of Columbium (1958), edited by B. W. Gonser and E. M. Sherwood, *Columbium Metallurgy* (1961), edited by D. L. Douglass and F. W. Kunz, and a monograph entitled *Tantalum and Niobium* (1959), by G. L. Miller.

The book under review, *Columbium and Tantalum*, consists of 14 chapters written by different authors, all members or former members of the Union Carbide organization. It is a monograph in which all the available information on the subject has been systematically assembled rather than the proceedings of a symposium in which individual contributors report the results of their own research. Union Carbide's Metals Research Laboratory (Niagara Falls, N.Y.), has been one of the most active among the organizations responsible for the very rapid development of columbium and tantalum technology. This guarantees that all those who contributed chapters are recognized authorities in their fields.

The main emphasis is on the metallurgy of columbium and tantalum base alloys, including the pure metals. Consolidation by powder metallurgy and vacuum melting, mechanical working and joining of the metals and their alloys, their physical and mechanical properties, their corrosion and electrochemical behavior, their reaction with atmospheric gases, their alloying behavior, and their metallography are discussed in the principal chapters of the book. In addition, three introductory chapters treat the occurrence and preparation of ores, the extraction and separation of columbium and tantalum, and the methods of reducing their compounds into metals, and three final chapters give a cursory and necessarily incomplete discussion of the analytical chemistry, the applications, and the chemistry of the compounds of the metals.

In many chapters the authors have included data from unpublished work at the Metals Research Laboratory. By using these data, they have often succeeded in bringing order into the confused picture that has resulted from contradictory data in the literature. This must be considered one of the most valuable features of a book that will be an indispensable reference volume for all those actively engaged in work on columbium and tantalum metallurgy.

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Geological Processes

Physical Geochemistry. F. Gordon Smith. Addison-Wesley, Reading, Mass., 1963. x + 624 pp. Illus. $15.

Physical chemistry is being applied widely to geological problems, with major emphasis on physical geology, and, in most departments of geology, a course in physical chemistry is now required for an advanced degree in physical geology. Increasingly, this requirement is being met by courses given in geology departments. It is gratifying, therefore, that this book, the first textbook entitled *Physical Geochemistry*, originated in a department of geology. The author teaches in the department of geological sciences at the University of Toronto.

Smith clearly states in his preface that he intended the book to apply only to the geochemical problems of igneous petrology and (related) mineral deposits. Thus, it is unfortunate that he used a general title. Even for this restricted scope, his theoretical treatment (part 1) is inadequate. There is a chapter on the structure of matter, three on crystals, a short one on liquids, a very brief chapter (three pages) on gases and gaseous solutions, and a comprehensive discussion of heterogeneous equilibrium and phase diagrams. There is no systematic or adequate treatment of such topics as thermodynamic principles or laws, thermodynamic properties of naturally occurring materials, the properties of solutions, chemical kinetics, chemical statistics, and Eh-pH relations.

Part 2 is largely a presentation of systems (silicate-water-sulfide) and discussions of their application to problems of petrogenesis and ore formation, but four chapters in the section appear to be out of place. The one on geothermometry and geobarometry is not a compilation but a discussion of the theory of the methods used; this chapter might have been more appropriately placed in part 1. Chapters 15, 16, and 17 are largely concerned with the chemical composition of igneous rocks and ore deposits of the earth's crust. This is descriptive geochemistry and might well have been omitted.

At the beginning of chapter 10 there is a table in which are listed 28 of the "more important silicate phase diagrams of petrogenetic interest," complete with literature references. Diagrams for only nine of these are reproduced, but diagrams for ten systems not listed in the table are given, mostly without any credit line or reference in the text or in the legend. For the majority of these diagrams, and for those in chapter 12, it is impossible to tell whether they were taken directly from the literature, whether they have been modified, or, in a few cases, whether they are calculated or hypothetical diagrams.

If one wishes to teach a course that has just the scope of the one taught at the University of Toronto, he will find it very convenient to have available, in one volume, the pertinent data and references given here. But those who wish to include other material will prefer a more comprehensive treatment of the physical chemistry of geological processes, for with a more comprehensive textbook each instructor can choose the material he wishes to use.

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Astronomy

Stars and Galaxies. Birth, ageing, and death in the universe. Thornton Page, Ed. Prentice-Hall, Englewood Cliffs, N.J., 1962. xiii + 163 pp. Illus. Paper, $1.95; cloth, $3.95.

Innovation in astronomical concepts and techniques has doubled the number of articles published in each volume of the *Astrophysical Journal* since 1950. During these years, all of today's large radio telescopes have been constructed and the radio data have been integrated into the mainstream of astrophysical thought. We could only guess about the existence of cold interstellar hydrogen before its 21-centimeter radiation was detected in 1951; subsequent observations have given us a radically new picture of galactic structure and galactic motions. In this same period radio observations revealed that sources scattered all about the sky are radiating prodigiously by poorly understood nonthermal processes.

During these same years, astronomers who worked at optical wavelengths have raised photoelectric techniques to a new order of sophistication. Image intensifiers have borne their first fruits in observations of sources too faint tc be studied otherwise. The use of electronic computers has become routine in the reduction of large quantities of observational data and in the construction of

theoretical stellar models. The probable nuclear reactions that generate stellar energy have been elaborated, and theorists have turned to stellar interiors as the place of nucleosynthesis.

Bits of a new picture of the evolution of stars and galaxies are emerging from this harvest of techniques and theory. Of course, they are emerging stubbornly, for, as Armin Deutsch puts it in *Stars and Galaxies*, the evolutionary changes of a typical star during all of recorded human history corresponds to the ageing of a man in five minutes.

The purpose of *Stars and Galaxies* is to make the present state of astronomical research more widely known. The book had its origin in a symposium sponsored by the Frontiers of Science Foundation of Oklahoma, at Oklahoma City, in 1961. The Committee on Education in Astronomy of the American Astronomical Society chose the speakers and their topics, and each of the seven contributors is an astronomer who has helped to bring astronomy to its present state. The symposium was held for selected high school students and science teachers; consequently this expanded account uses a wealth of analogies, diagrams, and lucid description in getting at the fundamental problems that occupy astronomers today.

The result is very likely the best description, of its kind, of the present moment in astronomy. The book will serve as excellent collateral reading for an introductory course in astronomy. Or, for that matter, it will provide excellent reading material for anyone who would like to know about the direction that astronomy has taken in the past dozen years.

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Crystal Structure

Structure Reports for 1953. vol. 17. W. B. Pearson, General Editor. Section Editors: W. B. Pearson (metals), J. Wyart (inorganic compounds), and J. Monteath Robertson (organic compounds). Published for the International Union of Crystallography by Oosthoek's, Utrecht, 1963. viii + 863 pp. Illus. $33.50.

This valuable series of annual reports on crystal structures, begun about 15 years ago by the International Union of Crystallography (IUCr), as a continuation of the former *Strukturbericht*, is still about 10 years late in appearing. The present volume, which covers 1953, appears about 15 months after volume 18 which covered the work for 1954; thus, for the moment it seems that the lag in publication is becoming worse. The IUCr Commission on Structure Reports has stated that it "has been greatly concerned with the problem of reducing the time-lag in the production of *Structure Reports*, and also in the question of the extent of the subject matter which is to be reported."

In volume 17 the section on metals occupies 305 pages, inorganic compounds 292, and organic compounds 206. The scope is very broad. Not only are there reports on atomic arrangements, mostly based on x-ray diffraction (with some based on electron or neutron diffraction, Raman spectra, infrared absorption, and other techniques), but in the sections on metals and on inorganic compounds there is much material not concerned with crystal structure in a strict sense. This includes phase diagrams, properties of mix-crystal systems, and various other matters that are more or less remote from the main subject of the series. Limitation of scope and perhaps a more modest format seem to be indicated to reduce both the lag in publication and the very high price of these volumes.

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New Books

Biological and Medical Sciences

Annual Review of Medicine. vol. 14. Arthur C. DeGraff and William P. Creger, Eds. Annual Reviews, Palo Alto, Calif., 1963. 476 pp. Illus. $8.50.

Biochemical Clinics. An integrated series of international symposia. No. 1, *The Heart*. I. Newton Kugelmass, Ed. Donnelly, New York, 1963. 366 pp. Illus. Paper.

Brain Lipids and Lipoproteins, and the Leucodystrophies. Proceedings of a symposium (Rome), September 1961. J. Folch-Pi and H. Bauer, Eds. Elsevier, New York, 1963. 225 pp. Illus. $11.

Chemical Exploration of the Brain. A study of cerebral excitability and ion movement. Henry McIlwain. Elsevier, New York, 1963. 215 pp. Illus. $7.

Comparative Biology of Calcified Tissue. Harold E. Whipple, Ed. New York Acad. of Sciences, New York, 1963. 410 pp. Illus. Paper, $6.

Comparative Pathology in Monkeys. B. A. Lapin and L. A. Yakovleva. Translated from the Russian (*Ocherkl Stravnitel'noy Patologh Obez'yan*, Moscow, 1960) by the U.S. Joint Publications Research Service. Thomas, Springfield, Ill., 1963. 288 pp. Illus. $10.

Comprehensive Biochemistry. Section 2, vol. 9, *Pyrrole Pigments, Isoprenoid Compounds, and Phenolic Plant Constituents* (284 pp. $12.50); vol. 11, *Water-Soluble Vitamins, Hormones, Antibiotics* (255 pp. $11.50). Marcel Florkin and Elmer H. Stotz, Eds. Elsevier, New York, 1963. Illus.

The Cultivation of Animal and Plant Cells. Philip R. White. Ronald, New York, ed. 2, 1963. 236 pp. Illus. $9.

Disorders of Blood and Blood-Forming Organs in Childhood. H. S. Baar, Stella Baar, K. B. Rogers, and E. Stransky. Hafner, New York, 1963. 912 pp. Illus. $60.

Elementary Genetics. W. Ralph Singleton. Van Nostrand, Princeton, N.J., 1962. 496 pp. Illus.

Emotions and Emotional Disorders. A neurophysiological study. Ernst Gellhorn and G. N. Loofbourrow. Harper and Row, New York, 1963. 508 pp. Illus. $12.

Entomologie. Appliquée à l'Agriculture. vol. 1. *Coléoptères. Caraboidea, Staphylinoidea, Hydrophiloidea, Scarabaeoidea, Dascilloidea, Cantharoidea, Bostrychoidea, Cucujoidea, Phytophagoidea (Cerambycidae et Bruchidae)* (592 pp., 1962, F. 132); vol. 2, *Coléoptères. Phytophagoidea (suite et fin) (Chrysomelidae, Curculionidae, Attelabidae, Scolytidae, et Platypodidae)* (876 pp., 1963, F. 162). A. S. Balachowsky, Ed. Masson, Paris. Illus.

Funktionelle und Morphologische Organisation der Zelle. P. Karlson, Ed. Springer, Berlin, 1963. 257 pp. Illus. Paper, DM. 36.

The Human Body. Its anatomy and physiology. C. H. Best and N. B. Taylor. Holt, Rinehart, and Winston, New York, ed. 4, 1963. 766 pp. Illus. $8.75.

Limnology in North America. David G. Frey, Ed. Univ. of Wisconsin Press, Madison, 1963. 752 pp. Illus. $8.50.

Man and the Biological World. A laboratory manual. Shelby D. Gerking. Burgess, Minneapolis, ed. 2, 1963. 139 pp. Illus. Paper.

Marine Microbiology (Deep Sea). A. E. Kriss. Translated from the Russian by J. M. Shewan and Z. Kabata. Interscience (Wiley), New York, 1963. 554 pp. Illus. $19.75.

Medical Behavioral Science. A selected bibliography of cultural anthropology, social psychology, and sociology in medicine. Marion Pearsall. Univ. of Kentucky Press, Lexington, 1963. 144 pp. $4.

A Monograph of the Immature Stages of Australasian Timber Beetles (Cerambycidae). E. A. J. Duffy. British Museum (Natural History), London, 1963. 243 pp. Illus. Plates. £5 5s.

Pesticide Handbook, 1963. Compiled and edited by Donald E. H. Frear. College Science Publishers, State College, Pa., ed. 15, 1963. 312 pp. Paper, $2.50; cloth, $3.50.

Physiological Pharmacology. A comprehensive treatise. vol. 1, *The Nervous System*; pt. A, *Central Nervous System Drugs*. Walter S. Root and Frederick G. Hofmann. Academic Press, New York, 1963. 719 pp. Illus. $22.