scribe physical space. Rejecting the a priori, the naively empirical, and the totally conventionalistic answers, Grünbaum argues that there is a delicate balance between conventional and empirical elements which, when handled with proper care, allows us to formulate genuine empirical questions about the metrical character of physical space. Problems that are to some degree analogous arise for physical time. Also treated in this part is a geometrical paradox dating back to Zeno of Elea in the 5th century B.C. Though less famous than the paradoxes of motion, it is logically prior to them, and it poses profound difficulties in the very concept of an extended continuum.

Part 2, Philosophical Problems of the Topology of Space and Time, centers chiefly upon the causal theory of time and the problem of temporal direction. Grünbaum rejects the opinion that the second law of thermodynamics itself is temporally asymmetric; he argues that only in conjunction with specifiable initial conditions does this law provide a physical basis for the asymmetry of past and future. He claims, moreover, that the laws of classical mechanics, in conjunction with specifiable initial conditions, likewise provide a physical basis for the anisotropy of time.

Part 3, Philosophical Issues in the Theory of Relativity, consists mainly of a chapter devoted to philosophical and historical analysis of the fundamental principles of special relativity. Grünbaum emphatically reiterates Einstein's distinction between the *conventionality* of simultaneity and the *relativity* of simultaneity. The former is the more basic, for it arises within a single inertial frame and does not depend upon relative motion. Indeed, Grünbaum shows that by adopting a logically permissible, though otherwise unappetizing, *definition* of simultaneity, the *relativity* of simultaneity can be made to disappear! This distinction is intimately involved in an understanding of the relations among the following principles: (i) The speed of light is independent of the direction of its travel. (ii) The speed of light is the same in all inertial systems. (iii) Light is a fastest signal. Failure to make the necessary distinctions has led, Grünbaum charges, to widespread historical and logical confusion regarding the special theory. The remaining brief chapters in part 3 deal with specific problems in special and general relativity raised by Milne, Jammer, and Whitehead.

So remarkable is the scope of this book that it is difficult to think of any important philosophical problem of space or time that is not treated, or to find any important contributor whose views are not taken into account. These authors—including such men as Bridgman, Duhem, Eddington, Einstein, Milne, Poincare, Reichenbach, Riemann, Russell, and Whitehead—are discussed with scrupulous care. The book exhibits thorough scholarship and complete mastery of technical detail. Unmatched in breadth and rigor by any other recent book on the subject, *Philosophical Problems of Space and Time* is a significant contribution to contemporary philosophy of science.

WESLEY C. SALMON
Department of History and Philosophy of Science, Indiana University

Genetics Yesterday

Genetics and Man. C. D. Darlington. Macmillan, New York, 1964. 382 pp. Illus. $7.50.

Genetics and Man is a revised edition of *The Facts of Life*, first published in 1953. Although the title is changed, less than 10 percent of the first edition is altered: discussion of some new subjects has been included, two concluding chapters have been deleted, but no basic change has been made in the organization. Such revision is surely minimal in view of the almost revolutionary discoveries in molecular genetics and the advances in human genetics during the past decade.

Darlington is at his best in describing the excitement and far-reaching implications of the genetic discoveries made at the turn of the century and during the next few decades. These were exciting times in genetics, but the past decade has been no less exciting; however, this is an excitement in which Darlington apparently does not share. Only 2½ pages are devoted to an elementary discussion of the chemical nature of DNA. No hint is given in this discussion of the great impact that the Watson-Crick model of DNA structure has had on current genetic experimentation. The implications of this model pervade genetics from viruses to man, from the molecular level of biological organization to the population level, and are being used as working hypotheses by many geneticists and cytologists.

Although this revision does not bring the book into step with the times, reading it does give one a deeper appreciation of our current knowledge of inheritance because Darlington places it in its proper historical perspective. This historical summary is only slightly biased by the fact that Darlington has viewed genetics primarily through a microscope. He clearly portrays the reasons why genetic concepts have successfully infiltrated practically all aspects of biological thought. His succinct discussion of the genetic basis of evolution is outstanding.

The second half of the book provides a persuasive argument for viewing many of the problems of man and his society in terms of their genetic and evolutionary components. The coverage is broad, including such topics as race and class, sexual behavior, marriage and divorce, Freudian psychology, immortality, and free will.

There is a great deal of value here for the general biologists, the new generation of geneticists, the social scientists, and the interested laymen who are not familiar with the first edition. One only wishes that Darlington's fertile mind had provided some new meat to chew on in his revision.

WILLIAM K. BAKER
Department of Zoology, University of Chicago

Vermilion Sea Expedition

Marine Geology of the Gulf of California. A symposium (Memoir No. 3). Tjeerd H. van Andel and George G. Shor, Jr., Eds. American Association of Petroleum Geologists, Tulsa, Okla., 1964. vi + 408 pp. Illus. Charts. $12.50.

In 1747 Ferdinand VII of Spain issued a royal decree stating that "California no es isla." For about 100 years prior to that proclamation California was thought to be an island separated from the mainland by the Vermilion Sea, which, regrettably, is now better known as the Gulf of California. This mariner's mirage evaporated in 1698 when Father Kino, a Jesuit priest,

reasoned that, because the abalone (*Haliotis* spp.) was found along the Pacific coast of California but not in the Vermilion Sea, there could be no northern connection between the sea and the Pacific Ocean. Hence, "el mar es un golfo."

Although Father Kino's deduction was largely ignored for nearly half a century, his geographical study was probably the first scientific inquiry into the marine geology of the Gulf of California. This pioneering work has been most impressively carried on in the recent publication *Marine Geology of the Gulf of California*, a symposium volume which contains 16 well-written papers concerning the latest geophysical, geological, oceanographical, and biological researches in the gulf. Most of the authors, including the editors, T. H. van Andel and G. G. Shor, Jr., are savants at Scripps or elsewhere in southern California. Like its predecessor which dealt with the Gulf of Mexico, this symposium volume will doubtlessly be well received.

Although considerable attention is given to the sediments, bathymetry, and biota of the gulf, the book is perhaps most outstanding for its presentation of geophysical data and geotectonic ideas regarding the origin of the gulf, and, incidentally, of the development of portions of the continental margin of southwestern United States and northwestern Mexico. These ideas are developed in a series of papers by Allison ("Geology of areas bordering Gulf of California"), Rusnak, Fisher, and Shepard ("Bathymetry and faults of Gulf of California"), Harrison and Mathur ("Gravity anomalies in Gulf of California"), Phillips ("Seismic refraction studies in Gulf of California"), Hilde ("Magnetic profiles across Gulf of California"), Biehler, Kovach, and Allen ("Geophysical framework of northern end of Gulf of California structural province"), and Rusnak and Fisher ("Structural history and evolution of Gulf of California"). These authors present impressive evidence, marshalled by Rusnak and Fisher, that large-scale crustal translocation formed the gulf in Miocene time. Incidentally, it is interesting to note that only passing notice is given to Warren Hamilton's earlier (1961) exposition of this idea. Because the southern portion of the gulf has an oceanic crust, those unmoved by the gravity-sliding interpretation may wish to regard this part of the gulf as a graben that lost its original continental foundation by subcrustal erosion, or to perhaps face the problem of evolving the granitic rocks of the outlying Baja California peninsula from an oceanic crust. The sliders appear to have won this round.

The book also includes papers on classical subjects—for example, Roden's "Oceanographic aspects of Gulf of California," Shepard's "Seafloor valleys of Gulf of California" (in which he once again comes to grips with his favorite subject, submarine valleys, although this time he deals with canyons cut in granite), Curray and Moore's "Pleistocene deltaic progradation of continental terrace, Coasta de Nayarit, Mexico" (a refreshing attack on the problem of the origin of the continental platform and slope, based on ideas gleaned from reflection profiles), and van Andel's lengthy (94 pp.) "Recent marine sediments of Gulf of California" (in which he shows that detrital debris is chiefly transported transversely into the Gulf from its flanks and not, as one might initially think, longitudinally from the Colorado River at its northern end).

In the next paper, "Factors affecting distribution of laminated diatomaceous sediments in Gulf of California," Calvert substantiates the concept that layered, diatom-rich slope sediments in the gulf are related to a zone of oxygen minimum in the water column. Parker's paper, "Zoogeography and ecology of macro-invertebrates of Gulf of California and continental slope of western Mexico," emphasizes the striking diversity of tropical and subtropical benthic communities in the gulf. In a companion paper, "Patterns of living benthonic Foraminifera, Gulf of California," Phleger describes what little information is available regarding the Foraminifera of this Pacific backwater. Ostracods are briefly treated by Swain, Miller, and Mandelbaum, and the Radiolaria by Benson.

Ideally, this book should be read from cover to cover, but individual contributions can be taken separately without undue reference to the preceding papers. Large-scale maps are included in a separate packet. The bathymetric chart in the packet is thoughtfully printed in deepening shades of blue that correspond to increasing depth zones, and thus is easily comprehended. This is an excellent chart, although for some reason San Lorenzo Island was not designated, Espíritu Santo Island was misspelled, and accent marks were not used on Spanish words as they were in the text of the book. *Marine Geology of the Gulf of California* is a worthy buy for most marine geoscientists as well as for those especially interested in this area, which is one of the world's most "readily inaccessible" regions.

DAVID W. SCHOLL
Earth and Planetary Sciences Division, U.S. Naval Ordnance Test Station, China Lake, California

Chemistry

Organic Name Reactions. A contribution to the terminology of organic chemistry, biochemistry, and theoretical organic chemistry. Helmut Krauch and Werner Kunz. Translated from the second revised German edition by John M. Harkin. Wiley, New York, 1964. xxiv + 620 pp. Illus. $16.

For various reasons, many organic reactions have come to be known by the names of their discoverers or early champions. Thus, organic chemists commonly speak and write of Friedel-Crafts reactions, Diels-Alder reactions, and the like, rather than referring to the reactions by more descriptive terms. This makes for efficiency in communication, particularly when the descriptive term would be long and involved. Many of the "name reactions" are not well known, and literature citations are sometimes omitted when they are referred to by name. Therefore a reference dictionary of name reactions is needed.

In this book, a translation of the German edition published in 1961, the main text (519 pp.) presents about one reaction per page. Virtually every reaction is illustrated by an eye-appealing chemical equation with structural formulas. A few descriptive remarks, mostly well-chosen, are made about each reaction, the probable mechanism is often briefly indicated, and important literature references are listed.

An "addendum" section (pp. 521–559) gives additional literature citations, reaction by reaction, many relating to work published during the period 1960 to 1963. The bibliographical material is quite good, but for almost every reaction the bibliography is split