approximately equal opportunity for social contact—the ratio of free time spent alone to that spent with family members is highest in the United States, although the ratio is of similar magnitude in a few other sites.

These examples can only suggest the book's potential for filling our hours and days instructively. It is a rich data bank for us to rob in our free time.

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High Energy Astrophysics

Gamma-Ray Astrophysics. Proceedings of a symposium, Greenbelt, Md., Apr. 1973. FLOYD W. STECKER and JACOB I. TROMBKA, Eds. National Aeronautics and Space Administration, Washington, D.C., 1973 (available from the Superintendent of Documents, Washington, D.C.). xvi, 413 pp., illus. Paper, $2.90. NASA SP-339.

Three years ago I participated in an international symposium on interstellar dust. When the proceedings finally were published, after more than two years, the price was $40 for the paperback edition and more than $50 for the hard-cover version. I was dismayed that the International Astronomical Union would tolerate such a price structure. It makes such volumes inaccessible to individual researchers; but, worse, I imagine that many libraries in developing countries will simply not be able to afford such prices. What was billed as an international symposium will turn out to be a symposium whose proceedings are available only to affluent individuals and affluent countries.

In view of all this, I am pleased not only that the editors of the symposium on gamma-ray astrophysics have been able to bring out the proceedings within a year of the meetings but also that the price is only $2.90.

The symposium deals with both theoretical and observational investigations. Clear attention is paid to the relationship between gamma-ray and x-ray astronomical results. Some of the findings obtained in the series of Apollo missions, between 0.3 and 27 Mev, are presented by L. E. Peterson and J. I. Trombka; and preliminary results on SAS-2 observations at energies above 30 Mev are given by D. A. Kniffen, C. E. Fichtel, and R. C. Hartman.

Shortly after the end of the symposium, the existence of occasional gamma-ray bursts was discovered by a group of Los Alamos scientists. The editors therefore have added two papers on this topic. Unfortunately, however, this opportunity was afforded only to contributors from the editors' own institution—the Goddard Space Flight Center—and only papers that had already appeared in *Astrophysical Journal Letters* and in *Nature* are included.

Rather more interesting from a historical point of view are comments in D. D. Clayton's article on prospects for gamma-ray astronomy and comments by E. Schatzman and C. Fichtel during a final session entitled Future Directions in Gamma-Ray Astronomy. Schatzman and Fichtel both worry about the detection of very short gamma-ray flashes expected from supernovas, and Clayton worries about the spectrum of gamma rays emitted in supernovas. While the subsequently discovered gamma-ray bursts may have no relation to supernovas, it is nevertheless pleasing that some theorists may have come so tantalizingly close to predicting the bursts.

This book is a great buy for anyone with even a small interest in high energy astrophysics.

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Current Algebra

Currents in Hadron Physics. V. DE ALFARO, S. FUBINI, G. FURLAN, and C. ROSSETTI. North-Holland, Amsterdam, and Elsevier, New York, 1973. xxvi, 874 pp., illus. $97.50.

There is essentially only one thing seriously wrong with this book: its price. In this it is a milestone of sorts in the history of physics; the next most expensive physics textbook that I know of sells for less than half as much. One should not necessarily criticize the publisher; North-Holland has been of exemplary service to the physics community and the book is superbly produced in a time of rapidly rising costs. But when a book is as expensive as this one an explanation is called for.

The book is wonderful for anybody wanting to learn about what happened in high energy physics between late 1965 and late 1970. The authors are members of the team who wrote many of the pioneering papers that brought about current algebra in the first place. It is always a treat to have a text written by people who helped in creating the material; it may be likened to an encore by a prima donna.

The book is primarily about current algebra in the loose sense of the term. After a reasonably thorough review of the roles of hadronic currents in the nonstrong interactions, it goes on to discuss low energy theorems, chiral symmetry, sum rules, and superconvergence relations. This is followed by three chapters dealing in agonizing detail with the method of obtaining sum rules by saturating commutators. It is certainly valuable to have all this methodology assembled in one place and presented clearly, but I think the discussion is so technical that it will be of interest only to people on the verge of going out themselves and doing a bit of saturating. What I really like about this book are two chapters supposedly peripheral to the main subject. These are an introductory chapter reviewing strong interactions and a chapter near the end discussing the dual resonance model. They contain probably the best presentation anywhere of two subjects often notoriously ill-explained. The discussion here is concise, touched with a certain elegance and always maintaining the proper emphasis, and may be read with delight and profit by anyone wanting an overview before plunging into the literature. Also, the book is graced by a comprehensive bibliography.

The book suffers because it was unable to make up its mind on what it wanted to be. It started out as a textbook and ended up like a summer school volume. The latter part consists of a hodgepodge of developments, only some of which have subsequently become important. The authors originally planned their manuscript to cover events up to the end of 1970. They mounted a valiant effort to make the book more up to date by including some material from 1971. Alas, the effort is in vain; it's now 1974. We are older and a bit wiser, and know that while certain subjects call for a more detailed treatment other material may be better off enshrined in the journals. The book could have maintained its style by leaving out this last part altogether and thereby cutting down on its bulk, which is considerable. Incidentally, a book of this size might be more conveniently published in two volumes, much in the manner of a well-known field theory text. In any

case, graduate students should be warned that they do not necessarily have to master the book in its entirety before they can do current research. In closing, I should like to call on the publisher to consider issuing this fine book in a paperback edition.

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Marine Symbionts

Symbiosis in the Sea. Papers from a symposium. WINONA B. VERNBERG, Ed. Published for the Belle W. Baruch Coastal Research Institute by the University of South Carolina Press, Columbia, 1974. xvi, 276 pp., illus. $25. Belle W. Baruch Library in Marine Science, No. 2.

This volume is a compilation of 13 papers by 17 contributors. Its purpose is to present a summary of knowledge about certain aspects of marine symbiosis. This purpose has been successfully achieved. The papers fall into two categories: symbiont-host interactions and evolutionary trends.

J. H. Vandermeulen and L. Muscatine present a very good overview of current knowledge of how symbiotic dinoflagellates accelerate calcification in reef-building corals. Present information, however, does not provide a sufficient basis for clearly defined conceptual models of coral calcification. R. V. Dimock, Jr., investigates problems of intraspecific aggression and distribution of the polychaete *Arctonoe pulchra* on its hosts—the sea cucumber *Stichopus parvimensis* and the limpet *Megathura crenulata*. Evidence is presented to suggest that intraspecific aggression serves as a constraint upon the symbiont population. T. C. Cheng, A. Cali, and D. A. Foley review some of the more salient features of phagocytosis and related processes in marine clams, especially *Crassostrea virginica* and *Mercenaria mercenaria*. An interesting suggestion is that Microsporida are rarely found in mollusks because their small size renders them particularly vulnerable to phagocytosis by granulocytes. P. J. DeCoursey and W. B. Vernberg review the phenomenon of competitive interaction of two or more species of larval trematodes in host snails, especially *Nassarius obsoletus*. They state that complete coexistence without harmful interaction can occur, but they question whether this phenomenon is a contradition of the Gausian principle. Other papers on symbiont-host relationships are authored by R. W. Greene (slugs and their chloroplasts) and B. W. Ache (host location in invertebrates).

R. M. Cable discusses problems relating to phylogeny and taxonomy of marine species of Aspidobothria and Digenea. He presents a convincing diagram of the evolution of trematodes, and he calls attention to new and promising investigations of the amount and complexity of DNA in different species of parasites. A good review of turbellarian symbioses and their implications concerning the evolution of parasitism is authored by J. B. Jennings. He emphasizes the great variety of types of associations formed between turbellarians and their "hosts." W. B. Vernberg and F. J. Vernberg are concerned with the evolution of physiological responses, especially metabolic patterns of trematodes and their hosts. Each stage of parasite development, in some aspects, has apparently evolved independently of the next stage. Other papers on evolutionary trends are by D. M. Ross (associations between crabs and sea anemones). J. E. Simmons (*Gyrocotyle*), W. K. Patton (coral reef communities), and D. L. Taylor (marine algae). The last 14 pages of the book consist of a summary and an index.

Throughout the volume are abundant reminders that much more research must be done in these exciting and significant areas of investigation. I recommend the book for those interested in general biology as well as for symbiologists.

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Teleost Genetics

Genetics and Mutagenesis of Fish. Papers from a symposium, Neuherberg, Germany, Oct. 1972. J. H. SCHRÖDER, Ed. Springer-Verlag, New York, 1974. xvi, 356 pp., illus. $18.50.

Despite the growing economic importance of fish culture and the key position the fishes occupy in any understanding of vertebrate evolution, the genetics of only a few of the teleosts has been studied. Recently, the study of fish genetics has been broadened by numerous descriptions of karyotypes, measurements of DNA, and analyses of isozyme polymorphisms—none of which requires the propagation of fishes generation after generation in captivity—but our knowledge of the subject remains in a distressingly sketchy state, and this situation is reflected in the present volume.

Readers of the book will be able to pick up practically all the diverse threads that make up the loose-woven fabric of fish genetics today, but the newcomer faces several hazards in obtaining a balanced view of the subject or, in some instances, even getting his facts straight. Poor editing or translating has produced too many passages that are likely to be misread. Schröder has presented a commendable summary of the use of teleosts in mutation research and Kirpichnikov and Whitt *et al.* have successfully reviewed the voluminous literature on biochemical polymorphism, especially the lactate dehydrogenase isozymes of fishes, but readers of other papers will have to search the bibliographies to learn the complete range of the topics.

Seven of the 29 contributions emanate from the research group headed by Fritz Anders and deal with *Xiphophorus*, a group of viviparous fishes with polymorphic pigment patterns that often develop abnormally in inter- and intraspecific hybrids, sometimes producing pigmented tumors. The cytological, genic, and biochemical bases for these abnormalites have been explored in several ingenious and exciting ways, but data necessary for evaluation of the results and conclusions are frequently lacking. Some of the patterns are sex-linked, and Kallman shows that *X. maculatus* is polymorphic for female-determining gonosomes, with many populations that simultaneously exhibit male and female heterogamety.

Preadaptive reproductive behavior and so-called regressive evolution in blind cave fishes are discussed by Parzefall, Wilkens, and the Peterses; salmonid isozymes by Utter and Wolf and their respective groups; sex differentiation and hormones by Satoh and Egami; the unusual karyotype of the deep-sea *Diretmus* by Post; and the laboratory synthesis of a unisexual species by Schultz. The volume is dedicated to Curt Kosswig, one of the pioneers of fish genetics, and he has contributed an account of a number of high points in genetic investigations of fishes.

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