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.

VERNON W. RUTTAN
Department of Agricultural Economics, University of Minnesota, Minneapolis

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.

ALAN J. KOHN
Department of Zoology, University of Washington, Seattle

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