logical theories, model universe and the red-shift, and the selection of a model universe. The final chapter is a short summary and conclusion. The author concentrates on general relativity, the steady-state theory, and, briefly, kinematical relativity. He is not a devotee of the latter two theories, but he correctly points out that their controversial natures have forced all cosmologists to refine and to make precise their own ideas.

The book would be improved by illustrations and by a more complete discussion of distance determination technique, such as moving cluster parallaxes and the use of the zero-age main sequence. A second edition should necessarily include a discussion of the exciting new radio data on the numbers, diameters, and duplicity of these strange, incredibly distant sources.

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Encyclopedic, Indispensable

British Prosobranch Molluscs. Their functional anatomy and ecology. *Publication of the British Ray Society*, No. 144. Vera Fretter and Alastair Graham. Published for the Society by Quaritch, London, 1962. xvi + 755 pp. Illus. £8 8s.

Molluscan shells have long been attractive objects to man, but the soft, often slimy, body within is more apt to be greeted with repulsion or indifference by everyone except a few molluscan specialists. This is ironic, for the classification of the whole ancient and important phylum of the Mollusca, and especially the Gastropoda, is based upon anatomical features. The tendency has been, among zoologists, to generalize upon an occasional study of soft parts and to group by analogy or by the use of a few easily seen structures. Paleontologists, of course, are obliged to do this, but now that this book is available, neontologists no longer have an excuse, for this book will stand as a landmark in the interpretation of functional morphology, which may differ rather widely between one species and the next.

In part 1, the introduction, a selected prosobranch, *Littorina littorea*, is used to demonstrate organization and structure of the gastropod body in detail. Then, in the second part, on functional anatomy and development, each of the organ systems is given elaborate treatment, with a review of pertinent literature. One or more chapters are devoted to the shell, the mantle cavity, the skin, the muscular system, the alimentary system and feeding, the vascular, excretory, nervous, and reproductive systems, and spawning, development, and larval forms. Although research on British mollusks forms the primary reservoir of the literature discussed, the work of malacologists elsewhere is not neglected, so these chapters (16 in all) are applicable far beyond the limited area of the title.

Part 3 (6 chapters) deals with the ecology of British mollusks. With the preceding parts as background, the significance of the adaptations to habitat stands out more clearly. The parasites of these prosobranchs are listed and discussed in one unusual chapter.

For the lay malacologist, perhaps the meat of the book is in part 4, on relationships. Here the authors suggest the classification they prefer. No new groupings or terms are proposed, but a different emphasis is reached on the basis of functional morphology and anatomy: Gastropoda are divided into three subclasses—Prosobranchia, Opisthobranchia, and Pulmonata. The Prosobranchia are subdivided on heart and pallial structure primarily, on radulae secondarily. The primary divisions are Diotocardia (which includes Rhipidoglossa and Docoglossa, the equivalent of Thiele's Archaeogastropoda) and Monotocardia. The latter are again divided into two parts, the Taenioglossa (Mesogastropoda of Thiele) and the Stenoglossa (synonym, Neogastropoda). The authors furnish evidence to show that the family Pyramidellidae, formerly considered a prosobranch group, probably should be transferred to Opisthobranchia. There are, it seems, several families in each of these two subclasses which have the morphological characters of the other; hence, differentiation is not altogether clear-cut.

This monumental work will be a great boon to the nonspecialist, for it brings together a wealth of scattered literature on the anatomy and physiology of these organisms. So diverse has the field become that few workers can evaluate the significance of researches outside their immediate domain. Here, however, one sees that histology and biochemistry can contribute to an understanding of molluscan structure and function. The bibliography alone (its content is well summarized in the body of the text) amounts to some 35 pages. The 317 illustrations are original line drawings, well planned to clarify the descriptions of soft parts.

Except for its summary chapters, this book, which is encyclopedic in scope, is not easy reading, but the scope makes it indispensable to all serious students of malacology. The book does not pretend to be a work on nomenclature or taxonomy, but one may easily predict that it will have no little influence in future systematic studies.

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Current Research

Rare Earth Research. Proceedings of the symposium held at Glenwood Springs, Colorado, September 1961. Joseph F. Nachman and Charles E. Lundin, Eds. Gordon and Breach, New York, 1962. xv + 354 pp. Illus. $14.50.

This volume, the proceedings of the second conference on rare earth research, differs from the volume published following the first conference in several respects: the editors and the publisher are different, and the volume is slightly longer and appreciably more expensive.

The five half-day sessions of the conference were devoted to the following topics: chemical properties of the rare earths and their compounds; mechanical and metallurgical properties of rare-earth metals and alloys; thermodynamic properties of rare-earth metals, alloys, and compounds; physical properties of rare-earth metals and their compounds; and rare-earth chalcogens, borides, and nitrides.

In the introductory address it is pointed out that only a few chemists and physicists were interested in these elements during the first 140 of the 160 years that have followed the discovery of the first true members of the rare-earth series. Although the rare earths "represent about one-eleventh of the known naturally occurring elements, the properties of their metals, alloys, compounds, and solutions are relatively unknown." However, the numerous papers

now being published in this field are evidence of the change that has occurred as the result of vastly improved modern methods of separation and purification of these elements, and new subjects have been created for investigation by both the old standard techniques and the most recently developed research methods.

The 30 papers, which follow the introduction, range from the highly practical one entitled "Fabrication of yttrium metal" to the theoretical one entitled "The electronic structure of the rare-earth metals." Many metallurgical grams are established, and lattice spacings are determined with great precision.

The reader will find much good inorganic and physical chemistry and solid-state physics. Some papers review a considerable amount of background information in covering their subject. The book will bring inorganic chemists up-to-date on some very interesting problems, such as the nonstoichiometric hydrides of the rare earths, but it is intended primarily for specialists in the field of rare earth research—to them it will bring new and valuable contributions in their field.

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Components of Matter

Theory of Elementary Particles. Paul Roman. North-Holland, Amsterdam; Interscience, New York, ed. 2, 1962. xvi + 580 pp. Illus. $12.75.

This book is described on its title page as a "second improved and revised edition" of a work first published in 1960 [reviewed in *Science* **132**, 1391 (1960)].

In his preface to this edition, Roman states that he has "endeavored to keep intact the structure and character of the book." On perusal, I find that this is a very accurate statement. No extensive revisions have been made in either the subject matter or its treatment. Apart from a little up-dating of the material at the end of the book and correction of errors, the present edition is essentially the same as the first, with its good and bad points.

The reader who is familiar with the first edition will know that the book is divided into three roughly equal parts of approximately 200 pages each. The first covers the four-dimensional orthogonal group, field equations, and field quantization. The second deals with symmetries, conservation laws, and selection rules, while the last, somewhat shorter, section treats isospin and classification schemes for the fundamental particles.

I find no real fault with the first two-thirds of the book. The author's treatment of the group-theoretic and algebraic structure of relativistic fields is clear and elegant. His discussion of invariances and selection rules is generally good, with many examples drawn from particle-antiparticle systems and weak interactions.

The last section is the least useful. The dangers of an extensive presentation of the "geometry" of quantum numbers, as it existed three or more years ago, are evident when one considers current concepts in this area. The existence of multiboson resonances (ρ, ω, η, K*, and the like) and meson-baryon resonances of various sorts has stimulated many new and evolving theories of symmetries based on SU_3 and other groups. At the present time the situation is so fluid that it seems unwise to devote a large amount of space in a self-styled introductory book to a discussion which is so readily outmoded. Even the few pages of new material at the end of the book are now superseded.

What the author chose to cover in the first parts of the book, he treated extremely well. But I object to the book's title, for it does not present an accurate description of the contents. The study of elementary particles, whether theoretically or experimentally, involves intimate consideration of transitions of quantum-mechanical systems from one state to another. Consequently, when the author states in his preface, "I never attempted in the book to actually calculate a transition probability or a lifetime. I did not even mention the 'classical' tool of the S-matrix method," I can but reply that he is not presenting the theory of elementary particles, but only a very restricted part of that theory. The student who seeks to learn about the theory of elementary particles will find much of value in this book, but he will be forced to go elsewhere to complete, even partially, his education in the field.

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Notes

Commercial Alloys

This fourth edition of the well-known **Engineering Alloys** by Norman E. Woldman (Reinhold, New York; Chapman and Hall, London, 1962. 1363 pp. $29.50) lists 35,000 commercial alloys together with their composition, their uses, and the names of the companies that manufacture them. The new edition contains information on 15,000 more alloys than its predecessor (1952) and represents a major revision. Woldman is to be congratulated for his careful effort to list alloys manufactured throughout the world. An alphabetical index of engineering alloys together with an alphabetical list of manufacturers (totalling 1536) provides ready identification of most important engineering alloys. The book should be very useful to those who deal extensively with commercial alloys. A minor deficiency is that to find the manufacturer of a pure metal one must know the trade name of the specific pure metal desired. The descriptions of foreign alloys are not as accurate as those of domestic alloys (for example, S.A.P., Hiduminium 100, and Sendust are incorrectly described for composition).

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Recent Research

Parts 1 and 2 of volume 15 of **Fortschritte der Zoologie** (Fischer, Stuttgart, 1962. 164 pp. and 172 pp.), which is edited by Hans Bauer, contain the same sort of excellent reviews as the earlier volumes in the series. W. Hasselbach (Heidelberg) gives an extensive summary, including a substantial bibliography, of recent work concerned with the coupling of chemical and mechanical reactions during contraction and relaxation of skeletal, heart, and smooth muscles; he places special emphasis on the various reactions of the isolated contractile proteins and on the role of the physiological relaxation factor. H. Lüttgau (Bern) summarizes, under the somewhat misleading title "Physiology of nerves," the most recent findings about ion movements on the excitable membranes of vertebrates and invertebrates, their electrical characteristics