

BOOK REVIEWS

Modern Astronomy

Astronomy: Fundamentals and Frontiers. By Robert Jastrow and Malcom H. Thompson. Pp. xiv+404. (Wiley: New York and London, 1972.) £7.35.

THE authors' aim in writing this book was to provide the liberal arts student with a one-year course dealing with the central problems of twentieth century astronomy. It is hard to imagine how they could have performed their task more admirably. The sequence of the book is unusual. The stars, the galaxies and cosmology precede the sections on the solar system, the Earth and the evolution of life because the authors feel that an astro-physical background is required to discuss the evolution of the solar system. The professional astronomer is unlikely to advance his knowledge of the subject by reading this book but he will be given a brilliant lesson in exposition at an elementary level. Indeed I agree with the remark made by Bengt Stromgren in his foreword that the authors have made "a very significant contribution in the area of communication between scientist and the community".

An impressive feature of the writing is that the authors do not evade the difficulty of explaining the essential fundamental physics—for example of the nature of light or the production of spectra. The chapters on the evolution of the stars and the elements, in particular, are models of exposition at an elementary level. A typical example of the authors' style occurs when they pose the question of "How large must a cluster of atoms be before its own gravity is strong enough to hold it together permanently?" After some further exposition they quote the theoretical result as about 10^{57} atoms and then they continue in this manner: "This is a staggeringly large number. We have searched for a comparison that would make the meaning of the number 10^{57} clear, such as comparing 10^{57} with the numbers of grains of sand in all the beaches of the world; but even that seemingly uncountable number is only a mere 10^{25} . In fact, the number of neutrons and protons contained in the nuclei of all the atoms

of the entire Earth is only 10^{51} . The trouble is that no number on Earth can possibly match this number; it is a number that corresponds to the building blocks of objects the size of stars, not objects the size of planets." I can well imagine that the liberal arts student will be as stirred by such passages as I was to read in a later chapter an account of the most recent researches on the great plates into which the Earth's surface is divided. It will be hard to forget that the plate underlying the Pacific Ocean is scraping past a plate that includes most of the North American continent and that at the present rate of movement of 1.5 inches per year "Los Angeles will enter the suburbs of San Francisco in ten million years".

Only authors with a deep knowledge of the subject would be capable of writing this type of book. It is, therefore, the more surprising to find the occasional strange historical lapses. The discovery of the cosmological redshift is attributed to Slipher in 1926. Slipher discovered the redshifts from several nebulous objects in 1912; but they were believed to be galactic objects until Hubble in 1926 produced the observational evidence for their extragalactic nature. And surely neither Grote Reber's many admirers, nor Reber himself, would wish to claim that he discovered the radio galaxies in 1940. Although he observed enhanced radiation from the Cygnus region, astronomers had no idea of the significance of this for another 11 years. The sequence of observations which led to the discovery of the radio galaxy in Cygnus began in 1946 when J. S. Hey and his colleagues found that the intensity of the radio waves from Cygnus fluctuated. Their conclusion that the emission emanated from a source of small dimensions was confirmed by the interferometric measurements of J. G. Bolton and G. S. Stanley in 1947, but no further progress was made until the accurate positional measurement made by Graham Smith in 1950 enabled W. Baade and R. Minkowski to identify the object on plates taken with the 200 inch Palomar telescope in September 1951. It is a pity, too, that the authors give a poor and misleading account of the discovery

of the quasars. Although an account is given of Maarten Schmidt's identification of the spectral lines in 3C 273 in 1963, the sequence of British, American and Australian radio observations during the preceding years is a memorable event of 20th century astronomy and deserves appropriate treatment in a text of this nature.

The student will find his appreciation of the book enhanced by the excellent diagrams and many beautiful photographs of the sky. He will be stimulated to understand the text by the test questions which follow every chapter and he will no doubt be surprised to find that even in this most lavish of texts a number of omissions, errors and inconsistencies escaped the proof reader.

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Structure of Cells

Techniques of Biochemical and Biophysical Morphology. Edited by D. Glick and R. M. Rosenbaum. Pp. ix+280. (Wiley: New York and London, November 1972.) £6.25.

OF the writing of annual reviews there is no end. The editors of this new series state: "A pressing need has evolved for review volumes published at regular intervals, usually annually, to aid scientists in keeping up-to-date with developments in instrumentation, methodology and techniques of biochemical and biophysical morphology". Well, yes; we all make use of such volumes, quite often at the beginning of an investigation and frequently to check our sources of information at later stages. It is the definition of the subject matter that is the trouble. Quite a number of articles in this volume could with equal justification have appeared in another series, for example, the *International Review of Cytology*.

This volume contains eight articles on a wide range of subject matter. All contributions are supplemented by references to the literature and there are separate and useful author and subject indices. All these contributions seem to be competently written and to give good introductory guides to the present state of the subject. The first article on glycogen localization gives procedures