physics, and at least classical field theory is required of the reader, and the concise presentation makes few concessions to his weaknesses. It cannot be expected to serve as an account for the general reader, for the undergraduate in physics, or even for most scientists trained in fields other than physics. For those with adequate background, however, it should prove to be a valuable discussion of a field in which good books are rare. To some extent it may serve as a sequel to Fermi's similar book, '*Elementary Particles,*' published eight years ago.

ALAN M. THORNDIKE
Department of Physics,
Johns Hopkins University

The Central Nervous System and Behavior. Transactions of the first conference, 23–26 February 1958. Mary A. B. Brazier, Ed. Josiah Macy, Jr. Foundation, New York, 1959. 450 pp. Illus. $5.25.

This is a remarkably fine, interesting book. It is crammed with provocative ideas on the central nervous system and behavior—the functions of man that presumably give him status in the animal world. The contributions of the Russians are the springboard—immediately apposing their scientific and political behavior and ours. The discussions are soundly rooted in the rich soil of history. There is a pictorial survey of over 100 pages, starting with the seal of the first Italian scientific academy and ending with a panorama of Moscow University, which presents the Russian intellectual heritage in science better than any other single reference in English with which I am acquainted. Recognition of the true place of Lomonosov, Sechenov, Pavlov, and even Popov (the Russian counterpart of Marconi) among the important minds that have advanced all mankind may some day replace the propaganda distortions from the Kremlin and the uninformed journalistic outcries that serve as the Western answers.

The second portion of the book brings up to date the important modern developments of post-Pavlovian physiology: brain stimulation and conditioned reflexes, electroencephalographic studies, and electrical correlates of conditioned learning. Although these three chapters are attributed to Robert W. Doty, Frank Morrell, and Robert Galambos, respectively, they are "group interchanges" in the now-familiar style of the Macy conferences. The naturalness and the clarity of the presentations reflect great credit upon the editor, Mary Brazier.

The conference is brought to an integrated wholeness by a thoughtful summation, led by Robert Livingston. He contrasts the monistic Russian physiology with our fractionalized approach and develops this significant thought (credit for which he shares with Paul MacLean): "Perhaps because of our philosophical as well as physiological isolation of visceral and somatic mechanisms, our political tradition has tended to look upon somatic and visceral needs as rather completely independent. Our physiological philosophy has a certain impact and bears a certain responsibility in relation to our Government's political actions and diplomatic relations, and especially with respect to how, as a people, we communicate our ideals to others. This becomes of particular concern at the present in relation to how the United States is viewed by the so-called uncommitted countries. Russia has . . . been much more sensitive . . . to the importance of visceral well-being and to the relationships which they conceive to exist between the physiological and social integration of man."

To paraphrase the thought in a more concrete example: the ideals of free enterprise sound better on a full than on an empty belly, but the fullest belly will not offset the insult of being considered inferior. The psyche and the soma are indivisible, and both must be satisfied.

If, indeed, science has a role as a bridge of understanding between the two great systems of politics confronting each other with gestures that augur ill for mankind, the area of investigations of the central nervous system appears to be particularly fruitful. It would be useful indeed if all American scientists read with care the proceedings of this conference. As a reviewer I have urged the translation into English of many a Russian book; this is one which we could profitably translate into Russian if it were possible to place a copy in each scientific institute of the Soviet Union.

MICHAEL B. SHIMKIN
National Cancer Institute,
Bethesda, Maryland

Electric Conduction in Semiconductors and Metals. W. Ehrenberg. Oxford University Press, New York, 1958. x + 389 pp. Illus. $10.10.

The three most active periods in the development of theories of conduction of electricity in solids are reflected in Ehrenberg's book. In the early years of the century, Drude, Lorentz, and others based their calculations on a model in which the outer or valence electrons of the atoms in a metal become detached to form an electron gas, which was treated classically. Shortly after the discovery of quantum theory in 1926, Sommerfeld, Houston, Bloch, and others showed that many of the difficulties of the earlier theories could be removed by application of quantum statistics and by taking into account the wave nature of the electron. During the next several years the foundations of the modern theory of solids were laid down and a number of excellent texts and treatises appeared. Basic to most of this work was the Bloch or one-particle approximation, in which correlations between positions of the electrons are neglected. In general, with a few notable exceptions, agreement between theory and experiment was qualitative rather than quantitative.

The past decade has been another active period, particularly in the field of semiconductors. Extensive theoretical developments, based largely on Wilson's (1931) energy band model, and well-controlled experiments with exceptionally pure single-crystals, have brought about a close coordination of theory and experiment. Recent work on the many-body problem has helped remove some of the limitations of the one-particle theories.

In the first four chapters, Ehrenberg discusses the theory of conduction in ionized gases, which is in many ways analogous to that in semiconductors, and presents in more detail than seems necessary the classical Drude-Lorentz type theory, with some modifications for quantum statistics and two-carrier models. Chapters 5 through 9 outline the wave-mechanical treatment. The one-particle approximation is used throughout, without apology or explanation. The last four chapters (10 through 13) cover some of the postwar experimental and theoretical work on semiconductors and transistor electronics. It is unfortunate that a book on such an active field should have been so long in preparation. It is evident that most of the text must have been written in 1955 or earlier; the latest date in the bibliography is 1955.

While the book has some valuable features, it is on the whole unsatisfactory. Theoretical derivations often are given in great mathematical detail, but uncritically and without first giving the reader an understanding of what is to be accomplished and what physical assumptions are involved. The book would be difficult for a beginner in the field and, moreover, not very rewarding if the aim is to get a real understanding of what has been accomplished and what outstanding problems remain. It is probably most useful as a reference volume or for supplementary reading on particular topics. The book is beautifully printed, in keeping with other Oxford University Press volumes.

JOHN BARDEEN
Department of Physics,
University of Illinois