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