should read. And seldom has this been more true than in the case of this latest book by one of the leaders of the experimental study of evolution.

It is not the subject matter itself but rather the method of treatment that makes this book outstanding. As might be expected of a book in this genre, it opens with a chapter placing the subject in its general setting and another dealing with the elements of general genetics. Then it proceeds to cover in considerable detail most or all of the interfaces between genetics and the mechanisms of evolution, in each case showing how the one provides the means for the other and how the other results from the interaction of the genetic apparatus with the requirements of the real world. Balancing selection, polymorphism, genetic load, directional selection, random drift, the founder principle, the species concept and species formation constitute the core.

The surprise arises from two aspects of the manner of treatment. First, in a field where mathematical models are the fashion of the day, Dobzhansky uses only a tiny amount of elementary mathematics. Instead, he relies most successfully upon clear exposition in carefully constructed English. Thought and expression triumph over formalism. Not that the book is easy reading. Each sentence and paragraph carries a full load of meaning, and the cargo must be carefully transferred to one's brain lest the thoughts fall into a jumbled heap.

Second, there is continuous use of evidence from nature to act as the guideline for evaluation and interpretation of the theoretic concepts. The theory of the evolutionary process becomes once more a part of the natural sciences. Only a man who combines deep knowledge of theory with extensive first-hand contact with organisms in the field could bring this off successfully—and Dobzhansky is such a man.

The book is not perfect. There are the usual, fortunately few, typos. There is the section that might have been better. Bruce Wallace, for example, made the matter of genetic load, especially as it concerns hard vs. soft (or rigid vs. flexible) selection, a bit clearer in his recent book than does Dobzhansky here. But whatever minor faults there may be disappear into the whole of this work of a lifetime of scholarship supported by about 1,300 references to the literature. It is highly recommended reading for all biologists who have a basic background in genetics and evolution.

Werner G. Heim
Colorado College
Colorado Springs

TRANSCRIPTION OF THE GENETIC MATERIAL. Vol. 35 of *Cold Spring Harbor symposia on quantitative biology.* Foreword by James D. Watson. 1970. Cold Spring Harbor Laboratory, Cold Spring Harbor, L.I., N.Y. 912 p. $25.00.

This volume continues the series, begun in 1933, in the fashion to which biologists have become accustomed: concise, information-packed summaries of research at the forefront of what might loosely be called molecular biology. The 1970 symposium was devoted to the subject of transcription, especially as it relates to the nature and actions of the various kinds of RNA involved in that process. The approximately 95 articles cover the "state of the art" rather thoroughly. Included are two papers on RNA-dependent synthesis of DNA, one by D. Baltimore and one by S. Mizutani and H. M. Temin. The volume concludes with a summary, of about 20 pages, by M. Chamberlin. It is particularly noteworthy that about 40% of the book is devoted to a consideration of these subjects in eukaryotes—offering the hope that the elephant may yet supplant *E. coli* as an object of study by molecular biologists.

Werner G. Heim
Colorado College
Colorado Springs

Historical Geology

HISTORY OF THE EARTH, by Bernard Kummel. 2nd ed., 1970. W. H. Freeman & Co., San Francisco. 726 p. $12.50.

History of the Earth provides a detailed summary of geologic history, but I can't find it in my heart to ask a student to read it. This would be like asking him to read an encyclopedia, and not a very well organized one at that. The book is organized chronologically: if I want to know something about the geology of Africa I have to look in several different chapters to pick up a piece here and a piece there. If I want to read about reptiles I again have to search through several chapters, losing the thread as I go. Kummel wants to give a "world view" and to provide my students with background so that they will have a framework within which to evaluate my lectures. The trouble is that I believe students learn better when I don't lecture but instead allow them to *do* or read about the aspects of historical geology that they find intrinsically interesting. I'm not convinced a "world view" of Kummel's type is very important to a beginning student.

As a reference book, *History of the Earth* does provide at least capsule descriptions of the geologic history of many parts of the earth. Unfortunately, few references to Kummel's direct sources are given in the text. This is a bad habit of many writers of introductory texts. To the biologist the geologic descriptions and interpretations will be of little interest unless he happens to be traveling someplace and wants a little background. But Kummel tries to cover so much ground that his treatment is skimpy. Shortly after receiving this book for review I traveled to the Caribbean, taking Kummel's book along to get some information on geology there; although the book contains several scattered pages that discuss the Caribbean islands, I found the material of little real use or interest.

Biologists will find a great deal of space devoted to fossil organisms. A chapter on the fossil record discusses fossils as documents of ancient environments and as documents of evolution, among other things. I found the sections on Precambrian life interesting. Chapters entitled "Paleozoic Life," "Mesozoic Life," and "Cenozoic Life" are just about what you find in any historical-geology textbook.

Kummel states in his introduction that his book is intended to be a classical treatment of the geologic history of the continents. He intends that a first-year student's reading of his book should be "passive." He has succeeded in that intention . . . ho hum.

William D. Romey
Earth Science Educational Program
Boulder, Colo.

History and Philosophy

THE CHILDREN OF FRANKENSTEIN: A PRIMER ON MODERN TECHNOLOGY AND HUMAN VALUES, by Herbert J. Muller. 1970. Indiana University Press, Bloomington. 431 p. $10.00.

This is a book that will help science teachers to see their endeavors in the context of history and philosophy. The author, a cousin of famed biologist Hermann J. Muller, is known for his perceptive books on science and world history. Here he tackles the problem of how to place technology in a framework of values that are both involved and implicit. His effort comes off superlatively: he does not prescribe, but he delineates and clarifies. Muller never hesitates to use the personal pronoun. He refuses to embrace the gloominess of Lewis Mumford, who lately, like King Canute, has commanded the sea to stop; instead, he shows how we came into our technologic world and how each step in the process is understandable, even though indefensible.

It is difficult to characterize Muller's views. He refers to his background and approach as "mongrel," and that is the beauty of it. He displays real hybrid vigor and the genius of the real generalist. He is already the author of *The History of Freedom,* and the present book is a fitting part of his life-long intellectual concern. It is well worth careful reading and savoring.

Paul Klinge
Indiana University
Bloomington