1957 is instructive in several ways. Recent years have brought a population explosion of physiologists studying fishes, with a much smaller fraction of this group than previously concentrating upon economically important forms in possibly economically significant ways. Practical considerations still underlie much work in several fields (among them nutrition, reproduction, and growth), but it is satisfying to a dyed-in-the-wool fish fan to note the increasing awareness of fishes as organisms interesting and theoretically significant in their own right.

A proviso to this last remark is that the volumes make less use of this organismic orientation than I think would have been useful. The approach taken by the editors (in their selection of chapter headings) and most chapter authors is discussion by either physiological process or by organ system. This makes it difficult (at least for me) to develop a mental picture of how any given kind of fish, or related group of fishes, functions as living animals adapting to their environments.

There is also little play given to some other useful ways of considering physiology. There would undoubtedly have been some redundancy in literature coverage between expositions of these and some of the process- and system-oriented chapters, but I think useful insights are missed by giving only passing consideration to the coherent sets of adaptations shown by animals (such as Arctic and Antarctic marine teleosts, amphibious fishes, and cave fishes) adapted to special (particularly extreme, environments. There are also particular individual species (for example *Latimeria*) and some limited, theoretically significant, taxonomic groups (for example the Agnatha) that deserve more special treatment than they have received.

The range of subject matter covered by the present edition is far greater than that of the 1957 work. The topics of several chapters (for example, D. H. Copp's "The ultimobranchial glands and calcium regulation," and H. A. Bern's "Urophysis and caudal neurosecretory system," both in volume 2) hardly existed in 1957. Even with this expansion, however, some important topics apparently will not receive much attention (this based on lists of chapter headings for all six volumes). Two among these are the general chemical composition of fishes and the interactions of fishes with environments either drastically changed by or made by man. I hope that the latter topic will be discussed to some extent in F. E. J. Fry's projected chapter for volume 6, "The effect of environmental factors . . . ."

It is interesting to note that, even with substantial recent activity in the specific areas involved, several chapters indicate that a number of significant problems of long standing remain unresolved. Three of these are: the biochemical origin of trimethylamine oxide, the metabolic functions of the neurohypophysial hormones, and the metabolic functions of thyroxin. These volumes provide many challenges for future research by pointing up such situations.

Just as in the volumes edited by Brown, the chapter authors are mostly established and well-known workers in their areas. The editors have done well by the younger generation in selecting their authors, many of whom have developed their reputations within the last ten years.

The authors in turn have generally done good, thoughtful, reasonably well balanced jobs in covering the literature of their subjects. Bibliographic citations are thorough and as up to date as the logistics of book publishing will allow. In these first two volumes coverage is quite good through 1967, partial through 1968, and scattered in 1969. The older literature happily is not neglected. Linguistically and geographically, coverage is generally excellent for North American and Western European journals, but is quite limited and spotty for East European and Russian, Asian (especially Japanese), Latin American, and Australian journals. Some of these remarks will probably not apply to some of the chapters in later volumes which have been written by Japanese workers.

Factual errors in the text are few and of limited significance. Most appear to be due to such factors as unfamiliarity of the authors with the biology of the species involved (for example, the habitat of the stenohaline marine Chilean clingfish *Sicyases* is given as fresh water, volume 2, p. 358) or with the taxonomy involved (for example, the skipjack, *Katsuwonus*, is called a bonito, volume 2, p. 289). That physiologists are rarely familiar with taxonomy is further demonstrated by the large numbers of misspellings of the Latin names of many forms.

The technical quality of the production of these volumes is generally good. Typographical errors are few and usually minor, but occur frequently in the systematic indexes. Each volume has three indexes, author, subject, and systematic. These indexes are fairly good, but variable. The subject index in volume 1 is one and a half times the length of that in volume 2 and proportionately better. The quality of microphotographs (there is a color plate of several in volume 2) is variable, ranging from fair to good. Quality of paper, binding, and typography are all up to the usual standards of the publisher. Price per volume is also up to the publisher's usual standard.

To sum up, the first two volumes of this series augur well for its success in achieving the editors' hope that "it will serve biologists of the 1970's as *The Physiology of Fishes* served its readers throughout the 1960's." The earlier work served excellently.

[Volume 3 of the work, Reproduction and Growth, Bioluminescence, Pigments, and Poisons (502 pp., $24; by subscription, $20), is now available—ED.]

MALCOLM S. GORDON
Department of Zoology,
University of California, Los Angeles

A Plant Process

The Induction of Flowering. Some Case Histories. L. T. EVANS, Ed. Cornell University Press, Ithaca, N.Y., 1969. viii + 488 pp., illus. $18.50.

For nearly a century, plant biologists have tried to find a unified theory to account for the flowering process. Aware of the failures and difficulties in this field, the author of this book presents 20 case histories of species which are most important as experimental objects in investigations of the mechanisms of flower induction. The selected examples are "plants requiring exposure to only one day of appropriate length and which can be induced as seedlings, since these are likely to be of increasing importance in future work." Aside from the classical cocklebur, soybean, *Pharbitis nil*, and *Perilla*, the book presents such newcomers in the field as *Chenopodium rubrum*, *Anagallis arvensis*, *Cestrum nocturnum*, and even the "Ceres" cultivar of *Brassica campestris*, which has been studied very recently in the author's laboratory. Old-timers

in the field will look in vain for a chapter on the various species of *Nicotiana*, such as the historical short-day *N. tabacum* "Maryland mammoth" or the long-day *N. sylvestris*, or one on *Hyoscyamus niger*. However, these are mentioned in several places in the introductory and concluding chapters.

The bulk of the book is devoted to the description and discussion of the flowering mechanisms in the chosen examples, each species being presented by a specialist. The great number of data and references packed in each of these physiological monographs are easily accessible since all the chapters follow the same sequence of presentation, from the historical introduction to the chemical, histochemical, and ultrastructural changes (if known) at induction. Particularly useful are the details given on growing techniques, which sometimes include unpublished work, for example in the chapter on *Xanthium* by F. B. Salisbury. In short, these chapters constitute a rather unique reference book for workers engaged in the field, on which further work can be based.

Aside from this major contribution, the first chapter of the book presents an interesting historical sketch containing data not widely known or acknowledged, such as Tournois's contributions to the discovery of the photoperiodic effect in plants.

The last chapter presents the thoughts and conclusions of the editor on "the nature of flower induction." These are certainly thought-provoking, not only for a detail in wording (the term "evocation" is suggested for the induction of the shoot apex and contrasted to "induction," which is restricted to changes occurring in the leaf only), but also for several unorthodox views worth pondering. Evans remarks first that the flower stimulus is a general stimulus which initiates or increases the activity of many processes in apical meristems, from an increase in ribosomes to one in RNA and DNA. He builds up evidence around the rather earthshaking statement that, even in so-called "qualitative" photoperiodic species, "the induced state is a quantitative one" (p. 462). He observes that, in general, there are two classes of stimuli: those which promote and those which inhibit the inductive process. In some species (such as *Xanthium*) the positive stimulus predominates, in others (as in *Fragaria*) the inhibitory one may be dominant, and in still others (such as *Lolium temulentum*) the effects are balanced. Furthermore, the idea is advanced that one of the cardinal points of the florigen theory may be illusory, namely that the floral stimuli of long-day plants and short-day ones are identical. According to Evans, this point is not as well established as it seems, and floral stimuli in the two physiological classes may be different.

In summary, Evans's book is very valuable both for the quantity of pertinent facts which make it an important reference manual and for the critical views which are presented on the flowering process and which are necessary to shake this field out of its present stagnation.

J. P. NITSCH
Centre National de Recherche Scientifique, Gif-sur-Yvette, France

Channeling of Particles

The Observation of Atomic Collisions in Crystalline Solids. R. S. NELSON. North-Holland, Amsterdam; Interscience (Wiley), New York, 1968. xiv + 282 pp., illus. $16.50. Defects in Crystalline Solids, vol. 1.

One of the prominent developments in the past six years in the study of atomic collisions has been the realization that the regular nature of crystal lattices can exert a large influence on the interactions of energetic charged particles. For example, if a beam of million-electron-volt protons is aligned with a crystal axis or plane, the crystal atoms can steer the MeV charged particles along the lattice structure. Under the right conditions, this steering or channeling effect can reduce the yield of close-impact processes such as nuclear reactions, x-ray emission, and Rutherford backscattering events by one or two orders of magnitude. In the case of heavier incident ions, such as gallium or antimony, the range of well-channeled particles can be increased by an order of magnitude over the range in noncrystalline solids. Consequently, an understanding of the basic phenomena is necessary for such diverse uses as fabrication of semiconductor devices by ion implantation and measurement of nuclear cross sections.

In this book, Nelson gives straightforward and easy-to-follow descriptions of the influence of the crystal lattice on atomic collision phenomena. This is demonstrated most vividly in the transmission of MeV particles through thin crystals. By placing a photographic film at a distance behind the sample, one can see directly the influence of the crystal axes and planes on the trajectories of the energetic particles through the samples. By use of color film, an estimate can be made of differences in energy loss under various channeling conditions.

Nelson develops theoretical concepts along with experimental results for the range of heavy ions where energy loss due to collisions with lattice atoms is important as well as for interactions of lighter projectiles, where losses due to electron collisions are dominant. He includes a major discussion of the subsequent motions of the recoiling lattice atoms and the various features observed in sputtering experiments.

There is a thorough account of experimental work on channeling up to mid-1967. The close-impact studies (Rutherford scattering and the like) which have contributed greatly to our present quantitative understanding of channeling are presented, but receive less emphasis. For example, there is little discussion of the quantitative aspects of dechanneling, which occurs when particles are scattered out of a well-channeled trajectory as they penetrate deeper into the crystal. Also, the more recent application of the channeling effect to the study of disorder and the lattice location of dopant atoms is mentioned only briefly.

This book provides a useful introduction to the subject of atomic collisions in solids. However, the reader should be aware that there are some inconsistencies in the discussions of channeling. The emphasis on various aspects of research on atomic collisions is not well balanced, for predominant emphasis is placed on the work done at Harwell, with a large portion devoted to the author's investigations. As an overview of the Harwell work in this field, this is a good summary and does provide cross-ties to work at other laboratories where indeed major investigations of atomic collisions and channeling have taken place. Historical development, one of the predominant themes of the book, is presented from a very personal point of view and does not reflect the relative importance of contributions of other groups.

JAMES W. MAYER
Department of Electrical Engineering, California Institute of Technology, Pasadena