundreds of years. Mussels have also been "cultivated" in biological laboratories, and the scientific "harvest" has been large; the selective bibliography in this volume contains over 1300 references—most of them published since 1950.

Thus, it is not surprising that *Mytilus edulis* was chosen as one of the themes of the International Biological Program. The results are summarized in this volume, a critical review of the ecology and physiology of *Mytilus* and other mussels. The emergent goal of the book is to describe, in as full detail as possible, the interaction between mussels and their environment. A broad synthesis has resulted, including all levels of organization, from subcellular to population. The individual chapters were meant to be "prospective rather than retrospective," and this goal has been achieved.

The heart of the book is contained in three chapters on physiology and physiological integrations, written by Brian Bayne (the general editor) and two of his co-workers, R. J. Thompson and J. Widdows. In two of these chapters, the authors describe the structure and function of organ systems concerned with feeding and digestion, respiration and circulation, excretion, ionic and osmotic regulation, and nervous control. The sections on neurosecretion and the nervous system are sketchy; in the latter, the focus is, appropriately, on the sensory apparatus. However, the limits of toleration and the adaptability of feeding, respiratory, and circulatory functions to such environmental variables as temperature, oxygen partial pressure, food ration, salinity, and season are thoroughly discussed. Some complex relationships are developed; for example, the responses of respiration to temperature fluctuations are considered in the light of simultaneous effects on feeding, gametogenesis, and maintenance metabolism.