

cidal process because of the biological role of these granules and of the many enzymes they loose on the engulfed bacterium.

The chapter by Hager, Thomas, and Morris on a chloroperoxidase, which differs from myeloperoxidase in that it is able to chlorinate as well as iodinate substrates in the presence of peroxide, provides an interesting comparison with the leukocytic situation. That of Morrison, Bayse, and Danner on the role of mammalian peroxidase in iodination reactions amplifies the realization that the polymorphonuclear leukocyte has several similarities to thyroid cells. This has been hinted in the past from more general metabolic observations, such as the response of the thyroid to thyroid-stimulating hormone compared to the response of polymorphonuclear leukocytes to external particles they internalize.

As so often happens in collections of papers delivered at symposiums, the parts of the resulting book do not coherently form a crystalline whole. The chapter of Lehninger and Carafoli on calcium transport certainly cannot be faulted on its content or its importance. However, its inclusion in this particular volume is not easy to justify; it really does not seem germane to phagocytosis. Finally, the preface to the volume contains some statements that are not completely in accord with the views of some of the authors of the various chapters and that seem to be somewhat uncertain in the context of current experimental information.

Despite these remarks, this book does come at a fortunate time and will certainly stimulate interest in intracellular sequels of ingestion by phagocytic leukocytes, even if the larger theme envisaged by its title necessarily must await a more extensive treatment.

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## Population Theory

**Mathematical Topics in Population Genetics.** KEN-ICHI KOJIMA, Ed. Springer-Verlag, New York, 1970. x, 400 pp., illus. \$18.70. Biomathematics, vol. 1.

Ken-ichi Kojima has assembled a sort of "Festschrift for Everybody" in the field of theoretical population genetics. It is a mixture of review papers

and original research papers. Their authors are among the most active researchers in the field.

There has been a shortage of good reviews that make the theoretical literature more accessible to newcomers. The reviews in this volume will go far toward filling this need, although they do not pretend to cover the field completely.

Sewall Wright reviews his "shifting balance" theory of evolution. Although Wright has not been reticent in stating his views in the past, this paper is valuable as one of the most concise and readable statements of his views on evolution. It also contains judicious comparisons of his theory with the views of Fisher and Haldane.

J. R. G. Turner reviews the work that has followed Fisher's fundamental theorem. His review contains an extensive exposition of the mathematics of changes in mean fitness.

R. H. Richardson reviews models of dispersion of organisms, the emphasis of the review being on comparisons of the models with real biological data. It is a sad comment on the gulf between theoretical and experimental population genetics that this paper seems almost out of place in the volume, purely because it is more concerned with realism than with precision.

J. F. Crow presents an extensive review of genetic loads, and Motoo Kimura reviews stochastic processes in population genetics. Kimura's review concentrates on diffusion approximations. A review by Henry Schaffer of work on branching processes and the survival of mutant genes complements Kimura's review by covering some of the work on the stochastic processes to which the diffusion equations are an approximation.

J. A. Sved and O. Mayo review recent theoretical work on the evolution of dominance. C. C. Li reviews segregation analysis of human sibship data, confining himself to the case of complete ascertainment of affected individuals. Kojima and Lewontin review linkage and epistasis in evolution.

If the reviews are highly useful, the original papers are fascinating. C. Clark Cockerham presents recurrence relations for inbreeding coefficients in systems of mating that avoid mating close relatives. His paper is an attempt to bring results in this area into a single picture.

Although there is no review paper

covering quantitative genetics and animal breeding, two papers by W. G. Hill and Alan Robertson provide a view of the Edinburgh school at work. Hill and Robertson view animal breeding in terms of changes of gene frequencies at single loci, making extensive use of diffusion approximations. They are less interested in the gain from selection in one generation than in the ultimate probability of fixing favorable alleles in a line. Hill compares the effectiveness of different methods of selection by line-crossing. Robertson examines the effect of linkage on the gain from truncation selection when there are many loci. His paper is a demonstration of how far one can go beyond exact equations by a careful combination of approximations, computer simulation, and heuristic arguments.

Richard Levins provides the liqueur to this repast in a brief but important paper which is one of the first serious attempts to grapple with the problem of group selection.

In general, the quality of the contributions compensates for the high price of this volume.

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## A Physical System

**Three Body Problem in Nuclear and Particle Physics.** Proceedings of an international conference, Birmingham, England, July 1969. J. S. C. MCKEE and P. M. ROLPH, Eds. North-Holland, Amsterdam, and Elsevier, New York, 1970. xii, 564 pp., illus. \$32.

An ever-increasing number of theoretical and experimental papers has been published in recent years on various aspects of the three-body problem. Improved mathematical methods, such as Faddeev equations, improved computer technology, and new experimental techniques have given impetus to substantial research in this field. It was very fitting, then, that a conference be held to discuss the three-body problem. The proceedings of this conference, which was attended by some of the better-known workers in the field, contain 30 full-length articles and the abstracts of another 39 contributed papers. There are 16 theoretical and 11 experimental articles. In addition, three review papers, summarizing all avail-

able information on elastic nucleon-deuteron scattering, on polarization effects in nucleon-deuteron scattering, and on effects of final-state interactions in the three-body system, make this volume particularly useful. The majority of the theoretical papers discuss mathematical methods for the solution of the three-body problem, with the Faddeev equations playing a central role. One can't help noticing, however, that there is little discussion of the dynamics of the three-body system. Three-body forces are not even mentioned except in an abstract near the end of the book. The conference often focused on the two-body interaction in the three-body system, but one important aspect of this interaction, namely its locality or nonlocality, is not given sufficient attention in spite of a forceful introduction of this subject by H. P. Noyes. Furthermore, in spite of the title of the volume, there is little in it that will interest elementary particle physicists. What there is, however, is stimulating—R. D. Amado's model for the study of final-state interaction effects in three-body decays, the article by J.-Y. Pasquier and R. Pasquier on three-meson resonances from Faddeev type equations, R. Blankenbecler's paper on relativistic aspects of the three-body system, and the extension of Faddeev's work to the  $N$ -particle case by Faddeev's student O. A. Yakubovsky.

The experimental papers deal primarily with the search for resonances and excited levels of the three-body system and the investigation of low-energy scattering parameters of the two-body interaction in the final state of the three-body system, as well as with three-body final states. The Watson-Migdal model is often made use of, sometimes successfully and sometimes not very.

As R. E. Peierls observes in his closing summary of the conference, one appealing aspect of both the theoretical and the experimental papers is that they keep details of techniques and numerical-computational methods to a minimum and focus primarily on results. There is a wealth of results in this volume, especially of an experimental nature, and it is this feature I would like to emphasize. Another appealing feature is that the discussion that followed the presentation of papers seems to have been reproduced in full. One finds that one can often extract an additional ounce of wisdom from any given paper in perusing the post-

delivery discussion. Finally, the bibliography seems to be more than adequate.

The articles along with the abstracts of contributed papers present a fairly satisfactory picture of the activity in the field of three-body calculations. This volume can be useful to workers in the field, but is not recommended for novices in the three-body problem.

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## Satellite Data Interpreted

**Plasma Waves in Space and in the Laboratory.** Proceedings of a NATO Advanced Study Institute, Røros, Norway, April 1968. J. O. THOMAS and B. J. LANDMARK, Eds. Elsevier, New York, 1969–70. 2 vols. Vol. 1, viii, 488 pp., illus. \$23.50. Vol. 2, x, 564 pp., illus. \$21.

Plasma in space and plasma in the laboratory are particular examples of the same medium, and, although the parameters are vastly different, one expects to encounter the same physical phenomena albeit on different temporal and spatial scales.

This was once more convincingly demonstrated at the NATO Advanced Study Institute of which these volumes are the proceedings. The central theme of the discussions was measurements by the Alouette 1 and 2 and the Explorer 20 satellites and their interpretation. The proceedings are therefore considerably more specialized than the general title would suggest.

The most exciting, because unexpected, new information was provided by the topside sounders that detected plasma resonances at certain frequencies. The resonances that occurred at harmonics of the electron cyclotron frequency were identified as Bernstein waves, and it is probably in the interpretation of these resonances that a close coupling with laboratory plasma physics becomes most apparent. Because of their interesting dispersion characteristics Bernstein waves have been investigated extensively in the laboratory, and they are used more and more for the study of novel plasma effects. It is also not surprising that the few laboratory experiments on plasma waves that are reported in the proceedings deal mostly with aspects of Bernstein waves.

A considerable fraction of the papers is devoted to the performance of an-

tennas in an ambient plasma, a crucial experimental problem in space physics. The theoretical analysis of the coupling between antennas and plasma has reached a high degree of sophistication, and it is encouraging to see that good experimental data on this phenomenon are gradually becoming available.

The third main subject is very low frequency phenomena, which cover the audio and subaudio frequency range. Drift waves and drift instabilities are increasingly recognized as possible important sources of such phenomena. Since drift waves have been studied in great detail both theoretically and experimentally, this might be another area where space and laboratory plasma physics can greatly benefit from each other.

The proceedings contain surprisingly little work on nonlinear aspects of plasma waves. It is probably safe to predict, however, that there will be much more emphasis on nonlinear effects in space plasmas as time proceeds.

The format of the proceedings deviates from the usual pattern in that the papers are divided among two volumes. Volume 1 contains invited papers that are supposed to provide introductions and reviews, whereas volume 2 is reserved for contributed papers. This commendable scheme, however, was only partially successful. Apart from excellent review papers, notably those by Thomas and Andrews on resonances in space and by Crawford on laboratory plasma wave experiments, volume 1 also contains several short and specialized contributions which appear more appropriate for volume 2.

The proceedings are nevertheless an excellent collection of generally high quality, and the subjects it deals with are ones that researchers in space plasmas and laboratory plasmas alike should find extremely stimulating.

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## Ion Solvation

**Electron Transfer Reactions of Complex Ions in Solution.** HENRY TAUBE. Academic Press, New York, 1970. viii, 104 pp., illus. \$5.75. Current Chemical Concepts.

This book is an updated and expanded version of four lectures given at the Polytechnic Institute of Brooklyn in 1967. The material covered reflects to