

of the Hartmann Type, by Yu. Ya. Borisov, concerns the radiation of high-intensity sound into gases by devices that utilize the instability of a supersonic gas jet directed into a resonator. This article is a critical analysis of the theoretical and experimental problems encountered in the design of gas-jet generators. It also describes some practical gas-jet generators that have been developed for industrial use. The longest chapter is devoted to stem-jet generators, a modification with a solid core along the jet axis; Borisov considers these to be the practical answer to the high power and stability requirements of industrial applications. The field of gas-jet generators is filled with conflicting reports, and in general Borisov is careful to indicate which results and beliefs are not firmly established. One major subject of dispute is the mechanism by which the sound field is generated—by relaxation or by resonance. Borisov presents both sides of this question. An underlying message throughout the article is that the evaluation of experimental data has been greatly hindered by the lack of adequate standard techniques of acoustic measurement. Borisov is critical of conclusions based on pointwise measurements, and he urges instead the use of integral measurements.

Part 2, Ferrite Magnetostrictive Radiators, by I. P. Golyamina, describes the properties of magnetostrictive ferrite materials and their use in transducers for industrial applications. Golyamina indicates that, opposing their advantages, ferrite radiators have limited durability and a limited intensity output. Of particular interest is her emphasis on the importance, in the selection of a radiator for high-intensity application, of nonlinear effects associated with large amplitudes of elastic stress and of magnetic induction. One reason is that nonlinear effects impose upper limits on the vibration amplitude and radiation intensity. I found some of the general material in part 2 confusing because the author presents many facts but relatively few unifying concepts.

Part 3, Ultrasonic Focusing Radiators, by L. D. Rozenberg, is aimed at the problem of generating acoustic fields of extreme intensity in liquids. The first chapter is a concise summary of theoretical results for the pressure, velocity, and intensity in the focal region of a converging spherical or cylindrical wave front. Rozenberg stresses the conditions for optimal focusing. A chapter on absorption tells how non-

linear absorption sets an upper limit on the intensity. Finally, Rozenberg describes the ultrahigh-intensity radiators that he and his co-workers have used in studies of acoustic cavitation. These radiators are capable of producing intensities of nearly 150 kilowatts per square centimeter, whereas conventional focusing radiators generate intensities of only a few kilowatts per square centimeter.

The book as a whole is clear and well written. It should prove helpful to anyone who seeks a broad view of these subjects, with some guidance toward what the problems are and where more work is needed.

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Explorations in Systematics

Systematic Biology. Proceedings of a conference, Ann Arbor, Mich., 1967. National Academy of Sciences, Washington, D.C., 1969. xiv + 634 pp., illus. \$15. NAS Publication 1692.

This book consists of the proceedings of a conference held at the University of Michigan in June 1967. The chairman of the organizing committee, who also prepared the preface and presumably edited the book, is Charles G. Sibley. The book consists of 18 papers on different aspects of methodology and principles of systematic biology. For nearly all of these papers, the remarks of two or more formal discussants have been published, together with edited transcripts of the informal discussion that followed. Although the authors are mostly Americans, a significant number came from other countries so that the conference was justifiably billed as international.

As in any work of this sort there is much diversity in the objectives and presentations of the various authors. The historical review, for example, falls short of the needs of most modern systematists because it scarcely touches upon the post-Darwinian period. Most of the articles are review papers in their various fields. The objective of the conference was clearly not to offer authors an opportunity to report on their original research, and for the most part the papers are not at all like research papers. However, substantial sections of new ideas, as distinguished from new factual material, are included. For

example, we find published here W. H. Wagner's account of "The construction of a classification," an account that has been presented orally on various recent occasions and is now printed for the first time.

The greater part of the book is on systematics rather than taxonomy in the narrow sense. The relations of systematics to ecology, evolution, behavior, cytology, and other fields of biology are explored by a variety of authors. There is a substantial section on molecular data and their use in systematics. A summary of the conference by E. O. Wilson terminates the book.

One might have thought that in a book of this sort emphasis would have been almost exclusively on principles and theory and on those aspects of methodology that concern the uses to be made of characters once they have been discovered and recorded. From these standpoints the kinds of characters used would usually make no difference. Actually, nearly half the book consists of chapters placing emphasis on discovery and use of particular kinds of characters. Thus there are four chapters on molecular data and one each on comparative morphology, isolating mechanisms, behavior, and cytology. Some of these kinds of characters provide special evolutionary, functional, or other insight of various sorts, and therefore have value beyond merely additional characters. Nonetheless, the theoretically oriented systematists' need for and use of more characters than have yet been recorded for most groups is evident.

Broad as the book is in its coverage, there are significant areas of modern systematics that are omitted. One is that of numerical taxonomy or numerical phenetics, an omission that is easily justified by the recent extensive treatment of the field in a readily available book and in the pages of such journals as *Systematic Zoology*. Another major field that is inadequately treated is that of cladistics. It is often, and I believe correctly, concluded that cladistics carried to its logical extreme, as by Hennig, does not provide a suitable basis for classifications, but this is no reason for not considering in some detail cladistic methodology for those things that it can do well, that is, for formalizing the methods by which we determine the branching lines of descent of organisms. Finally it may be mentioned that the field of experimental systematics, a field developed largely in botany although useful also in zoology,

has not been well explained in this book.

There is no doubt that the average systematist should buy this book and read it and that his appreciation of the depth and breadth of systematics will be enhanced thereby.

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Galaxies

Radio Astronomy and the Galactic System. The IAU/URSI Symposium, Noordwijk, the Netherlands, 1966. HUGO VAN WOERDEN, Ed. Published for the International Council of Scientific Unions, with the financial assistance of UNESCO, by Academic Press, New York, 1967. xviii + 502 pp., illus. International Astronomical Union Symposium No. 31.

Astrophysics today is in fruitful turmoil. Pulsars and quasars are relatively new mysteries while, more than 100 years after the discovery of the spiral nebulae by Lord Rosse, there is no generally accepted theory of the dynamics and structure of spiral galaxies. One has the feeling that surely the dike will break in the next five years, giving some basic answers about objects of galactic dimension, but this volume reveals that while the observers make one breathtaking discovery after another, leading theorists cling to elaborate reworking of an old purely gravitational model for spiral galaxies that, after *four* decades, still does not fit the facts. Models in which the galactic magnetic field plays a role comparable to that of gravitation are almost ignored at this symposium, although the protests of the distinguished Soviet astronomer Pikel'ner are duly recorded.

An enormous variety of subjects are reviewed in this volume, which is the proceedings of an international symposium attended by 87 invited participants. The book consists of three parts, subdivided into 16 subsections, one part on interstellar clouds, the second on the interstellar gas, and the third on the Galaxy as a radio source and galactic magnetic fields. Actually, despite the phrase "radio astronomy" in the title, almost all the information that bears on the Galaxy as a whole, whether from the optical, radio, x-ray, or other regions of the spectrum, or from extragalactic studies, is touched upon in some fashion in this stimulating and tremendously informative volume.

Some of the extremely active and sometimes controversial topics to which subsections are devoted are interstellar molecules, physical processes in the interstellar medium, the spiral structure of the Galaxy, the galactic halo, the galactic magnetic field, the galactic nucleus, cosmic rays in the Galaxy, and x-rays in the Galaxy.

With a very active Union, astronomy is probably reviewed more thoroughly and more often than most fields of science. Unfortunately this has led to some defects. One is the custom of having the same person review a topic in one symposium after conference after "institute" after another. Inevitably those who work in the field can predict what viewpoint will be stressed. However, repetition of the conventional wisdom does not guarantee truth.

A second foible of astronomers is their tenacious devotion to purely gravitational theories. Thus, the group of papers on spiral structure does all but proclaim the success of the density wave theory whereas, in this reviewer's opinion, its success is totally illusory. In his introductory report, Prendergast actually uses most of his article to describe the Lin-Lindblad model. This paper is then followed by an article by Lin and Shu. No mention is made of the competing magnetohydrogravitational model for spiral galaxies proposed by Greyber in 1960 and refined since then, and crucial evidence that casts doubt on the density wave model, such as the careful research by M. E. Dixon which reveals the need for non-gravitational forces in explaining spiral arms, is not even alluded to.

Moreover, no mention is made of the famous observations of M31 by the late Walter Baade at Palomar, who discovered a large-scale spiral pattern from about 100 parsecs from the galactic nucleus to a radius of 20 kiloparsecs, since they conflict with the density wave model which permits such a pattern only outside the Lindblad resonance, or from about 4 to 12 kiloparsecs. Another serious objection to a purely gravitational model, the "anti-spiral theorem" due to D. Lynden-Bell, is blithely dismissed by Prendergast with some blarney about removing symmetries.

Similarly L. Woltjer, in a poorly written final chapter of the volume, mentions the Hoyle-Ireland model of a tightly wound helical magnetic field, strongly sheared, to explain the Faraday rotation data but does not mention the much simpler model due to Grey-

ber which fits the same data, that is, a topology where the magnetic field runs along the spiral arm in one direction above the galactic plane and in the opposite direction below the galactic plane. Additional virtues of the Greyber model are that the configuration has already been observed in the magnetotail of the earth and that star formation is simplified in the neutral magnetic field sheet.

Only a careful reading of the discussion comments by S. B. Pikel'ner (U.S.S.R.) and H. Alfvén (Sweden) can save the nonexpert from a badly one-sided impression of these vital issues.

However, the vast majority of the reports are impartial and excellent. The pair of papers on the high-velocity gas at high galactic latitudes, by Blaauw *et al.* on the observations and by Oort on the interpretation of the observations, present an important new topic with exceptional clarity. Especially worthy of praise are the reports by B. J. Robinson, J. E. Baldwin, E. M. Burbidge, and B. B. Rossi. Of course, such very recent discoveries as pulsars and the newer interstellar molecules are not reported.

With clear printing, good indexing, and an exceptionally low number of misprints the volume reflects credit on the editor. This volume is a "must" for any serious research worker in galactic structure and dynamics, and especially for those who are concerned with our Galaxy.

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Cellular Activity

Protein Biosynthesis and Membrane Biochemistry. Richard W. Hendler. Wiley, New York, 1968. xiv + 354 pp., illus. \$11.95.

The literature of the last decade on protein biosynthesis can be a discouraging experience for the beginning student. All too often it conveys an atmosphere of triumphant self-satisfaction, a sense that the major problems have been solved and that current activity in the field is largely a mopping-up operation. The characteristic activity of the molecular biologist, that of performing slightly more elegant experiments to confirm the obvious, lacks the tang of adventure which inspires and motivates. Furthermore, the reader will search in vain for intimations of the origins of