the widespread malnutrition which was known to exist. Again, in a different field, there were undoubtedly unnecessary delays in the practical utilization of new inventions. Pre-war official investigations of the history of a number of the most important American inventions showed that from thirty-three to fifty years usually elapsed from the time of the first working model to the time when the invention had come into general use. There is little reason to doubt that the experience of Britain has been similar. It is understandable therefore that many scientists and technicians before the war increasingly came to feel that they should be "on top" rather than "on tap," since the "tap" was only too often not fully turned on.

Britain at war can not afford to dispense with science. It is at last safe to say that science has been granted a great measure of the recognition and facilities it requires. Great improvements in productive techniques, in the quality of war materials, advances in the design of aircraft, tanks and shipping, the development of radio-technology and many other devices, all testify to this. Thanks to the U-boat and to Lord Woolton and his scientific advisers, the public has taken tremendous steps forward in its nutritional knowledge. It is possible to believe that there is less malnutrition in Britain to-day than before the war. These are only some of the respects in which war-time necessity has compelled a better utilization of scientific and technical capacity. As a letter published on this page this morning points out, the neglect of the scientist and technician which was tolerated before the war will be as intolerable in the future as it would be now. The nation needs more science, in peace as in war, and must be prepared to pay for it. While science can not offer a utopian "age of plenty," Sir Robert Pickard, Professor Findlay and Sir Lawrence Bragg rightly insist that, in order to maintain and improve Britain's future standards of health and well-being, "scientific and technological research will be required on a scale not yet envisaged." If this fact is squarely faced and acted upon, and provided that experts are freely and fully consulted, few will disagree with our correspondents' judgment that a democratic community can not allow to the scientist, as scientist, a "position of exceptional authority in deciding the policies of governments." It is when the expert is ignored or frustrated that he becomes a "technocrat."—*The Times,* London.

SCIENTIFIC BOOKS

THE WORLD OF THE PHYSICIST

From Copernicus to Einstein. By HANS REICHENBACH. Translated by RALPH B. WINN. 123 pp. New York: Philosophical Library. 1942.

A PHYSICIST would infer from the title of this book that it would give a survey of all the great discoveries, all the great contributions leading us to our present knowledge of the physical universe. For in the time of Copernicus the world of the physicist was without form and void and darkness covered the deep mysteries of nature. During these 400 years light has entered. How the universe has grown as light supplied by a host of workers has at length allowed us to see vast bodies at distances "farther than ever comet flared or vagrant stardust swirled" or to penetrate into the inner recesses of particles in which masses and distances are measured in micro, micro, micro units. But the 123 pages of this book would hardly be adequate for the unfolding of the story. Its purpose is "to serve as an introduction to the great problems of space, time and motion. More definitely, it is concerned with the development (and glorification) of the theory of relativity. Its methods are very simple. No mathematical formulae or operations, no computations of any kind are introduced. It starts with the revolutionary view introduced by Copernicus—the earth does not stand still. The conservatives fought against his view. It belied the testimony of our senses. "So too do the revolutionary views introduced by Einstein."

From the consideration of motion and gravitation the book proceeds to the problems of light. What is light? Is there an ether? What did the Michelson and Morley experiment prove? According to the author it proved that there is no ether. And Einstein seized this result, "one of the greatest experimental precision." Thus "Einstein's theory of relativity, the most magnificent achievement of modern physics, was suggested by the closest adhesion to experimental facts" (p. 51). Unfortunately, however, it would appear that the author has never seen the interference fringes in a good interferometer and he has an extremely hazy view of the phenomenon of interference, for in explaining the Michelson and Morley experiment he states that "the belated arrival" of one of the beams "could be proved by the appearance of shadow bands." "Yet the surprising result was that no shadow bands appeared at all: there was no retardation of the ray" (p. 55). Shades of Michelson, Morley, D. C. Miller! The fact of course is that the interference fringes (shadow bands) were marvelously clear. What was looked for was a side shift of the fringes as the instrument was rotated so that the East-West arm became the N-S and *vice versa.* In the Michelson and Morley experiment no appreciable shift was seen, in the Miller case a partial shift (cause unknown) was detected.

The decrease in frequency, the increase in wavelength, of a spectral line sent out from an atom in a very strong gravitational field as compared with the radiation in a weak field is set forth, but again the author's knowledge of physics is greatly at fault. According to him "the number of vibrations of the light emitted by a *circulating electron* is a measure of the number of revolutions of the electron about the nucleus." That point of view, briefly held, was exploded thirty years ago. The author believes that the confirmation of this result of the relativity theory —the red shift of spectral lines due to strong gravitational fields—depends on the completion of the "Einstein tower" in Potsdam, "a structure combining to perfection every astronomical and physical contrivance," designed by E. Freundlich (who according to the translator was forced to leave Germany in 1933), who was to measure with high accuracy the dark lines of the solar spectrum. But the shift for radiations coming from dense stars has been found. It is several times greater than the computed solar shift and is in accord with the theory.

The book is intended to acquaint philosophers with some of the new aspects of matter and motion. But the author does not feel that it is necessary, perhaps not even advisable, to point out that some of these new properties, such as the increase of mass on account of motion, have an experimental basis entirely apart from the theory of relativity. It may be that the author desires to avoid, for himself and his probable readers, the difficulties involved in the elucidation of these experiments.

GORDON FERRIE HULL

RADIOLOGY IN INDUSTRY

Industrial Radiology. By ANCEL ST. JOHN and HERBERT R. ISENBURGER. Second edition. New York: John Wiley and Sons, Inc. 1942.

THE first edition of this book, entitled "Industrial Radiography," was published in 1934. The chief subjects of the first edition and of the present revised edition are the examinations by means of x-rays and gamma-rays of castings, forgings, welded joints, packaged materials, assemblies such as vacuum tubes and other industrial products. The authors are pioneers in this field of investigation. During the last five years, the use of the methods which they discuss has increased tremendously. Thus, they have an admirable background for describing the radiographic and fluoroscopic methods which are used for examining a great variety of the products of industry.

The new second edition contains in slightly revised form the material of the first edition. The discussions of gamma-ray radiography and fluoroscopy have been expanded in the new book.

The most important new material in the second edition is the expansion of the list of references in the field of industrial radiography. In the first edition, the bibliography at the end of the book lists 426 books and articles in technical journals. In the new edition, there are 1,314 items listed in the bibliography; some of these are as recent as October, 1942. The index is very usefully arranged. After each item of the index, page numbers appear, as in the conventional index; in addition, there are numbers in italics and these refer to the numbered references in the bibliography. Thus, if the book is used as a reference work, an item in the index will refer the reader not only to the material in the book on this particular subject, but also to the work of one or more writers who have presented their work in the technical literature.

No material is included in this book on the use of x-ray spectroscopy in industry. One might be led to believe that such material would form a part of "industrial radiology." Apparently, the use of x-ray spectroscopy in industry and the use of x-rays and gamma-rays for making fluoroscopic or radiographic examinations are two distinct fields; the authors of this book confine their attention to radiography and fluoroscopy, except for a brief note on the diffraction of x-rays in Chapter IV.

S. REID WARREN, JR.
MOORE SCHOOL OF ELECTRICAL ENGINEERING,
UNIVERSITY OF PENNSYLVANIA

ENZYMES

Chemistry and Methods of Enzymes. By JAMES B. SUMNER and G. FRED SOMERS. 365 pp. New York: Academic Press, Inc. 1943.

AN author of a book on enzymes, unless he writes an all-inclusive one such as Oppenheimer's Handbuch, faces the same problem as an anthologist. His choice and emphasis will follow his personal predilection or some definite plan. The authors of this book on enzymes appear to have followed the former method.

The enzymes are classified in the usual way into esterases, proteases, oxidases, etc. With the exception of urease, which is discussed as a possible important factor in the nitrogen cycle, no attempt is made to assess the functions of the enzymes in the cell. Perhaps as a consequence of this, the amount of space allotted to an enzyme is not commensurate with its known importance. For instance, under the esterases the cholinesterase is discussed in one and a half pages and no description of the methods of isolation is given, whereas chlorophyllase, the function of which is still unknown, is allotted more than two pages which include a detailed description of its preparation. Under the proteases, the methods for the crystallization of