by A. B. Novikoff on enzyme localization in the dorsal cord of the rat and on lysosomes, by J. Taxi on the ultrastructure of amphibian ganglion synapses, and by T. W. Blackstad on cerebral cortex, it is the correlation of light and electron microscopy of the regions or structures studied. In *The Cell* (vol. 4, Brachet and Mirsky, Eds., Academic Press, 1960), Hydén summarized in a 100-page chapter the cytochemical, ultrastructural, and microchemical knowledge of the neuron at that time. He included considerable speculation on the function of macromolecules in the nervous system. Some seven years later, in the present volume, Hydén reviews various experiments on isolated neurons and their surrounding glia which support the hypothesis of a reciprocal relationship. The chapter in the present volume is a convenient summary of his microanalytic studies on brain RNA. Experiments involving elegant microtechniques have led Hydén to conclude that there is an actual passage of RNA from glia to neuron and that characteristic changes in amount of RNA in selected neurons or glia can occur under the influence of drugs, exercise, change in state of consciousness, and learning. More recent studies on changes in protein observed in Hydén's laboratory are not reported in this volume. While Hydén maintains that there is a characteristic shift in the amount or in the base ratios of RNA, he has grown more cautious in the interpretation of his results. He points out the need to do confirmatory studies with isotopes. Since his studies involve selected neurons and their surrounding glia from specific brain regions, the various new techniques for the separation of neurons and glia from large amounts of brain tissue cannot be expected to shed additional light on his approach. It will probably remain for investigators trained in microtechniques to elucidate further the significance of these findings.

The free use of photographic plates throughout the book might seem extravagant. A pleasant exception is a chapter by the late C. M. Pomerat and coworkers in which frames from time-lapse cinematographs illustrate the dynamic nature of neurons in culture. If the chapter encourages those who have not already done so to view the films of Pomerat, of Paul Weiss, and of others, it will have served a good purpose.

BERNARD AGRANOFF
Mental Health Research Institute, University of Michigan, Ann Arbor

Overview of Animal Virology

The Biology of Animal Viruses. FRANK FENNER. Vol. 1, Molecular and Cellular Biology (xvi + 501 pp., illus.). Vol. 2, The Pathogenesis and Ecology of Viral Infections (xvi + 879 pp., illus.). Academic Press, New York, 1968. $18.50 each vol.

The study of viruses began, of necessity, with their role as agents of disease. Fenner in this new two-volume study looks beyond this aspect to consider the comparative biology of avian and mammalian viruses. He is well qualified to attempt this task, for his own contributions encompass the whole of virology, from ecology to molecular biology.

The first volume reviews what has been learned through the application of the methods of molecular biology to animal viruses and the cells they infect. Avoiding the one-virus-to-a-chapter approach that would be employed by a series of specialists, Fenner skillfully guides the reader through the various stages of viral growth from adsorption of the infecting particle to the release of progeny. Each of these stages is illustrated with data drawn from the whole spectrum of animal viruses. Where studies of related viruses have yielded similar results, Fenner discusses in detail only the clearest example, simply supplying references for the others. The resulting cross-sections of knowledge exhibit both the diversity and the unifying concepts of the subject. In the second volume Fenner uses the same plan to consider the interactions of viruses with whole animals and populations of animals. Here again the experimental models are clearly described and the schematic drawings—for example, one of the reproductive tract showing possible routes of infection of the embryo—give the reader a graphic sense of processes involved.

We live in an age in which data are accumulating ever more rapidly, the product of what, for the most part, are laboratory scientists, highly competent in technical aspects of their subjects but often unable to simplify, generalize, or interpret their material in a way that might make for greater meaning and usefulness. It is here that Fenner makes possibly his greatest contribution. Whether he is discussing the synthesis of viral nucleic acid, the pathogenesis of viral diseases in relation to such things as the immune response and the spread of virus through the host organism, or the ecology of animal viruses as related to spread in vertebrate populations with changes in virus and host, he draws his material, like a true biologist, from all sources, the field as well as laboratory, animals as well as man, and thus achieves an exemplary point of view which should be welcome to anyone who wishes to see the wood rather than merely the trees.

These well-documented volumes provide a reliable entry into the current literature and should be the delight of graduate students. A specialist who might be tempted to use only the particular volume that touches his interest should also avail himself of an unexcelled opportunity to view the whole of animal virology.

LAWRENCE KILHAM
E. R. PFEFFERKORN
Department of Microbiology, Dartmouth Medical School, Hanover, New Hampshire

Interactions

Low-Energy Neutron Physics. I. I. GUREVICH and L. V. TARASOVA. Translated from the Russian by Scripta Technica. R. I. Sharp and S. Chomet, Eds. North-Holland, Amsterdam; Interscience (Wiley), New York, 1968. xiv + 608 pp., illus. $28.

Many of the recent books in physics have been written by committees; that is, they are compendia of individual papers collected by someone or some group. It is extremely pleasant to encounter a book which is clear, comprehensive, and reasonably up-to-date and reflects the work of one or two individuals. The excellent book by I. I. Gurevich and L. V. Tarasova is such a volume.

Displaying a breadth of understanding that is increasingly rare, the authors tie together the theoretical and experimental bases of the interaction of neutrons with nuclei. They consider both macroscopic and microscopic interactions of neutrons. For example, there is an elementary discussion of the neutron dipole moment. There is a rather complete treatment of the macroscopic nuclear and electromagnetic interaction of neutrons with nuclei, atoms, crystals, and liquids. At all points the authors clearly bring out the basic relationship of the *S*-wave nuclear scattering amplitude for low energy neutrons to macroscopic phenomena such as the scattering from crystals and liquids.

The comprehensive nature of the

book, as well as its organization, makes it possible for a student with a basic knowledge of quantum mechanics, or for a research worker, to utilize it readily and effectively. For example, there is the particularly clear and interesting section fairly late in the book on the Van Hove correlation function, complete with a particular example of scattering by liquids, which was illustrated earlier with several pieces of experimental data and a qualitative discussion.

There are, however, several omissions which are unfortunate because the authors' style and ability are so excellent. Except for a brief mention of nuclear resonance scattering early in the book none of the studies of these data and their implications in nuclear and fission physics are discussed. It is also regrettable that there is no discussion of neutron polarizability and its implications for the structure of the neutron. To dwell on these or other omissions would, however, be a disservice to an excellent book.

N. S. WALL
Department of Physics and Astronomy, University of Maryland, College Park

Effects of Impurities

Localized Excitations in Solids. Proceedings of the first international conference, Irvine, Calif., 1967. R. F. WALLIS, Ed. Plenum, New York, 1968. xvi + 782 pp., illus. $22.50.

Over the past decade physicists have become very much interested in the effects of impurities on the excitations of otherwise pure materials. The impurity can be considered to act as a microscopic probe in the host material, and it is hoped that by measurement of its behavior information about the host can be obtained. However, most impurities produce large changes in the parameters defining the excitations in the host, and rather exact calculations with good models are required. When the changes are localized in the immediate vicinity of the impurity, the possibility of carrying out exact calculations does arise. The book under review contains the proceedings of the first international conference in which, predominantly, the properties of such impurities in a variety of systems are discussed.

The systems covered are drawn from lattice dynamics, magnetism, and semiconductor physics. As most work has been done on the impurity modifications of the vibrational modes of a crystal, the conference was dominated largely by papers on these effects. In this system the changes in the host crystal parameters are due to the different mass of the impurity and the different force constants coupling it to the motion of neighboring atoms. These changes can lead to resonant modes in the host crystal pass band or to localized modes in the band gaps. These two kinds of behavior are characteristic of all the impurity systems discussed here. As the impurity also removes translational invariance, radiation can couple with modes of all wavelengths, and optical absorption yields more information than usual. A variety of detailed calculations and experiments, both optical and thermal, are presented and reviewed, and it is noted that good agreement between them is becoming possible.

Discussion of the magnetic impurity problem is complicated by the lack of an exact solution for either a pure ferro- or antiferromagnet. Except at very low temperatures the necessary approximations lead to effective parameter changes throughout the crystal, in addition to the different impurity spin magnitude and associated Heisenberg exchange constants. Hence only rather simple model calculations are reviewed. However, a considerable amount of optical work in magnetic systems is presented, particularly on the sidebands induced in the electronic spectra of an impurity.

The study of electron-hole pairs bound to isoelectronic impurities in semiconductors forms the remaining major topic. Here it is the impurity potential that is of short range. Detailed calculations of fair accuracy are described, but probably more useful is a discussion of a very simple model illustrating the many complications of this system. Again a large quantity of optical data is presented and discussed.

Probably owing to the fact that the various topics are drawn from different fields, most of the reviews are quite accessible. In any case, this book is one of the very few places where these topics are brought together and is thus of interest to anyone wishing to be informed of this branch of impurity physics.

D. W. TAYLOR
Department of Physics, McMaster University, Hamilton, Ontario

All about Some Instruments

Magnetic Compasses and Magnetometers. ALFRED HINE. University of Toronto Press, Toronto, 1968. viii + 386 pp., illus. $30.

As I read this book, I was reminded of the Admiralty Manuals. For those who have not encountered them, it should be explained that Admiralty Manuals are series of monographs on topics of immediate concern to H.M. Royal Navy. They are models of exposition, full of precise and elegant descriptions in simple, clear English. Somewhere in the literary Valhalla there must be a reward for those who write them. Like the Admiralty Manuals, this book contains a mass of detailed knowledge for the specialist and is so well written that the general reader can enjoy it.

After a brief and interesting historical introduction, the author considers the basic principles of pivoted-needle and inductor instruments. The treatment is very thorough. For example, several pages are devoted to the important problem of the behavior of pivoted-needle compasses in a moving vehicle. This permits analysis of the effect of acceleration of the pivot or suspension arising when the vehicle changes speed, turns, pitches, rolls, or yaws. In particular, a detailed analysis of the northerly turning error is given. The development of what we now call flux gates, the best-known form of a saturable inductor, is traced from the simplest rotating coil devices. The flux gate itself is introduced as follows:

> The most common forms are single-core and twin-core inductors depending for their operation on a.c. excitation of such magnitude that the cores are periodically driven into saturation on either side of the unmagnetized or zero field state. The application of an ambient magnetic field along the axis of the core or cores alters the relative positions in the magnetizing cycle where saturation is reached in either direction of magnetization. The corresponding distortion of the flux can be detected as an e.m.f. in the excitation windings (or, better still, in a separate secondary winding), this e.m.f. being in certain conditions proportional to the axially applied field.

The four basic forms of saturable inductors are discussed, as are aspects of the design of cores and the behavior of inductors in moving vehicles.

Having established the basic principles of the detector systems, the author describes the various compasses