volume are those that draw on an author's depth of research and experience. The paper by Le Houerou, "North Africa: past, present, future," is an outstanding example. Most of the authors, either by choice or by assignment, restrict themselves to rather general literature surveys. Interdisciplinary communication is reflected only at the most superficial level. Most of the papers contribute little in the way of new knowledge or insight and are valuable primarily for their extensive literature citations. In a few cases even this symbol of scholarship is lacking.

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Environmental Physiology

Biology of Intertidal Animals. R. C. NEWELL. Elsevier, New York, 1970. viii, 556 pp., illus. $23.75.

The simplest animals face the same array of basic problems in making a living as the most complex, and the sapient. The right kind of food in sufficient amount, an adequate supply of water and oxygen, protection from enemies and adversities of the physical environment, and a suitable mate are important requisites of species throughout the animal kingdom. Richard Newell's general view of the biology of the animals dwelling between high and low tide lines on the shore is that their physiological responses to the chemical and physical stresses of their environments largely determine where they will occur. The title of this book is thus to be construed narrowly. The dust jacket and preface describe its intent more aptly: to account for the distribution of intertidal invertebrates in physiological terms. The author devotes little attention to the biology of intertidal animal assemblages or communities.

The major sections of the book treat the establishment and maintenance of intertidal zonation patterns, feeding mechanisms, respiratory adaptations, and thermal stress and desiccation. These chapters are detailed and up-to-date reviews stressing the present state of knowledge and well documented with tables and graphs redrawn from original sources for increased clarity. The coverage is taxonomically wide but geographically restricted largely to the British Isles; however, many of the genera mentioned are also found along North American shores.

About 40 percent of the text is devoted to problems of respiration in the intertidal zone. Environmental factors affecting respiration are categorized as controlling, or setting boundaries of tolerance, and limiting, or actually determining metabolic rate at a given time. This section is lucid and informative, in part because the author's own research contributions have clarified some of the factors affecting the rate of oxygen consumption by intertidal invertebrates. Clarity is perhaps also facilitated here because the environmental requisite of all animals is identical—molecular oxygen. The other major topic covered, feeding mechanisms, is more challenging to present, because the energy sources of animals are packaged in a wide variety of complex molecular configurations, and the diets of all species differ: it is easier to describe utilization of the services of a gas pump than of a supermarket.

In the section on responses to thermal stress, Newell ranges to molecular levels of organization in seeking to explain mechanisms of acclimation and the well-documented fact that active rates of metabolism are dependent on temperature whereas resting and maintenance rates are constant over the broad temperature spans characteristic of the intertidal zone. Here important unanswered questions are clarified, and hypotheses based on knowledge of isoenzyme production at different temperatures in fishes are proposed as relevant to intertidal invertebrates.

By treating species of animals as independent entities and taking a reductionist or analytical approach, the author is able to concentrate on evaluating the environmental physiology of individual organisms, and the coverage is intensive but selective. Newell believes that to account for the distribution of intertidal animals in physiological terms is "by no means an easy task"; I believe it is impossible. One must consider that factors dependent on the presence of other organisms (of the same or different species) in the community may also be important determinants of distribution patterns, and these are either omitted or given only brief mention. Chief among the missing are predation and competition (the important studies of J. H. Connell in Scotland a decade ago are not cited), reproductive strategies and tactics, and defensive mechanisms against predation.

Selectivity of topics, absence of these more synthetic aspects of the ecology of intertidal invertebrates, and limited summarization and generalization detract from the book's desirability as an undergraduate text. For the topics covered, it will serve admirably as a reference, lucidly reviewing and guiding the reader to the relevant primary literature, including several recent important and unpublished London Ph.D. dissertations dealing, for example, with the biotic requirements of high tidepool organisms, effects of tidal level and temperature on activity, and a model of the settling behavior of free-swimming larvae.

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Inactive States

Dormancy and Survival. Symposium No. 23 of the Society for Experimental Biology, Norwich, England, Sept. 1968. Published for the Company of Biologists by Academic Press, New York, 1969. viii, 598 pp., illus. $15.

The speakers at the symposium of which this book is the proceedings included bacteriologists, protozoologists, botanists, entomologists, and mammalian physiologists. One might wonder how the convenor and editor could possibly organize the thinking of such a variety of scientists so that they could come out with an organized unit deserving the name "symposium." The types of dormancy even within the mammal group are diverse (there are at least four distinct types), so that it would seem difficult to compare "hibernation" in a bacterial spore and a mammal. The audience for the symposium should expect each of the 22 articles to include consideration of most of the following questions: (i) Does dormancy in the various groups of plants and animals show a central theme or common element? (ii) What induces dormancy? (iii) What keeps the flicker of life in protoplasm during dormancy? (iv) What initiates break from dormancy to growth? (v) What are the evolutionary meaning and ecological implication of the dormancy of the particular organism under discussion?

When I began to read the articles, I was reminded of a famous artist who

was showing his paintings to a scientist. He said, "This work I painted for other artists, but this one I painted for people like you scientists." In other words, some of his work was extreme specialization (artists' art). A few of the articles in this symposium appear to be so extreme in their specialization that they go even beyond the level of "artists' art." Most speakers, however, treat their audience well and put their subjects in perspective.

Most of the authors conscientiously attempt to answer most of the questions listed above. I did note that an attempt to define or explain the term "dormancy" does not appear until page 219. Many of the articles introduce stimulating new terms such as "germination inhibitors," "seasonal tokens," "capacity adaptation," "resistance adaptation," or offer explanations of the differences between "winter rest," "diapause," and simple "cold resistance." However, a few articles do not even mention the terms "dormancy," "survival," "environment," or "evolution" and consider only, for example, if a block in protein synthesis is removed, or the exact composition of a cyst wall. The good teachers of the symposium make up for the few superspecialists, however. Because of the carefully designed papers of Fogg, Williams, Andjus, Lyman and O'Brien, Wimsatt, and others, biologists who are not scientists in this field will be pleased to have the volume at hand. These authors pay particular attention to explaining how dormancy assists the survival of the individual animal or plant in a hostile environment. They answer the frequent questions that come to mind concerning the exact differences between dormancy, hypothermia, and hibernation. This symposium will be of timely assistance to the lecturer and investigator on topics of environmental biology.

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Algal Model

Acetabularia and Cell Biology. S. PUISEUX-DAO. Translated from the French by P. Malpoix-Higgins. Logos, London, and Springer-Verlag, New York, 1970. xii, 162 pp. + plates. $9.80.

We are experiencing a third awakening of interest in the algal cell *Acetabularia*. The first, beginning in the 1930's, resulted from Joachim Hammerling's discovery that the morphogenesis of this giant cell could be manipulated experimentally. Thus *Acetabularia* promised a model system for differentiation at the cell level without the problems inherent in embryonic fields, competence or even induction.

Jean Brachet was responsible for a revival of interest that occurred in the early days of cell and molecular biology. He exploited the unique geometry of this cell to characterize the instructions passing from nucleus to cytoplasm. Hammerling's group also entered into this work, and considerable early evidence for the role of RNA in transferring nuclear information was obtained. *Acetabularia* as a model system lost out to *Escherichia coli*, but some of the findings from it have served to indicate the difficulty in direct extrapolation of prokaryotic results to eukaryotes.

The current revival of interest results from the high degree of cytoplasmic autonomy already demonstrated in this alga and the discovery of DNA in chloroplasts and mitochondria. This revival has carried *Acetabularia* to a number of new laboratories. *Acetabularia* chloroplasts contain large amounts of DNA and have extensive biosynthetic capacity, both in isolation and after long periods of enucleation, again providing a model system, this time for studying the genetic capabilities of organelles. Thus, given the role that this alga has played in cell biology, the title of the book is appropriate. The role of *Acetabularia* in cell biology is treated only in the preface by Brachet and the author's introduction, however.

The book provides a review of *Acetabularia* literature in French, German, and English, covering 250 references, mostly from the last ten years. A large number of tables and graphs from this literature are reproduced. Other illustrations range from lovely line drawings and light micrographs of *Acetabularia* to electron micrographs of its nucleus and plastids. The emphasis, though, is on the author's own work and that of several of Brachet's coworkers.

Perhaps the greatest strength of the book lies in original contributions of Puiseux-Dao and her co-workers in two areas: the biology of *Acetabularia* and the development of a concept of "plastidal units." The biology chapter provides information that is difficult to find elsewhere on growth, morphogenesis, life cycles, and culture of several *Acetabularia* species. Plastidal units are minimal plastids consisting of lamellae, a single starch grain, and a DNA area. Most chloroplasts consist of several such units in tandem, separated, according to the author, by specialized lamellae representing a potential division plane. Workers who are interested in plastid biogenesis and DNA content will find this concept useful.

One cannot read the book without recognizing the lack of concrete information on some important aspects of *Acetabularia* biology, particularly the nuclear events during its life cycle. In effect no genetic control of these algae is possible at present. (The author does not discuss this impediment to experimental work.)

The book is often flawed by attempts to incorporate experimental observations that should be considered preliminary or inconclusive into comprehensive theories concerning the roles of nuclear and plastid genes and RNA's in such processes as morphogenesis or circadian rhythms. The results are less than convincing.

That the book was translated from a French manuscript is often noticeable, but seldom interferes with comprehension.

This book will be most useful to those contemplating work with *Acetabularia*, but anyone dealing with chloroplast autonomy, circadian rhythms, or nucleo-cytoplasmic interactions is likely to find accounts of interesting phenomena readily observed only in this alga, but almost certainly not unique to it.

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Applying Solid Mechanics

Physical Processes in Geology. A Method for Interpretation of Natural Phenomena —Intrusions in Igneous Rocks, Fractures and Folds, Flow of Debris and Ice. ARVID M. JOHNSON. Freeman, Cooper, San Francisco, 1970. xiv, 578 pp., illus. $14.75.

The geology graduate student or professional who wants to learn solid mechanics in order to apply it to geological problems is faced with a difficult and frustrating task. He has to learn a great deal of new mathematics and