Book Reviews

Niels Bohr in Science and in Politics

Niels Bohr. The Man, His Science, and the World They Changed. RUTH MOORE. Knopf, New York, 1966. 459 pp., illus. $6.95.

Niels Bohr must be a fascinating subject to a biographer. He was born and trained in a small country with no impressive current tradition in physical science, and he became the main figure in the greatest intellectual adventure of our time, the development of atomic physics. He built an institute that became a mecca for physicists. He created a view of life based on what he called complementarity, a concept suggested to him by quantum mechanics. He was a chief contributor to the study of atomic nuclei that threw physics into the arena of politics. When he was a member of the Manhattan Project during the war his greatest effort was to try to change statesmen's way of thinking so that they would avoid those traps of the nuclear age with which we are now all too familiar, the arms race and the cold war.

However, the wide scope of Bohr's activities makes severe problems for a biographer. To give a balanced account of all aspects of his work, a biographer must be able to discuss Bohr's contributions to quantum theory, explain the meaning of his philosophical ideas, and describe his political views. To give an impression of his intricate personality is even more demanding.

Ruth Moore's is the first comprehensive biography of Niels Bohr. Addressed to a wide circle of readers, it is well written, factual, and informative and is an enthusiastic and exciting piece of reporting.

In spite of the considerable success with which Moore has accomplished her task, however, the difficulties of her undertaking show up. In her description of Bohr's work on quantum theory she has not resolved the dilemma of a historical versus a popular account but has attempted a mixture which does not really give an impression of the nature of the quantum problems and of the *Kopenhagener Geist der Quantentheorie*. Nor does she discuss adequately Bohr's philosophical ideas. Her description of Bohr's personality is sketchy and sometimes stereotyped. In her sympathetic account of what happened, the events often seem closer than the person. She reveals little of what it was, apart from his scientific genius, that made Bohr a unique individual.

These and other shortcomings are greatly offset by Moore's brilliant description, more than 150 pages, of the period between 1938 and 1945. This is first-rate scientific and political reporting. She details the dramatic events following Hahn and Strassmann's discovery of the fission of uranium nuclei. She describes how Bohr escaped from Nazi-occupied Denmark in September 1943, how he tried to make the Swedish government take steps to dissuade the Nazis from arresting the Jews in Denmark, how he was flown to England in the bomb bay of a Mosquito plane, how he was appointed a "Consultant to the British Directorate of Tube Alloys" (the code name for the British atomic bomb program).

When Bohr was shown the bomb project, he immediately began to think about the long-term political effects of the bomb and the political changes it would necessitate. In the next 19 years this problem occupied him as intensely as the quantum problem had occupied him 30 years earlier. In England, and then in the United States, Bohr's prestige as a physicist opened political channels to national leaders. His view was that the new weapon made the old relations between nations impossible but that it also gave the opportunity to change these relations. He found Roosevelt sympathetic to his ideas. Churchill refused to see the situation in a long-term perspective.

Moore's account of Bohr's political crusade is thorough and impressive. Many of Bohr's hopes may seem naive now, but his voice during the war was a voice of wisdom and sanity in a very dark time.

AAGE PETERSEN
Belfer Graduate School of Science, Yeshiva University, New York City

A Comprehensive Text

Biological Chemistry. HENRY R. MAHLER and EUGENE H. CORDES. Harper and Row, New York, 1966. 890 pp., illus. $16.50.

This is a distinguished addition to the small group of important texts covering its field. Its major themes are, in brief, the structure, function, and biosynthesis of proteins and nucleic acids and the thermodynamics, kinetics, and mechanisms of biochemical processes. These themes are developed broadly, and worked out in searching detail. After a short introduction, three chapters (180 pages) deal with the structure and physical properties of proteins and nucleic acids, at such a level as to prepare the student for reading most of the current research papers on these macromolecules. Three substantial chapters on thermodynamics, enzyme kinetics, and enzyme mechanisms follow. There is then a long discussion of coenzymes, and an important chapter on the structure of cells and the fractionation of cell components, with a thoughtful discussion of the pitfalls that await the investigator in the borderland between biochemistry and cellular fine structure. Three of the longest chapters in the book deal with carbohydrate metabolism, with biological oxidations, and with amino acid metabolism; shorter but very substantial chapters deal with photosynthesis, lipid metabolism, and the citric acid cycle. The two last chapters are on nucleic acid metabolism and the biosynthesis of proteins; the latter runs to nearly 80 pages and includes a quite detailed presentation of biochemical genetics and the genetic code.

Within the broad area covered, the achievement is most impressive. I know of no general text that deals so thoroughly with the free energy changes of biochemical processes, and certainly of none that gives so searching an account of the mechanisms of metabolic processes. The chapter on enzyme kinetics deals with the subject in far more depth than most similar books attempt. It is a splendid discussion for one who already knows something of the subject, but the student encountering it for the first time may find it too abstract and mathematical; to assimilate it properly, he should read it in conjunction with some of the later chapters, where he can apply the general principles of kinetics to specific enzyme systems. Here, and in some later chapters, there is considerable

discussion of allosteric systems, including the Monod-Wyman-Changeux model. This and other aspects of regulatory control receive due emphasis at many points throughout the book.

The discussion is critical and detailed. In the chapter on photosynthesis, for instance, after describing the Calvin-Bassham cycle for CO_2 assimilation, the authors point out in some detail the various remaining discrepancies between the postulated cycle and the experimental findings. The discussion of the tricarboxylic acid cycle presents, among other features, the most thorough discussion I have seen in any book of the stereochemistry and mechanisms of the reactions involved. These examples are typical. The detailed and critical character of the presentation will make the book slow reading for the beginner, but those who master the material presented will be brought close to the frontiers of current research. To lead them further, each chapter includes an extensive list of references, both to reviews and to original papers.

The book contains no chapters dealing specifically with the biochemistry of blood, muscle, kidney, or other mammalian tissues, and the references to hormone action are extremely brief. Hemoglobin structure is discussed in chapter 3; and the reactions of hemoglobin with ligands are treated briefly, together with those of other heme proteins, in the chapter on biological oxidations; but the Bohr effect, which is one beautiful example of a biological regulatory mechanism, is not discussed at all, although it is implicit in Fig. 14–6.

There are, I think, some weaknesses in the organization of the book. The chapter on coenzymes overlaps with several of the later chapters, and the student must refer back and forth repeatedly between chapters to get a full understanding of many important biochemical processes. The complicated acid-base equilibria and ion binding of proteins are thoughtfully treated on pages 50 to 57, but the corresponding relations for the simplest acids and bases are not encountered until page 189. One could cite other such examples. On the whole, however, such problems are minor by comparison with the outstanding virtues of the book.

This book is not likely to be used as a text in medical school biochemistry courses, in part at least because, as indicated above, it omits several topics of importance to medical students, and indeed to others. However, medical students who are deeply interested in biochemistry should certainly find it valuable. For graduate students, and for undergraduates with adequate preparation, I would rate it very high. It has not only the transitory advantage of being the most up-to-date textbook but the more enduring values of solidity, reliability, and depth of insight into the central problems of biochemistry today. Many investigators, long past their graduate student days, will also find it profitable reading.

JOHN T. EDSALL
Biological Laboratories, Harvard University, Cambridge, Massachusetts

Keeping Book on Social Realities

Social Indicators. RAYMOND A. BAUER, Ed. M.I.T. Press, Cambridge, 1966. 379 pp., illus. $10.

This is the second volume in the series on Technology, Space, and Society prepared by the American Academy of Arts and Sciences. (The first, *The Railroad and the Space Program*, edited by Bruce Mazlish, was reviewed in *Science*, 25 Feb. 1966, p. 979.) It consists of two sizable monographs, one, on "Social indicators and goals," by Albert D. Biderman, and the other, entitled "The state of the nation: Social systems accounting," by Bertram M. Gross. In addition there is a long introduction by the editor which largely recapitulates the rest of the book, and there are two shorter essays, one by Biderman, entitled "Anticipatory studies and standby research capabilities," and one by Robert A. Rosenthal and Robert S. Weiss, "Problems of organizational feedback processes."

As in the case of the first volume of the series, the space program has provided an excuse for doing something which should have been done anyway. The references to NASA are slightly reminiscent of the libations to Marxism-Leninism that one finds in otherwise very sensible Russian works. The essential problem of the book is that of the epistemology of social systems, that is, how do we collect and organize information about very complex systems, especially with the aid of statistical and numerical techniques, which will give us a clearer picture of what the system is like and what is going on. The Biderman monograph is a substantial piece of work. It does not pretend to be comprehensive, but it shows how social indicators, that is, quantitative indices of social realities collected by careful sampling and published as continuous series, can be used and misused as what he calls vindicators and indictors. His discussion of the pitfalls of social indicators, as illustrated by crime statistics and their misuse, is brilliant and deserves to be widely read. One hopes he will write articles about this for the popular press.

The Gross essay is more speculative and abstract. Bauer's introduction suggests that while Biderman describes where we are, Gross indicates where we want to go. The essay is a rather ambitious summary of Gross's own system of analysis of the components and relationships of a total social system. One cannot in a brief review examine the merits of the Gross system. One can, however, criticize the essay, as in effect Biderman himself does, on the grounds that the system does not tie in very closely with the epistemological problem which is the core of the book.

The second Biderman essay is an eloquent plea for stand-by facilities and for a well-organized research apparatus which is equipped both to anticipate future events of interest and to take immediate advantage of research opportunities provided by unusual current events. This is reminiscent of what some of us have been advocating as "hot-spot research." It is when a system is exhibiting unusual variations that knowledge about it is most easily acquired. In the social sciences we take very little advantage of this principle, and the Biderman proposals are worthy of strong support.

The essay by Rosenthal and Weiss is an interesting though rather elementary piece on the epistemological problems of organizations, marred, however, by a very careless use of the word "feedback" and by what impresses this reviewer, at any rate, as a certain deficiency in epistemological theory. The whole work, indeed, is a kind of social indicator itself of the deficiencies not only of our information system and of the social sciences, but also of our epistemological theory. Perhaps the next venture in this program should be some excursions in the sociology of knowledge.

The style of the book is somewhat diffuse and verbose, and it would have