cally rigorous for problems involving discrete states, but assuming the natural extension to continuous spectra. Having so introduced Hermitian operators on vectors to describe observables and states in various representations, and the canonical equations of time change, he next deals with the application of group theory to give exact transformations for simplifying problems, and with perturbation theory in general. Then follow chapters on the methods of approximate solution: orbitals, variational methods, the Hartree-Fock equations, statistical fields, and the vector model for many-electron problems treated in detail by Dirac's methods, including applications to molecular structure. Finally, Corson deals with subjects at the frontier; second quantization and Heisenberg's *s*-matrix theory. To cover the material dealt with so well in this book would previously have required reading at least three monographs, as well as original literature.

L. H. THOMAS
Watson Scientific Computing Laboratory
Columbia University

Stratigraphy and Sedimentation. W. C. Krumbein and L. L. Sloss. San Francisco: Freeman, 1951. 497 pp. $5.00.

It is truly remarkable that in spite of rapid advances and the immense practical importance of stratigraphy, no general textbook has heretofore covered this field since Grabau's *Principles of Stratigraphy* in 1913. It is equally noteworthy that the present volume could hardly have been written more than a decade ago, for its viewpoint and substance have been strongly molded by recent advances in which its authors have played an active part.

Although the purpose of the book is clearly to interpret the stratified rocks, almost half its pages are devoted to sedimentary petrology and sedimentation. This is quite proper, of course, for materials and processes must be understood before rocks can be interpreted. The attempt to cover so wide a range of subject matter in a single volume must have imposed many difficult choices, and perhaps no one will regret that the book is rather heavily weighted in the aspects of stratigraphy in which the Northwestern school has recently been so much engrossed.

Following a brief introduction, Chapter 2 reviews the history of the geologic column and of our system of classifying the stratigraphic record. Here the reader encounters two viewpoints, which run through the book and will be warmly approved. One is the awareness that stratigraphy is a young and growing science in which ideas are still in flux; the other is consciousness of the problems arising out of the practical application of stratigraphy to the search for petroleum—especially in subsurface exploration.

Chapter 3 describes stratigraphic procedures, and Chapters 4–7 deal with various aspects of sedimentary petrology and processes of sedimentation. Chapters 8 and 9, devoted to stratigraphic paleontology and sedimentary facies, respectively, form a necessary prelude to the discussion of the principles of correlation covered in Chapter 10.

Chapters 11 and 12 develop the idea that the nature of a sedimentary deposit is largely determined by the tectonic framework in which it is formed, as well as the stage in the tectonic cycle. These chapters, synthesizing recent advances in philosophical interpretation, are perhaps the most thought-provoking in the book.

It is, of course, inevitable that, in a completely new treatment of a field so broad and controversial, other specialists will question some of the terminology and some of the interpretations. Indeed, one of the most wholesome aspects of the book is the frequence with which its authors indicate a tolerance for other interpretations. This is not the place to debate such problems, but a sample may serve to illustrate their nature. In discussing the tectonic framework of sedimentation, *shelf areas* are defined (p. 338) as

> the most neutral or stable parts of the craton, lying between and among the more postive or negative areas. The term applies to a degree of tectonism, and not to specific geographic areas. Present continental margins are shelves, but, in a stratigraphic sense, the term refers to any portion of the craton which displays no marked tectonism during a major cycle of deposition.

A further distinction is made between the *stable shelf*, which is "the most neutral part of the craton," and the *unstable shelf*, which is characterized by "slight oscillatory movements" that "commonly give rise to cyclical sedimentation." In view of the long-standing and widespread use of the term "shelf" in a different geological sense, this usage can hardly avoid misunderstanding and confusion. Certainly, the continental shelf off California has not been stable during recent geologic time, and that along the Gulf Coast has been rapidly subsiding. Neither of these regions could be accepted as *shelf* in the stratigraphic sense. Furthermore, the idea of shelf seas lying over the continental shelf is so deeply ingrained in geologic literature that to speak of the Illinois coal fields as having formed on a shelf would be confusing.

It is difficult to accept the generalization (p. 210) that "in the deeper parts of the neritic environment, clastic sediments are usually subordinate," and that "limestone may occur in great variety." The modern neritic sea floors certainly are generally covered with terrigenous muds or sands, except for limited areas.

In the attempt to be brief yet circumspect, the authors seem, in places, to be thinking rather more of their professional colleagues than of the student. On page 1, for example, stratigraphy is defined as "the integrating science which combines data from all other branches of earth science in a form from which historical geology emerges as a natural product." Probably only a very alert student would quickly translate this to mean that stratigraphy is the study of strata! Close reasoning in technical jargon perhaps inevitably demands close concentration, as on page 384, where we read: "The sedimentary environment is of strongest importance in controlling the detailed patterns of sediment distribution." But it would be unfair and un-

gracious to emphasize such difficult passages rather than the challenging and stimulating features of the book, not the least of which are the many well-chosen and effectively used illustrations. It goes without saying that the Krumbein and Sloss text will be warmly welcomed both by students and by professional stratigraphers.

CARL O. DUNBAR

Peabody Museum of Natural History
Yale University

The Origin of the Earth. W. M. Smart. New York: Cambridge Univ. Press, 1951. 239 pp. $2.75.

This book should prove to be a much-needed antidote to Hoyle's *The Nature of the Universe,* and it is gratifying to find a scientist who is not ashamed to confess that to him "the Heavens are telling the Glory of God and the Wonder of His Works." The book is nontechnical and can be read without any difficulty by the intelligent layman. It found its origin in talks given to servicemen and other lay audiences during and immediately after the second world war.

The book suffers somewhat from this transition from the spoken to the written word, and insufficient attention has been paid to the fact that statements made in print should be much more carefully weighed than those made in lectures. The result is a rather unbalanced presentation that, although not containing any apparent inaccuracies, gives a large number of half-truths which in a popular book of this kind should be avoided at all cost. This makes it difficult to recommend the book for popular reading.

There are quite a number of points that should be commented upon, but I shall restrict myself to a few remarks concerning Chapter IX, which discusses various theories of the origin of the solar system. It is clear that Professor Smart tried to steer clear of controversial points, but in doing so he gives a partial and inadequate picture.

First of all, the author makes the all-too-common mistake of lumping the Kant and Laplace theories together. As a result, he states that von Weizsäcker's theory is based on Laplace's, whereas it is clearly a variant of Kant's theory. The picture of von Weizsäcker's theory is incorrect and seems to borrow from Whipple. (By the way, why mention Hoyle's theory and not Whipple's?) The essential ideas of the theory attributed to Gunn were expounded in 1941 by Lyttleton. It should also have been mentioned that Birkeland (1912) and Berlage (1927) considered electromagnetic forces long before Alfvén. Finally, Spitzer's objections to dualistic theories should have been mentioned, since they dispose rather decisively of all dualistic theories.

D. TER HAAR

Department of Natural Philosophy
University of St. Andrews, Scotland

Genetic Neurology: Problems of the Development, Growth, and Regeneration of the Nervous System and of its Functions. Conference sponsored by the International Union of Biological Sciences. Paul Weiss, Ed. Chicago: Univ. of Chicago Press, 1950. 239 pp. $5.00.

This volume consists of a collection of essays written by the speakers at the International Conference on the Development, Growth, and Regeneration of the Nervous System held in Chicago in 1949. In the foreword and the first chapter P. Weiss, conference chairman, gives an account of the subjects discussed during the meetings, with his comments. The essays, which differ greatly in form, scope, and content, present:

A clear and concise review on the colloidal organization of the nerve fiber by F. O. Schmitt; a commentary to a motion picture (which can be rented or bought from the Wistar Institute) of neurons and neuroglia in tissue culture by W. H. Lewis; an account of the factors influencing the path of nerve growth and of the reciprocal influence of the lateral-line nerve fibers and organs in frog tadpoles by C. C. Speidel; an excellent review on certain aspects of nerve regeneration from a histological viewpoint—unfortunately, without any illustrations—by J. Boeke; an account of some factors influencing the size of nerve fibers and of the problem of internode length by J. Z. Young; an article on regeneration of peripheral nerves in man by S. Sunderland; a lucid and very stimulating article on differentiation of nerve cells and nerve centers by V. Hamburger and R. Levi-Montalcini; a discussion of limitations of the methods used in neuroembryology by J. Piatt; and a review of the results of spectroscopic studies on nerve cells of H. Hydén.

There is an excellent report on cytological and biochemical changes during maturation of nerve cells, and on the correlation of these changes with the onset of electrical activity, by L. B. Flexner; a stimulating review of certain aspects of neural growth and regeneration by R. W. Gerard; a discussion of neural growth, the development of behavior, and spinal cord regeneration by D. Hooker; a review of the development of reflex movements in mammals by W. F. Windle; an article attempting to resolve the present controversy regarding the development of integrative capacity of the nervous system in vertebrates by D. H. Barron; an article on neuronal specificity by R. W. Sperry; a discussion of neuron diversity by D. Bodian; and, finally, a report on the development of Mauthner's cell and one on regeneration in the central nervous systems of urodeles and reptiles by A. Stefanelli.

On the whole, the book provides highly stimulating material, although it is not always easy to read. A number of challenging problems are advanced which are likely to lead to fruitful controversies. The title of the volume, unfortunately, does not give a real indication of its actual content. As it is, the book may be missed by some who would appreciate the essays, and it may be disappointing to others who would expect an organized presentation of the entire subject.

JERZY E. ROSE

School of Medicine, Johns Hopkins University