a series than in separate groups, and he points out that the dividing line between groups will vary considerably depending upon the particular physical, chemical, or biological properties under consideration. However, the series concept is similarly beset by variations in order depending upon the particular characteristic chosen. It would seem, therefore, that grouping and ordering in series are both acceptable methods in regional limnology, their use depending largely on the particular lakes and characteristics that are chosen for the study.

Although Macan's book is enlivened by flashes of characteristic wit, it does not bring out the informality and sense of fun that have been characteristic of the Windermere laboratory and in my time there led one European visitor to express astonishment that such fine work could be produced by people who did not seem to take it seriously. Nevertheless, this book is an appropriate monument to their efforts, as well as to the foresight of the founders of the FBA to whose memory the book is dedicated.

For limnologists whose reading of the book inclines them toward keeping in touch with work at the Windermere laboratory, membership in the Freshwater Biological Association provides (very cheaply) a most informative annual report, which includes a list of currently available reprints and a valuable bibliography of limnological papers published each year in Britain.

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Short-Lived Pesticides

Biochemical Toxicology of Insecticides. Proceedings of the Fifth U.S.-Japan Cooperative Science Program, Tokyo, June 1969. R. D. O'BRIEN and IZURU YAMAMOTO, Eds. Academic Press, New York, 1970. viii, 220 pp., illus. $8.50.

In view of the slow but inevitable decline in the use of persistent insecticides, this book is particularly timely, being devoted almost exclusively to compounds that have a short residual life. Such compounds can be expected to have minimal long-term effects on man and wildlife and will probably occupy an important place in future pest-management operations.

The recognition of the central role of microsomal oxidations, more particularly of cytochrome P-450, in insecticide toxicology is most interesting. Excellent articles by Kuwatsuka on methylene dioxyphenyl synergists, by Sato on interactions of drugs with cytochrome P-450, by Dahm on the oxidative degradation and activation of phosphate compounds, by Hennessy on the potential for carbamate synergists, and by Plapp on the biochemical genetics of resistance all develop this theme in different ways. Unfortunately, the techniques developed by biochemists and pharmacologists for assaying cytochrome P-450 have not yet been adopted by all insecticide toxicologists. If the degradation of rat hepatic cytochrome P-450 to P-420 apparent on page 168 is indicative of the effectiveness of the methods used, the value to comparative toxicologists of the carp and cockroach spectra is minimal.

Other subjects of importance are also covered, including a contribution by O'Brien on the acetylcholine receptor molecule and a series of papers that emphasize the chemical approach. These include a contribution by Hansch that is an excellent example of the analysis of structure-function relationships for which he is known and a paper by Eto and Ohkawa on alkylation reactions.

This volume is flawed in two respects. A few of the contributions are on restricted topics of no great importance to the subject as a whole, and perhaps the organizers should have invited the participants to discuss topics carefully chosen to cover the field, rather than, as was apparently done, permitting each participant complete freedom to choose his topic. And placement of all the tables and figures in a chapter together at the end of the chapter is an unnecessary annoyance to the reader.

In summary, this book is an important contribution at an opportune time. Its importance is in large part that it helps set the stage for the development of better selective insecticides of short residual life, which must occur if both food production and the quality of the environment are to be maintained. It is apparent that such development must be based on an increasing knowledge of the biochemical toxicology of insecticides.

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Nuclear Activation

Cell Fusion. The Dunham Lectures, Cambridge, Mass., 1969. HENRY HARRIS. Harvard University Press, Cambridge, 1970. x, 110 pp., illus. Cloth, $6; paper, $2.95.

Personal writings are generally better than impersonal ones, and Harris's book *Cell Fusion* is definitely of the personal sort. It is a very nice account of his own experiments, some of which are very pretty ones and raise interesting and deep questions about the basis for the differentiated state and the control of cell division.

Until quite recently, all the author's published studies in this area concerned the short-term fusion products resulting from the action of Sendai virus. In such polykaryocytes or heterokaryons (is it not blurring distinctions to call them hybrids?) he has studied the remarkable process of nuclear activation, which is the principal subject of this book. But it seems to me that the author's account of the independent development of somatic cell hybrids (mononucleated serially cultivable lines) suffers from a viral inflammation. After its discovery in Barski's laboratory, somatic cell hybridization was developed by Ephrussi, Littlefield, and others before the virus came into use. This was possible because for the production of hybrid lines the virus, though it may be very helpful in some cases, is very often not necessary.

My main criticism of the book is related to the extravagance of interpretation it puts forth. For example, there are described some beautiful experiments on nuclear activation, in which the appearance of the nucleolus coincides in time with the appearance in the cytoplasm of proteins determined by the same nucleus. This observation must be important and is worth pondering, but, from a number of possible interpretations, the one chosen and developed by the author is that the transport of informational RNA from nucleus to cytoplasm can take place only when newly synthesized ribosomes are available to carry that RNA into the cytoplasm. Leaving aside any criticism of the evidence (such as might be applied to some rather odd-looking sucrose gradients), what strikes the reader is that this conclusion flies in the face of a much stronger (because more direct) body of evidence, obtained by many others, that synthesis of informational RNA is regulated independently of nucleolar functions. The work of

Penman, Brown, Gross, Darnell, Perry, and others on this point is completely convincing to me, and if it is not to the author many readers would like to know why. Since we know nothing about the mechanism of nuclear activation, why would simultaneous but not interdependent activation of nucleolar and nucleoplasmic functions be so improbable?

I would recommend to readers a careful study of the phenomenology of the Sendai-virus-produced heterokaryon, as described in Harris's book. But I have also to add (especially for readers of tender age) that a clear view of the significance of much of this work will require independent knowledge of the literature, both cited and not cited.

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Particle Concepts

Elementary Particle Theory. A. D. MARTIN and T. D. SPEARMAN. North-Holland, Amsterdam, and Elsevier, New York, 1970. xvi, 528 pp., illus. $27.50.

It is impossible to write a book on elementary particle theory since, as the authors themselves emphasize at the very beginning of their preface, there is no such thing in existence. Nevertheless, a number of useful books have appeared in the last five years on this subject. The present volume is a fine addition to this list.

Although there is no elementary particle theory in existence, the amount of activity that has taken place in the field is staggering. In writing a book of finite length, therefore, some choices must be made. One such choice is whether the book should discuss theoretical constructs and ideas that have been generated in the field or should concentrate on summarizing how we have managed to classify, organize, and, after a fashion, "explain" the vast amount of experimental information that has been accumulated. The present volume opts heavily for the former, although occasional applications and phenomenological considerations are mentioned both in the text and in the problems.

Even within the body of theoretical ideas, some limitations have been imposed in this book. Almost all of the discussion deals with what we have deduced from the Lorentz group and from analyticity, and the group theory used in particle classification and the theories based on the generalized concept of current are omitted. This limitation is explicitly stated by the authors and should not be counted as a drawback.

Within the boundaries thus outlined, the book is a very valuable contribution. The text is easy to read and lucid, the derivations are not overly formalistic, and the thread of development is logical and continuous. Credits for discoveries are not always accurately assigned, but that is an unimportant aspect of a book. The volume is greatly enhanced in value by the numerous problems given at the end of each chapter, with hints and partial solutions at the end of the book. This is a rare and welcome feature among elementary particle textbooks.

Although one-sentence comparisons are somewhat superficial, it might be said that the present volume is more abstract and more detailed than the book by Frazer, more theoretically oriented than the text by Kallen, and more modern in outlook than Muirhead's tome. As compared to Gasiorowicz's book, the present volume is less oriented toward field theory and less comprehensive, but on the topics treated more complete. Finally, the present book is of course more up to date than any of the above-mentioned "competitors," simply because it was written a few years later.

All in all, the book will undoubtedly find many readers among advanced graduate students learning about particle physics, as well as among workers in the field who want to clarify some basic concepts outside their own special area.

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Element No. 92

The Chemistry of Uranium. Including Its Applications in Nuclear Technology. E. H. P. CORDFUNKE. Elsevier, New York, 1969. xiv, 250 pp., illus. $16.75.

Anyone who sets himself the task of writing a monograph on the chemistry of uranium assumes an enormous amount of work, for uranium has probably been the most intensely studied element in the periodic table over the last 20 to 25 years. Katz and Rabinovitch covered the work up to 1950 in a well-known monograph (*The Chemistry of Uranium*, McGraw-Hill, 1951), but, as the present author states in his preface, "Now the time seems ripe for a new book that gives a broad survey of the current chemistry and technology of uranium."

The importance of uranium in the generation of atomic energy is enough to make a good monograph on its chemistry important, and when the nuclear applications of the subject are included the potential value is even greater. When such a great amount of work is to be covered compromises must be made, and perhaps the nuclear and analytical chemist would feel somewhat slighted by Cordfunke's choices. For instance, neutron cross sections are hardly mentioned, and analysis by isotope dilution is not discussed; both of these topics are important in many phases of technology. Indeed, nuclear and analytical chemistry are covered only sketchily—but excellent compilations already exist on these specialized subjects.

This book brings together the enormous amount of recent work on uranium metal, alloys, oxides, and salts in a well-planned manner—a welcome change from the collection of papers presented by Katz and Rabinovitch. After giving an interesting history of the discovery of uranium, the author systematically treats each of these topics concisely but thoroughly. Extensive use is made of phase diagrams to convey a great amount of information in a minimum of space. Thermodynamics, crystalline form, and interatomic distances are extensively covered, and this coverage alone makes the book quite valuable. The author's extensive work on uranium oxide systems is evident in his treatment of this important topic. Uranium salts, hydrates, aqueous ionic properties, and metallurgical aspects of uranium metal and alloys are also featured.

The synthesis of chalcogenides (compounds with sulfur, selenium, and tellurium) of uranium is a relatively recent development which is well summarized and brought up to date. Technological applications are emphasized throughout the text and also are the subject of a special chapter. A rather unusual feature of the book is that at the bottom of each page of text it gives the numbers of the pages (ends of chap-