dubius, the acanthocephalans on which most physiological information is available. In his analysis of the nature of the environment of these and, as it happens, many other parasites, the author has done parasitology a great service. In relating this information, where possible, to parasite physiology he sets an example which others could profitably follow.

It is a pity, perhaps, that the book has appeared in the rather dry, staid format of the Cambridge Monographs in Experimental Biology, when it could so easily have been made more attractive. Nevertheless, it has been carefully produced and stimulatingly written and deserves a wide readership among students, teachers, and research workers in parasitology and general invertebrate physiology.

R. A. HAMMOND

Homage to Krebs

Essays in Cell Metabolism. (Hans Krebs Dedicatory Volume.) Edited by W. Bartley, H. L. Kornberg and J. R. Quayle. Pp. 290. (Wiley Interscience: London and New York, August 1970.) 120s.

Essays in Cell Metabolism was intended as an offering by some of his friends and colleagues to Sir Hans Krebs on his seventieth birthday "in the hope that he will accept it as a tangible evidence of their gratitude, their good wishes and their warm affection". When Sir Hans delivered the Third Hopkins Memorial Lecture in 1961, the chairman remarked that, as the result of his studies on the various metabolic pathways, Sir Hans would likely ride to eternity on a "three-wheeler". It is unfortunate that so many students are aware only of the "three-wheeler" and tend to be unaware of the wide range of biochemical interests nurtured by Krebs. This volume goes far in correcting this impression, for the topics range from the internal machinations of cells, with essays on the turnover of mitochondrial constituents, pyridine nucleotide metabolism, (–) hydrocitrate, metabolism of simple carbon compounds, ammonia metabolism, ketone bodies and the sodium pump, through to the intact cell represented by contributions on spermatozoa and cytodifferentiation studies in microbes, and finally to the cell surface with an essay on life outside the cell.

The scientific content and standard of the essays are as might be expected from the high reputations of the authors, most of whom have written in a personalized style permitted them through the nature of the volume, which was to allow presentation in an "unedited and unvarnished" form. It is to be hoped that some editors might take note of the brief return to this form of writing which is in such pleasant contrast to the current stereotyped synthesis termed "scientific writing". In addition to presenting

scientific information, most authors have discussed the way in which they were guided, stimulated and befriended by the person to whom this book is dedicated. In doing so, they underline the scientific approach and way of life gained by Sir Hans in his contact with Warburg and Hopkins, and subsequently passed on to his own students and colleagues. This is certainly a volume to be read not just by biochemists, but by all students of biological sciences. In doing so they will help not only to celebrate a very happy occasion, but they will gain much from the way of thinking and working generated by Sir Hans and continued by his colleagues.

P. B. GAHAN

Metabolic Map Reference

An Introduction to Metabolic Pathways. By S. Dagley and Donald E. Nicholson. Pp. xi + 343. (Blackwell Scientific: Oxford and Edinburgh, 1970.) 75s.

THE study of metabolism has been, and remains, an important aspect of biochemistry. For ten years the maps of metabolic pathways designed by Dr Nicholson have been an invaluable guide through the maze of known pathways. Dr Nicholson, in collaboration with Professor Dagley, has now expanded the map into book form, an expansion which has been made in three principal directions. First, each sequence of reactions has been dissected from the map and is displayed on a separate page, which improves clarity and enables more detail about the reactions and the enzymes catalysing them to be included. In view of the current interest in metabolic regulation, it is unfortunate that no information has been given about the regulatory mechanisms operating on each pathway. Second, there is an introductory text of about ninety pages. The first part of this, which discusses methods of investigating metabolic pathways, is particularly welcome, for this subject has rarely been treated in such detail in one book. The second part considers the regulation of metabolism. This is a much reviewed topic and the brief presentation here differs little from many others. The third innovation is the list of selected references for each reaction, which enables the experimental evidence on which the sequences are based to be examined.

These additions result in a reference book which should prove useful to students, teachers, and research workers alike. It does not, however, even at an introductory level, cover all the important facets of the study of metabolic pathways, and must be supplemented by other reading. On its own it might foster an uncritical and disjointed view of metabolism. No distinction is made among the pathways presented on grounds of the weight of evidence supporting them, the

range of organisms in which they occur or their physiological importance, though some of this information is accessible through the references. Similarly, knowledge of the regulation of particular pathways and of their interrelations, which is important to a properly integrated view of metabolism, will require further reading. In short, a valuable aid to study, but not an object of study in itself.

KENNETH M. JONES

Phage Structure

Ultrastructure of Bacterial Viruses. By Anna S. Tikhonenko. Translated from the Russian by Basil Haigh. Pp. x + 294. (Plenum: New York and London, 1970.) \$19.50.

THE author of this monograph is an electron microscopist interested in bacteriophage as a model for structural interactions between biological macromolecules, and she gives a comprehensive review of bacteriophage structure and the methods of preparing different phages for the electron microscope. This includes much of her own work on phages studied less frequently than those of *Escherichia coli*.

There follows an account of phage ghosts, bacteriocins and the products of phage disintegration following different physical and chemical treatments. Some phages have a protein sheath which contracts during injection of their genetic material into the host cytoplasm. The author believes that an understanding of the mechanism of phage infection may provide a model for muscular contraction; a phosphatase activity is found associated with the sheath and the addition of ATP leads to some release of the phage DNA. A review of these studies is presented.

The monograph ends with electron micrograph studies of phage development inside the host cell. It is in this section that the absence of molecular biological studies is most strongly felt. The genetical and physical properties of most DNA-containing coliphage genomes can be explained on the assumption that the phage DNA is replicated as a concatenate. The evidence in some cases is strongly in favour of the view that this concatenate is cut by enzymatic systems into headfuls prior to phage maturation. Variations on this hypothesis will explain the genetical properties of most if not all double-stranded DNA coliphages. It is a pity that the author has not tried to relate these ideas to her studies of phage multiplication in *Bacillus mycoides*.

Although the translation sometimes shows unfamiliarity with current scientific usage and reflects the turgidity of normal Russian scientific writing, it is nevertheless unambiguous and easy to read. The inclusion of an index in the English version is appreciated, as is the bibliography which includes much of the Soviet work in this area. JOHN SCAIFE