"Greek fire" by means of rockets is more than doubtful (p. 280). On the same page one can find the customary misstatement that Sir William Congreve personally saw Indian war rockets in action. He did not, since he never left England, and the British did not use the Congreve war rockets "for attacking enemy fleets" but used them from their ships against shore targets. Nor did Napoleon use rocket batteries at Leipzig; they were used against him by the British Rocket Corps. Likewise the dates for the use of Russian war rockets during the nineteenth century and the dates for the publications of the Russian physics teacher Konstantin E. Ziolkovsky are wrong.

Why Peenemünde is consistently spelled with only one "e" (as "Penemünde") is mysterious, if unimportant. What is more surprising is a misleading statement on p. 397. After telling that a V–2 rocket reached an altitude of 162 kilometers in a vertical shot because of malfunctioning of the mechanism which was supposed to tilt it out of the vertical take-off path, the author calculates that a V–2 rocket, if powered by hydrogen and oxygen instead of the alcohol and oxygen actually used, would attain an altitude of about 260 kilometers on a vertical path. But the calculation shows clearly that it is based solely on a comparison of the heat of combustion. Actually the hydrogen-oxygen combustion would carry the rocket to a lesser height than the 162 kilometers actually reached, because of the low density of liquid hydrogen.

But these are minor flaws which can be ironed out in later editions. They do not change the fact that "Ballistics of the Future" is the most important technical work on the subject that has been published since Oberth's "Wege zur Raumschiffahrt" in 1929.

Willy Ley

History of Science

SCIENCE, SERVANT OF MAN. By I. Bernard Cohen. 362 pp. Little, Brown and Company, Boston, 1948. $4.00.

Dr. Cohen, a Ph.D. in the "history of science and learning" and an instructor in Harvard's new course in the physical sciences for nonscientific undergraduates, shows a fine combination of scholarship and simplification in this book designed for use as "a layman's primer for the age of science." It will certainly serve its purpose for the layman who has a fairly serious interest in science; it will also interest many a scientist, especially as a refresher or introduction to fields other than his own.

The author doesn't allow himself to get tangled in the cobwebs of ancient apocrypha. He starts right out with the most current technical developments, from television to nylon (omitting the much-told tale of nuclear energy), and soberly tells the well-documented story of how these things came to pass.

Departing from the chronological method that one expects from a historian, Cohen sets forth several major premises about the nature of scientific research, and then cites his historical material in the form of examples to prove, or at least to illustrate, the respective points. To give an example of these examples, Cohen makes the not-so-startling assertion that a practical development may be the wholly unexpected result of fundamental research: for instance, radio's emerging from the basic science of Faraday, Maxwell, and Hertz, and nylon's being extruded from Carothers' ambitious survey of the superpolymers.

Another premise is that a discovery doesn't get used until the "total scientific situation" is ready for it. For instance, Fleming's original discovery of penicillin was ahead of the times; not until the scientific world became alerted, from other sources, to the importance of antibiotics was Fleming's culture taken off the shelf and put to work.

Only a small proportion of the narratives have to do with physics, and only a limited area of physics is covered: there is a chapter on electric current and radio, and another on the solar corona and radio communication. Chemistry and agriculture receive at least equal recognition, and the physicist may learn a good deal from the clear, precise summaries of major discoveries in these fields. The chapter on hybrid corn will be especially interesting to readers outside the corn belt who may have heard of no other name in connection with its development than that of Henry Wallace. Where the author deals with organic chemistry, he doesn't hesitate to introduce and explain the structural formulas. Aside from that, however, the choice of graphic illustration appears somewhat random, and the book would have benefited from a more liberal use of diagrams and photographs.

Cohen's principal moral seems to be the truism that fundamental, exploratory research cannot be fully planned and programed in advance, and he repeatedly quotes the head of his university, Dr. Conant, to that effect. The numerous true stories related in this book certainly support that point. But more than that, they are interesting and informative in themselves.

Harry M. Davis
Newsweek

THE LIFE OF SCIENCE: ESSAYS IN THE HISTORY OF CIVILIZATION. By George Sarton. 197 pp. Henry Schuman, Inc., New York City, 1948. $3.50.

There is, in Dr. Sarton's opinion, a great need for study of the history of science, in particular the history of the ancient philosophers and their work, and he offers many examples—short outlines of the lives and works of scientists—to establish his point. "The outstanding difference between art and science," says Dr. Sarton, "is that the latter is progressive while the former is not. . . . The history of science should be divided, not according to countries, but according to time and that of each period considered as a whole."

This book is made up of a number of papers written at different times and on various topics which are, as a result, not too well connected. One section enters a plea for an institute to study, not science, but methods to humanize the scientist, and Sarton believes that about five per cent of our scientific budget should go toward support of such an institute. Another section is devoted to showing the West's dependence upon the East in advancing the position of science. In the main, Sarton feels,