Book Reviews

Reflections of a Physicist. P. W. Bridgman. Philosophical Library, New York, ed. 2, 1955. xiv + 576 pp. $6.

This book is a collection of talks delivered or papers presented on various occasions on topics concerning mainly the idea of operationalism as advocated by the author as *the* method of science, the so-called epistemological bearings of modern physics (especially relativity theory and quantum theory), and views on the social situation of our time. Being a European scientist and philosopher, I will be allowed, it is hoped, to say that P. W. Bridgman's opinions are not well enough known on the Continent, which is regrettable, because they are interesting and very original. But one may doubt whether it would be correct to consider them as falling into the classical realm of philosophy. The number of scientists who engage on a philosopher's pilgrimage increases—not always very happily, for in many cases a serious study of philosophy prior to the pilgrimage would have avoided both a naive position and an awkward use of philosophic concepts. Yet Bridgman has escaped the danger by developing some genuine ideas and a simplicity of exposition that reminds one a little of Hume. He is very Anglo-Saxon in the presentation of his argument which reflects the conclusions from his own experience.

Since the book is a second edition (containing some additions to the first one), its contents may be known to former readers. The scientist and philosopher will not find anything really new in it.

The main ideas of Bridgman's thought should be recalled: (i) the operational aspect; (ii) the private aspect of all scientific activity (prior to its public aspect). Science is *an activity*. Science has been contaminated by an overemphasis of the social factor. Science is, nevertheless, objective (this point is very well presented). In the analysis of the private and public level, he reminds us that the discovery of the private level (p. 75) "is almost always the result of some bitter experience"—this I can agree with.

These ideas and many more are presented in the first nine sections, which are a series of expositions all saying more or less the same thing. Of the following sections 10 to 17, which serve as illustrations, the same must be said. Some of the contributions date back quite a few years, and one gets the feeling on reading them that not all these things are new anymore. But they are always very well said, and the nonscientist in particular will profit by the lecture.

Whoever is not familiar with Bridgman's thesis on operationalism would do well to begin by reading section 6, for he could easily get lost by beginning with section 1. One of the best illustrations I find is given in section 13, which is an excellent discussion of the second law of thermodynamics from the operational point of view. In other sections, the writing is sometimes too long for what is really involved. The fact that the book is a collection of essays presented elsewhere has the inevitable consequence of repetitions, of which there are a good many.

In reading this book I was struck by one point that I never had realized before, namely, that the philosophic genre described as solipsism is really possible. Bridgman seems to me to be a genuine representative of that way of thought, and I respect him all the more, for his argument makes very good sense and is never offered for the sake of argument alone, as so often happens in conventional philosophic dispute. Yet a position like this is a rare thing, and I doubt whether it will have any future.

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Physiologie der Zelle. Johannes Haas. Gebrüder Borntraeger, Berlin, 1955. 474 pp. Illus. DM 48.

"The elementary constituent of all living substances and the substratum of all elementary vital processes is the cell. Hence, if the task of physiology lies in the explanation of the vital phenomena, it is evident that general physiology can be only cell physiology." With these words, Verworn introduced his *General Physiology* in 1894.

Now physiology deals with the dynamics of structure and ultimately with changes on a molecular level that are associated with the various activities of living matter. The discoveries of the cell morphologists at the end of the 19th century were indeed breath-taking, and they deeply influenced the thinking in all branches of biology. But they did not provide the basis for a true cell physiology as Verworn had hoped because their structures were still too far removed from the molecular level and thus for decades cytology and physiology went their separate ways. Cytology remained largely static while general physiology resorted to physical-chemical models and guesswork. There was no real physiology of the cell because we had no morphology of the cell in terms useful to the physiologist.

In recent years, developments in many different fields of biology have laid the foundations for such a physiology of the cell. The book by Haas is an attempt to collect the scattered results from modern chemistry, enzymology, cytochemistry, electron microscopy, genetics, embryology, and so forth, and to fit them into a physiology of the cell. The task is tremendous. It asks for a synthesis of classical cytology, modern quantitative cytology, cell chemistry, submicroscopic morphology, chemistry of macromolecules, and biochemistry.

It is obviously impossible for a single individual to know and evaluate critically the vast literature in all these areas, and the book is therefore largely based on existing reviews in these fields. In general, the author has succeeded in giving an interesting and balanced picture of the problems, methodology, and achievements of modern cell biology and in conveying some of the feeling of excitement that is associated with the vigorous expansion into new areas of exploration and the synthesis of previously unconnected branches of knowledge.

The organization of the book indicates the scope of modern cell physiology. (i) General properties of macromolecules; colloid chemistry of macromolecules; structure and properties of proteins and nucleic acids; general properties of enzymes and their distribution in the cell; and chemistry and molecular structure of lipids. (ii) Organization of the cell: ground substance of the cytoplasm; cell surface; mitochondria and microsomes; and the nucleus and its morphology, chemistry, enzymology, and functions. (iii) Interphase chromosomes; physiology of gene action; and gene duplication and mutation. (iv) Functions of the cell: glycolysis, respiration, energy transfers, and kinetics of membranes. (v) Cell

division, cell growth, differentiation of cells, and embryonic induction.

It seems unavoidable that in covering such a variety of rapidly expanding disciplines, the treatment should be uneven and often out of date. The coverage of the literature is often spotty, especially since 1950. The recent work on cell structure with the electron microscope is largely neglected and, as a result, the discussion of the "ground substance" of the cytoplasm is especially weak and based mainly on the speculations in the German literature before 1950. Sometimes different chapters come to contradictory conclusions: chromosome reproduction occurs in prophase on one page, but all the evidence for synthesis during interphase is presented in a later chapter. The expert in each of the fields covered will no doubt be annoyed by such discrepancies, by the omission of significant work, by the emphasis in some chapters on ancient speculations, and perhaps by the frequent misspelling of names. It is hoped that in a future edition the various chapters will be revised by experts in the respective areas.

Yet, despite these shortcomings, the book is a rich source of information, and it is unique in scope and conception. It deserves the attention of anyone who is interested in the activities of cells and the modern approaches to their investigation.

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Ergebnisse der Medizinischen Grundlagenforschung. K. Fr. Bauer. Thieme, Stuttgart, Germany, 1956 (order from Intercontinental Medical Book Corp., New York 16). 855 pp. Illus. $30.75.

As the title indicates, this book is largely concerned with giving an account of the present state of the basic sciences that underlie medicine. The several chapters are "Structure of bacterial surfaces," by J. Tomcsik; "The present state of fundamental research in the field of tuberculosis from a dermatological viewpoint," by C. F. Funk; "The mitochondria," by G. Glimstedt and S. Lagerstedt; "The fine structure of nucleus and cytoplasm in relation to general cell functions," by F. E. Lehman; "Metabolites and antimetabolites," by J. C. Somogyi; "Kinetic and thermodynamic enzyme reactions in living cells and tissues," by H. Holzer; "Results of vitamin research from 1950 to 1954," by W. Stepp; "Fundamental processes of muscular contraction," by A. Fleckenstein; "The essential amino acids," by J. Kapfhammer, R. Bauer, and V. Kapfhammer; "Tissue and functional therapy," by S. Funaoka; "The mechanism of parenteral tissue and stimulus therapy," by K. O. Vorlaender; "The present state of research in allergies," by F. Sheiffarth; "Biophysics of radiation," by F. Wachsmann; "Hypothermy," by H. Laborit; "Recent results in neurohistology," by E. Landau; "The development of the human cerebral cortex," by G. von Bonin; "The external and internal functional relationship of the hypophyseal organs," by E. Collin; and "Embryology in relation to medical research," by G. Töndury.

There are both author and subject indexes.

International Review of Cytology. vol. IV. G. H. Bourne and J. F. Danielli, Eds. Academic Press, New York, 1955. xii + 419 pp. Illus. $9.

The fourth volume of these reviews includes 12 articles assembled in accordance with the stated policy of the editors to survey the expanding field of cellular biology over a period of years. Selected topics range from a consideration of nucleic acids as ubiquitous cell components to examination of the properties of highly specialized cell types.

"The histochemistry of nucleic acids" is reviewed by N. B. Kurnick in a comprehensive manner. Emphasis is placed on the rigid requirements essential to critical analysis of these materials *in situ* by photometric, enzymatic, and staining procedures. Some of the same problems are examined by R. Vendrely in the "Histochemistry of bacteria," although constituents of bacterial cells other than nucleic acids are also considered. The short chapter by A. Marshak on "Bacterial cytology" sounds the precautionary note that students of the nuclear apparatus should rely on direct analysis and avoid the tendency "to seek in bacteria the morphological counterparts of intracellular structures seen in higher forms."

L. E. Wagge discusses in considerable detail the structure and function of "Amoebocytes," primarily as they occur in the Mollusca, but with reference to wandering cells in other phyla. This review, and the parallel study of Harald Moe on the mucus-secreting "goblet cells, especially of the intestine of some mammalian species," afford insight into the origin and structural modifications of cells concerned with transport and secretion.

Another outstanding review is D. P. Hackett's "Recent studies on plant mitochondria," in which morphological, biochemical, and physiological studies are evaluated, but which is devoid of illustrative material that could have enhanced its usefulness. R. Mühlethaler's consideration of the "Structure of chloroplasts" includes many of the more recent findings with respect to the ultrafine structure afforded by electron microscopy. M. Wolman surveys "Problems of fixation in cytology, histology, and histochemistry," presenting a treatment of general principles and problems in which the choice of a fixing agent to meet individual requirements is stressed, although specific formulas are not provided.

A review by W. S. Vincent of the "Structure and chemistry of nucleoli" includes results that he obtained in the study of nucleoli isolated from starfish oocytes; this article emphasizes the uncertain state of current knowledge despite the considerable progress that has been made in recent years toward an understanding of nucleolar structure and function. Localization of "Cholinesterases at neuromuscular junctions" is discussed by R. Couteaux and illustrated with photographs and diagrams. E. J. Conway contributes the second part of a discussion that was initiated in volume II of this series entitled "Evidence for a redox pump in the active transport of cations." The introductory chapter by M. J. Kopac on "Cytochemical micrurgy" lists some of the technical developments that facilitate quantitative study of small parts of cells.

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Yearbook of Anthropology, 1955. vol. I. William L. Thomas, Jr., Ed. Wenner-Gren Foundation for Anthropological Research, New York, 1955. xv + 836 pp.

The increasing importance of anthropology and the growing volume of its literature were appropriately marked in 1953 by the publication of an encyclopedic appraisal, *Anthropolgy Today* (edited by A. L. Kroeber *et al.*). The present *Yearbook of Anthropology,* benefiting from the experience of its predecessor, inaugurates a new series of annual publications and marks anthropology's full coming of age.

Although it focuses on the significant achievements and trends in the field of anthropology during 1952–54, the first volume of the *Yearbook* is truly a synthesis of heroic proportions. Excluding the editor and his staff, more than 40 contributors are involved; these include, to mention only a few, Birket-Smith, Eiseley, Firth, Haury, Koppers, Kroeber, Schultz, and Tax.

This book is divided into six sections. Part one is devoted to a "Guest editorial" by Julian Huxley on evolution.