The volume is largely in English, but the index is bilingual. The press work is excellent, and I found only a few typographical errors.

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Roman Construction in Italy from Tiberius through the Flavians. Marion Elizabeth Blake. Carnegie Institution of Washington, Washington, D.C., 1959. xvii + 195 pp. Illus. $9.

The present volume is the second part of a basic, three-volume work which will present in considerable detail the history and development of Roman building methods in Italy. The first volume (1947) takes us through the reign of Augustus; now this one guides us through the confusing history of building in the first century A.D.—a period in which builders seem to be striking out in all directions, but without arriving at any truly major discoveries, and only rarely contributing a great architectural monument.

The old saw would have it that Augustus "found Rome of brick and left it of marble." Just how wrong headed this notion is is amply illustrated by Marion Blake's book; for working with marble (except as a veneer) was never greatly interesting to the Romans, nor was their contribution to stone construction ever of major importance. The great Roman advances in building technique were in the use of brick and concrete, and their continued experiments with these combined media prepared the way for the great architectural masterpieces of Trajan and Hadrian, Diocletian and Constantine—masterpieces which remain to be dealt with in the final volume of the series.

The present volume, like its predecessor, is sumptuously published. The footnotes are set along the edges of the pages, opposite the passages to which they refer; there are five separate indexes; and the plates contain over 100 photographs, beautifully reproduced. Yet it is just in these points where cause for complaint can be found. Anyone likely to read this book will expect to find the footnotes at the bottom of the page, and the present method not only wastes paper when the footnotes are sparse, but, when they come thick and fast, there is really not enough room for them. This leaves the impression that footnote information is crowded back into the text, and confuses material which is already hard enough to read. As to the five indexes, I should much prefer them combined. Finally, it seems to me that for illustrating architecture (and thus building) *drawings* are far superior to photographs and should be used even though some photographs must be left out. Let us hope that in the final volume Miss Blake will append a generous portfolio of drawings to illustrate not only that volume but this entire work.

The text itself deserves only praise. The completed work will force us to reassess both the history of Roman architecture and its contribution to architecture in general. This work is fundamental for classicists and medievalists alike and is recommended to anyone interested in architecture and engineering.

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Elementary Astronomy. Otto Struve, Beverly Lynds, Helen Pillans. Oxford University Press, New York, 1959. viii + 396 pp. Illus. $7.

Otto Struve, one of our most distinguished and lucid astronomers, has produced an unusual, interesting, and very useful book. Struve was assisted by Beverly Lynds and Helen Pillans. Although the title is *Elementary Astronomy*, the preface as well as the text clearly indicates that this is not another general, descriptive, astronomical text. Instead the book stresses the physics involved in astronomy, especially dynamical and spectroscopic lines of evidence and analysis. It might have been titled "Elementary Astrophysics." This book will be received with pleasure by many instructors and serious students of astronomy and physics.

The student or general reader usually has a difficult time finding how astronomers proceed from their various types of observation to models of the interior of stars, or to general pictures of the structure and history of the galaxy. Of necessity most introductory texts, like a considerable number of popular books, are mainly descriptive. Books at the next level have generally consisted of specialized, and usually rather technical, discussions. For most readers the gap is too great to jump; but this volume will provide a useful bridge. The volume may also be of value to physics students who explore some of the interesting astronomical contexts in which physics is applied. Problems, but not references for further study, are provided at the end of each chapter.

Although the book jacket contends correctly that the volume is "written in readable, non-technical style, the text assumes no previous training in mathematics or physics; calculus and trigonometry have been omitted entirely," a reader who lacks a knowledge of introductory physics will proceed slowly in many sections. In many instances the discussion is more detailed and mathematical, as well as more modern, than that in the well-known *Astronomy* by Russell, Dugan, and Stewart.

The topics discussed range from coordinate systems and fundamental units, through planetary motions and physical conditions, to the sun and its structure, the origin of stellar radiation, the origin of the solar system, the arrangement and motion of stars in space, stellar spectra, clusters, nebulae, binaries, variable stars, galaxies, and relativity, and the book ends with a chapter on telescopes and their accessories. In every instance, as in the discussion of radio astronomical instruments and observations, emphasis is upon the physical principles used by astronomers in constructing their equipment and interpreting their observations.

The 110 halftone illustrations, all closely related to the text, are most attractive despite the use of nonglossy paper for the book. In addition, 181 diagrams and a four-color frontispiece clarify the discussion. Many of the illustrations are especially interesting because they deal with technical points not commonly discussed or illustrated in descriptive texts.

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On the Pectoral Fin and Shoulder Girdle of the Arthrodires. Erik Stensiö. *Kungliga Svenska Vetenskapsakademiens Handlingar*, vol. 8, No. 1. Almquist and Wiksell, Stockholm, Sweden, 1959. 229 pp. + plates. Kr. 114.

This is another of the important and beautifully illustrated works by a man who has greatly influenced the study of fossil fishes over the past 3½ decades. As the latest in a series of recent studies on the anatomy and classification of the

primitive fish groups, this publication will interest not only the specialist but will also find many readers among vertebrate morphologists generally because it presents some interpretations of one of the great, although poorly documented, events in the development of backboned animals—the origin of paired appendages.

From the meticulous preparation of a superb representation of fossil arthrodires, principally from Silurian and Devonian strata of Europe, many anatomical details of the pectoral girdles and fins of these fishes have been determined. From these facts Erik Stensiö has adduced "more or less arbitrarily" many other structural conditions of both the pectoral skeleton and the associated, soft anatomy. Seemingly interpreted in terms of a hypothetically ideal, paired fin fold, the variously modified, observed parts are divided into five defined and named types of pectoral appendages. These considerations, coupled with unpublished observations on cranial morphology, serve as the bases for a proposed, new phyletic classification of the Arthrodira in which the geologically younger members of the group are postulated as being the structural antecedent of the oldest known forms.

In his introduction, Stensiö expresses the hope that these ideas will stimulate additional study of the morphology and embryonic development of the paired fins of fishes. This desire is already realized. Many of his conclusions are the current subject of heated controversy among a number of the students privileged to examine his fossil materials in Stockholm prior to the publication of this volume.

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The Determination of Molecular Structure. P. J. Wheatley, Oxford University Press, New York, 1959. vii + 263 pp. Illus. $5.60.

The student of molecular structure has long needed a volume of this kind. Prefacing his book with J. E. Wertz's parody-phrase "pursuit of the details of molecular structure and molecular environment is the occupation of all chemists part of the time and part of the chemists all of the time," Wheatley presents "an introductory survey of main physico-chemical methods that have been devised for the determination of molecular structures."

Dedicated pursuit of such a goal gives rise to arbitrary decisions regarding depth versus breadth: a kind of literary uncertainty principle is in operation which necessarily sacrifices the clarity achieved by completeness for wide coverage. Any good survey tries to strike a happy compromise between the two. But the situation is further complicated when the text is regarded as "introductory," because this would appear to call for an attempt toward coherent exposition from fundamentals, conveniently and sufficiently referenced. This, in turn, necessarily implies some length. In this book, the limitations imposed by an "introductory survey," together with a remarkably meager referencing job (for a text apparently intended for students), give rise to the only serious defects, apart from style and a few typographical errors (for example, the mislabeling of axes in Fig. 1 on page 96) apparent in a first reading.

In the chapters on spectroscopic methods, diffraction methods, (covering electron, x-ray, and neutron diffraction), classical stereochemical methods, dipole moments, magnetic methods, and nuclear magnetic resonance, the author ably stresses which methods are most suitable for the structure determination of particular molecules (with many explicit examples) and the kind of information (molecular symmetry and molecular parameters) they can be expected to provide. Emphasis is placed throughout on the scope and limitations of the above methods, and instances are cited where one method may be preferable to another. In most cases, brief descriptions of experimental technique are given; these descriptions are helpful, at times, in understanding the basic physics of the method, but at other times they merely get in the way.

The style is dry without being crisp: in the section on symmetry properties and in the many examples introduced to punctuate a point or to explain by example, a deft touch would have provided welcome relief to the necessary detail.

While clearly written for the mature student with some background in quantum mechanics and atomic and molecular structure, the book will probably prove useful in general for its handy distillation of theory, fundamental working technique, and practical experience. These qualities will be especially useful to anyone interested in quickly picking up a working knowledge of the subjects covered. But again the purposes of the student and the requirements of a handy source for reference would have been better served had the author or publisher referenced the volume more carefully.

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Africa. Emil Schulthess. Simon and Schuster, New York, 1959. 384 pp. Illus. $20.

This pictorial volume resulted from the travels of a modern caravan (transported by a small fleet of Willys station wagons with four-wheel drive and cross-country gears) through the heart of the African continent. Schulthess, chief photographer of *Du,* traveled and photographed from the northern tip to the southern tip of the continent. He writes in the preface that "our itinerary and plans took shape. From Tunis to Tripoli we would go on through the Libyan desert to the highlands of Tibesti. From there across wide tracts of desert to Lake Chad, and southward again through French Equatorial Africa to the huge rain forest of the Belgian Congo. Then, after thousands of miles in the interior, we would reach the east coast and a completely different world along the shore of the Indian Ocean. On through Tanganyika and the Rhodesias to South Africa . . . the big city of Johannesburg . . . to a fitting close at the Cape of Good Hope."

The book's first illustration is of Roman ruins at Sabratha, near Tripoli, and the last is made looking south from the southernmost crag of the Cape of Good Hope—the end of Africa. In between are pictures (in color or in black-and-white) of desert and forest, velds and sand dunes, primitive Negro villages and modern production plants, and an endless variety of life.

New Books

Adventurous Alliance. The story of the Agassiz family of Boston. Louise Hall Tharpe. Little, Brown, Boston, 1959. 367 pp. $5.

American Research on Russia. Harold H. Fisher, Ed. Indiana Univ. Press, Bloomington, 1959. 254 pp. $5.

The Armchair Science Reader. Isabel S. Gordon and Sophie Sorkin, Eds. Simon