and related substances in fish" by C. B. Cowey, adds little to our knowledge of comparative biochemistry because very little if any of the underlying differences in metabolism, or of the specific mechanisms involved, is revealed. On the other hand, Jean Roche presents an excellent résumé of electron microscope studies on the high molecular weight erythrocruorins and chlorocruorins of Annelids. The postulate that these respiratory proteins might represent the first stages in the evolution of the red blood corpuscles is attractive indeed.

Among the next chapters, "The comparative physiology of the transfer of substance between the blood and central nervous system" (J. E. Treherne), "Comparative metabolism and toxicology of organic insecticides" (F. P. W. Winteringham), "Distribution of phosphagens in errant and sedentary Polychaeta" (N. V. Thoai and Y. Robin), and "Evolutionary implications of enzyme structure and function" (D. C. Watts), the last chapter is the most provocative field of comparative biochemistry covered in this volume.

One wonders about the value of publishing such symposia. First, publication is usually delayed for more than a year. Added to this is the usual requirement that the papers must be in the hands of the organizing committee many months before actual delivery at the symposium. This makes most of the material a rehash of papers previously given at other meetings and published in many journals. Second, in some cases only very specialized topics are discussed (the chapter on insecticides is an example). And third, a specific topic might be developed more fully, and to a much greater advantage to the reader, than is possible in the necessarily short form of a symposium paper (evolutionary implications of enzyme structure and function is an example of this).

In summary, this is a very heterogeneous volume that may in some instances serve to stimulate workers in this field to follow the call of Ernest Baldwin. But I doubt whether "the book will prove extremely valuable to all concerned with the study of aspects of comparative biochemistry."

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## A Matter of Focus

**Focus on Bacteria**. Emmy Klieneberger-Nobel. With a chapter by Ruth M. Lemcke. Academic Press, London, 1965. viii + 145 pp. Illus. $5.50.

In her foreword the author explains that "The purpose of this book is first and foremost to show that nature has a quality of beauty even in her smallest manifestations. Aesthetic considerations have therefore more or less decided the choice of the photographs. However, most of the constituent elements of bacteria can be seen in the pictures presented. Knowledge usually enhances enjoyment; therefore, brief information on the structure, arrangement, and some properties and activities of the bacteria have been given. The sequence of the pictures and descriptions as well as the informative text follow a scientific trend, yet this book must by no means be regarded as a textbook. Its main object will be abundantly fulfilled if it gives a certain amount of pleasure to the reader."

Because it is primarily a "picture book," the chosen title is apt. About one-half of the 125 pages (this excludes the glossary, references, and index) are covered by the 61 photo- and electron micrographs that serve to illustrate the gross morphology and anatomical details of bacterial cells. They are supplemented with 19 poorly executed sketches and with the "informative text," which is riddled with technical terms. The 14-page glossary contains their definitions, mostly quite primitive and sometimes erroneous. The following are examples of the latter: "Butyric fermentation" is defined as "Formation of butyric acid in butter, a process caused by a ferment of *Clostridium butyricum*. Consequently the butter develops a rancid taste and smell"; inosine and thiamine are listed as amino acids, and arabinose and rhamnose as polysaccharides.

Considered as an effort aimed at generating the "knowledge [that] usually enhances enjoyment," I find the contents of the book badly out of focus. It seems to me that the author's stated purpose could have been achieved more successfully if far less space had been devoted to illustrations, many of which are redundant, and if instead she had presented a more balanced picture of bacterial activities. From the start, the emphasis is on bacteria that cause diseases in animals; this is immediately apparent from the statement on pages 3 and 4: "For a long time Leeuwenhoek's observations were not followed up in a fruitful way to enlarge our knowledge of bacteriology any further, and, in particular, they were not applied to promote a better understanding of infectious diseases." Wherever possible, the association of a specific microbe mentioned in the text with a particular, even obscure, disease is mentioned, while scant attention is paid to the more general and fundamental activities of bacteria. This attitude reflects the training of the author as a medical bacteriologist not conversant with the current status of microbial physiology. Besides, it may well be true that pathogenicity is a property that strongly appeals to the lay reader, so that the hope expressed in the preface "that the subjects most interesting to the reader have been referred to in this book" may be justified. Nevertheless, seen in its proper perspective, this property is but a very minor aspect of the essential role played by the bacteria in perpetuating the cycle of matter, through which life on earth could persist and evolve. An attempt to inculcate a sound appreciation of this significant fact would have revealed that the vast majority of bacteria, rather than being menaces to human health, are indispensable to our very existence.

The latter kind of approach can be found in the masterly little treatise, *Microbial Life*, by Sistrom [Modern Biology Series (Holt, Rinehart, and Winston, 1962. 106 pp.)]. It covers a vastly broader area than Klieneberger-Nobel's booklet, and is, in my opinion, much more likely to create the knowledge that enhances enjoyment than the enumeration and designation in technical terminology of morphological and anatomical details.

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## Introductory Textbook

**Biological Effects of Radiation**. Daniel S. Grosch. Blaisdell (Ginn), New York, 1965. xiv + 293 pp. Illus. Paper, $3.50.

This is a textbook for advanced undergraduate biology students or begin-

ning graduate students, and the material covered should constitute a good one-semester course. In addition, life scientists who are interested in obtaining a start in the field, or in surveying its possibilities, would do well to start with this book.

The first section deals with the physical aspects of the field, briefly describing the different kinds of radiations, how they are generated, and how they interact with matter. Special emphasis is placed on radiations and radiation reactions of biological interest. It is very interesting to see emphasis placed on the historical approach to the field.

The author then turns to radiation effects at the cellular level, and quite correctly emphasizes the effects produced in the chromosomes. As a research tool, radiations have had their greatest impact in the science of genetics, and several chapters are devoted to this subject.

The next section discusses the effects of radiation on tissues and organs in plants and animals. Many of the effects discussed here were, only a few years ago, thought to be quite mysterious. In the light of modern concepts, as succinctly outlined in these chapters, they fall neatly into place.

There follow several chapters on the more practical aspects of radiobiology, including a treatment of the consequences of overexposure in mammals and the possibilities for protection and therapy. A chapter is devoted to ecology and the consequences of contamination of an ecosystem by radioactive materials. The problem of fallout from atmospheric testing of nuclear weapons is treated in a rational manner. In the final chapter a number of uses of radiation, including insect control by male sterilization and food preservation, are briefly treated.

Each chapter includes a number of references for the further pursuit of specific topics. Such a short book must necessarily be quite incomplete in attempting to cover such a wide field. However, the author has chosen carefully to make it a very readable introduction to all facets of the subject.

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## The Rutgers Symposium on Evolution

**Evolving Genes and Proteins**. A symposium (New Brunswick, N.J.), September 1964. Vernon Bryson and Henry J. Vogel, Eds. Academic Press, New York, 1965. xxiv + 629 pp. Illus. $19.50.

Those who feel that many of the recently published conference proceedings have been compressed at the expense of style and comprehensibility will be especially pleased with *Evolving Genes and Proteins*. The editors and publishers have preserved much of the discussion following each group of papers and have not obviously condensed any of the presentations, some of which are very discursive in tone. The result is an unusually readable (and rather expensive) volume. In most cases, this has added greatly to the sense of being present at a very exciting symposium. Occasionally this prodigality with the spoken and printed word was used for jurisdictional warfare between organismal and molecular biologists. At their best, these exchanges are short and witty, and reading them is good malicious fun. Unfortunately there are also one or two tedious filibusters alleging the superiority of one approach over another. An uncommitted reader will almost certainly feel that amino acid and nucleotide sequences will add tremendously to our understanding of evolution; just as surely he will hesitate to throw the classical taxonomists onto the pavement on the grounds that biochemists can now (laboriously) distinguish a fish from a bird.

An excellent summary of the symposium appeared in advance of the book [V. Bryson and H. J. Vogel, *Science* **147**, 68 (1965)], and little more need be said here. The book itself is organized along somewhat different lines, starting with a section on the general and specific evolution of metabolic pathways, proceeding to the evolution of the amino acid sequences of various single proteins as it can be reconstructed from our knowledge of present-day organisms. This group of papers is followed by a valuable series on the mechanism of action of enzymes, their active centers, and their quaternary structures as related to phylogeny. Finally, there is a section on the consideration of evolution at the polynucleotide level. Each of these approaches, ranging essentially from the phene to the gene, brings new and qualitatively different insights; in the terminology of evolution, the grouping of papers is phylogenetic, though perhaps in a retrograde sense. There are relatively few presentations on prebiotic organic evolution, but the subject is certainly not ignored. Although evolution is the thread that holds the various chapters together, the material will be invaluable to geneticists and chemically oriented biologists whose interest in evolution may be incidental. This book comes at a time when knowledge of our biochemical history is very fragmentary but rich in promise. As such, it is heartening that solid facts and unabashed speculation have been successfully juxtaposed without losing their separate identities.

Each paper in *Evolving Genes and Proteins* is followed by a list of references, and these are compiled into a complete alphabetical author index. There is also a subject index. The printing and proofreading are very good.

In short, this book can be recommended as a remarkable assortment of papers and discussions by eminent biologists. It will be of great value to specialists in evolution and comparative biochemistry and to interested bystanders. No doubt it will be a useful adjunct in the teaching of a number of graduate-level courses.

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## Space Technology

**Dynamics of Rockets and Satellites**. G. V. Groves, Ed. North-Holland, Amsterdam, 1965. xii + 313 pp. Illus. $11.20.

*Dynamics of Rockets and Satellites* is based on a series of lectures presented at Cambridge, England (in 1963), at a summer school of the same name. It suffers from many of the faults common to books derived in this manner. The material is very spotty. Some authors cover their subject matter very thoroughly, while others are content to outline the problem. Very few references are given; there are no abstracts; the index is inadequate; and