

## SCIENCE AND LEARNING IN THE FOURTEENTH CENTURY

### Introduction to the History of Science

Vol. 3: Science and Learning in the Fourteenth Century. By Prof. George Sarton. (Carnegie Institution of Washington, Publication 376.) Part 1. Pp. xxxiii+1018. Part 2. Pp. xiv+1019-2155. (Baltimore, Md.: Williams and Wilkins Co.; London: Baillière, Tindall and Cox, 1948.) £5 10s. 0d. net.

ALL will learn with regret that Prof. George Sarton regards this as the last volume he will be able to complete of his "Introduction to the History of Science", which was originally planned to reach the year 1900. But at least we can be thankful that he has been able to complete that part of the plan which covers the period—the twelfth to the fourteenth centuries—to which the greater part of his own researches have been devoted. The author estimates that, omitting unconscious or casual preparation, some twenty-seven years of work are represented in this last volume. It is no surprise, therefore, to discover the great wealth of information that has been collected in its 2,000-odd pages. What is more important, the information has been sifted, criticized and presented with great erudition and a wonderful breadth of scholarship.

The two halves of the fourteenth century receive one part apiece. The book is to be used as a reference work. Only two introductory chapters, one for each half-century, surveying more briefly and connectedly the material which is to follow, are intended for consecutive reading; and to me even these savoured more of the reference work than of the account intended to be 'readable'.

The greatest virtue of this work is certainly the breadth of its outlook. Virtually all peoples, all languages and all religions which have any relevance to the history of knowledge in the period receive attention—and, of course, every branch of science, as well as historiography, law, sociology and philology, which are not usually included in science in the English-speaking world. One finds seven pages on the life and labours of William of Occam, two pages on the mosaics of St. Saviour in Chora, five on treatises on military technology, two on Japanese medicine, a description of the Chinese census of 1370 together with a reproduction of the official instructions therefor, a paragraph on Buddhist atomism—these random selections obtained by flicking the pages must serve to indicate something of the variety of topics covered.

The book is brought up to date as at May 1947 by means of 41 pages of addenda; and in addition Prof. Sarton provides, through the columns of *Isis*, a continuous service of further addenda and errata. There is a bibliography of 40 pages, as well as numerous other bibliographical references in the text or in footnotes. There are three indexes: a general index (subject and author) of 174 pages, 8 pages of Greek index and 53 pages of Chinese index. That would seem to be more than adequate, and yet it was precisely in the index that the book seemed to me to be most deficient as a reference work. Under 'humanism' only three pages are indexed; they lead to one bibliographical item and two minor paragraphs; yet the work abounds in references to humanism which go unindexed, among them 14 pages (502-16) on Petrarca and five sections amounting to nearly 10 pages (1288-97) on humanism in various

European countries. Four pages (217-21) on mining and metallurgy are not indexed under either heading. I noticed many other similar omissions. There are some peculiarities, too, in the arrangement of the text—the reader must be aware that topics are not always treated where they might be expected; he will miss a lot unless he is prepared to follow up every possible cross-reference.

Not even Prof. Sarton can do everything, and for the potential reader it is perhaps as important to know what the book does not cover as what it does. Prof. Sarton's definition of science as "systematized, positive knowledge" allows him to include historiography, law, sociology and philology among the sciences. But it also implies restrictions. The emphasis throughout the book is on knowledge rather than the obtaining of knowledge (that is, method). The author is usually more interested in what a man knew, thought, believed or wrote than on how he reached his conclusions. He says (p. 17) that "Special pains have been taken to explain the emergence of the experimental point of view". I have no doubt that the material for doing so is contained in the book; but the arrangement does not permit of easy access to it. There is almost no discussion of method (experimental or other) as such; and the index gives little help—one reference each for "experimental method" and "experimental point of view" (many important references to these are not indexed), four to "causality, principle of" (all on philosophical rather than scientific approaches to the question) and none to such headings as "teleology", "observation" and the like, which would be very useful to the student interested mainly in methodology.

The definition of science as "knowledge" rather than "knowledge-and-power" (the Baconian view) also tends to restrict the scope of the book. Technology, though not neglected, is rather sketchily and disconnectedly treated, and (with a few exceptions such as some parts of chemistry) the treatment is but little integrated with the discussions of fundamental science. It is perhaps the same limitation that leads to the very full treatment of the religious, philosophical and cultural background and, in contrast, the almost complete omission of the social, economic and political background. Prof. Sarton agrees (p. 37) that "Political and economic factors are obviously important; we might even say that they are fundamental". But he leaves them to the reader to deal with, giving only 19 pages of "General Background", which treat general history (mostly political) in a rather superficial way, and some incidental references to particular social influences on particular scientific events but without any attempt at a general integration of scientific and social history. Indeed, it is in political and social matters only that I would dare to make criticisms of commission rather than omission. Few historians would agree that "waves of socialism were spreading over Western Europe in the fourteenth century" (p. 13); and to say that medieval thought overcame national boundaries (p. 78) is to give an entirely wrong emphasis, for at that time national boundaries had scarcely begun to exist.

All these points, however, are not so much criticisms as definitions of the limitations of this work. Limitations are not a disadvantage provided the reader is aware of them, and so does not seek in the book things which it does not pretend to contain. On those conditions he will find little to complain of in Prof. Sarton's crowning achievement. S. LILLEY