

nerves. The anatomy of the heart and its valves is well described. Nerves can be either sensory or motor and may even be distinguished structurally—a histological truth which could not have been known to Galen. He is interested in the occurrence of an os cordis, and claims to possess a very large specimen of it extracted from the heart of an elephant, where, however, the bone does not normally occur.

Galen must rank as an important experimental physiologist. The statement rife at the time that the arteries do not contain blood he dismisses as "impudent nonsense" worthy of the "comic writers". He then proceeds to demonstrate the falsity of it by observation. His experiments on the physiology of the respiratory movements and on the function of the spinal cord are truly remarkable. On the debit side, however, we have two disastrous errors to record. He believed in the existence of perforations in the ventricular septum of the heart, through which blood could pass direct from the right ventricle into the left, and he assumed that the veins originated in the liver, from which it follows that the flow of the blood in them must be peripheral.

The notes appended to Prof. Singer's volume are the result of unwearied critical research not only in determining the modern equivalents of the muscles, nerves and blood vessels which Galen describes in remarkable detail, but particularly in clarifying and stabilizing the text. Such work is indispensable and beyond praise. Only those of us who have stumbled through Galen's anatomy, dictionary in hand and confusion in mind, can realize how much Prof. Singer has done to lighten the labours of our more fortunate successors.

There is a good index but no bibliography.

F. J. COLE

## AN INTRODUCTION TO ASTRONOMY

Introduction to Astronomy

By Dr. Cecilia Payne-Gaposchkin. Pp. x+508. (London: Eyre and Spottiswoode (Publishers), Ltd., 1956.) 50s. net.

**I**N the United States much more instruction is given in astronomy than in Great Britain. There it is included in general science courses, and many arts students take short courses of one or two terms in astronomy. Astronomy, which is the oldest of the sciences, is well adapted for teaching as a cultural subject; the history of the development of concepts in astronomy from the early ages to the present time forms a fascinating subject, while the modern investigations into the nature and structure of the universe and the attempts to learn about its beginnings, its evolution and its future have an inherent appeal to the human mind.

Though this introduction to astronomy has been written primarily as an introductory text for American students, it is well adapted for the general reader. The cultural aspect of astronomy has been kept in the forefront of the author's mind and the associations of astronomy with the fields of language, literature and history have been emphasized; little background either in mathematics or physics is required of the reader.

About half the book is devoted to the solar system and half to the stars and stellar systems. The author of a text-book always has to face the problem

of the extent to which current ideas, which are still in a state of flux, are to be dealt with. This book gives a well-balanced account of modern views, and the author has pointed out that some of them may require modification or may prove to be quite incorrect. The chapter on variable stars, in which field the author herself has done much work, is perhaps too detailed for an introduction to the subject.

A few errors have been noticed. The statement about Augustus Caesar having taken one day from February to add to August is not correct and should be omitted in any future edition. The number of days in each month have remained as they were fixed by Julius Caesar. Halley spelt his Christian name Edmond, not Edmund as given on p. 145. Greenwich Civil Time, a term used in the United States, is not an acceptable alternative to Greenwich Mean Time; in the summer months in the United Kingdom the (Greenwich) civil time differs by an hour from Greenwich mean time. Some of the statements about Venus on p. 185 require modification. Venus does not reflect sunlight without changing its colour; Venus is yellower than the Sun. Its light is not white; it is yellower than the light reflected by the Earth. The statement on p. 208 that the spectrum of Jupiter shows some striking features that are common to a greater or less extent to all the major planets, followed by the statement that the dark bands have been identified as molecular spectra of methane and ammonia, is rather misleading, inasmuch as the spectra of Uranus and Neptune contain no bands due to ammonia.

The book is particularly well illustrated with photographs, and there are many text-figures. The series of planetary photographs, taken at the Lowell Observatory, is most valuable; many of the photographs of stars and galaxies were taken with the 200-in. telescope.

H. SPENCER JONES

## PHYSIOLOGY OF THE MINERAL MINUTIÆ

Trace Elements in Human and Animal Nutrition

By E. J. Underwood. Pp. xi+429. (New York: Academic Press, Inc.; London: Academic Books, Ltd., 1956.) 9.50 dollars.

**I**T is appropriate that the first book on the nutritional aspects of the trace elements should have been written by an Australian, for some of the most important work on the subject has been done in that country. This is partly the result of the 'challenge', in the sense used by Toynbee in his "Study of History", provided by the diseases of stock on certain Australian pastures, and the response of the scientific workers can only be described as having been an outstandingly successful one. This is not for a moment to suggest that Australia has had a monopoly in trace-element research. Little of the work on iodine, fluorine, molybdenum or manganese has been done there, and the pioneers like Chatin, Raulin, Bertrand, Hart and Ramage were not Australians (a number of them were French); but the work of Bennetts, Underwood and Marston on copper and cobalt has had such enormous economic repercussions that it is impossible not to be impressed by its importance.

In writing this book the author has considered iron, copper, cobalt, molybdenum, nickel, zinc,