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 nongravitational 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 "antispiral 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 Greyber 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 our present knowledge: the nature of the difficulties that confronted the pioneers and the devices used to overcome them. Now that we have passed the crest of the wave of success such insight may be essential for establishing the bases of the next hypotheses. Empirical digging and a sensitivity to incongruous fact are now the order of the day, if we are to come to grips with the mysteries of regulation in differentiated cells.

Hendler's book is a timely antidote to complacency, a reminder of how little we really know, a compendium of odd observations and discrepancies in our understanding of protein biosynthesis, a catalog of embarrassing questions. Hendler is well suited to the task of providing such an antidote, having been associated with the study of protein biosynthesis from its early days and having maintained over the years a reputation for skepticism and a frequently irritating propensity for calling our attention to the parts of the machinery we have been throwing away.

All of the protein-synthesizing systems with which we work are grossly inadequate reflections of the cell's synthetic capacity. They generally function at less than 1 percent of the *in vivo* rate. Within the cell, the reactions involved occur in close association with membrane components, and there is increasing evidence that such implied intracellular organization has fundamental qualitative and quantitative effects upon the much simpler reactions we study in the test tube.

The focus of Hendler's book, then, is the application of membrane biochemistry to the study of protein biosynthesis. His first three chapters are a rather personal, but extremely thorough, accurate, and critical review of the history of the development of our present knowledge of protein biosynthesis. In the process of unfolding this history, he calls attention to striking discrepancies between the behavior of *in vitro* systems and events *in vivo*. His close attention to details of experimental work makes this portion of the book useful to the active investigator. He next proceeds to a detailed account of our knowledge of cell structure, membrane structure and biochemistry, and the relationship of hormones and membranes, again taking a historical view with emphasis on experimental approaches. These chapters are useful in orienting the uninitiated researcher in a complex literature, but their balance and completeness are compromised by the absence of citations of important developments since 1966. The final chapter is an attempt to bring together a large number of isolated, often inexplicable and contradictory observations in the literature on protein synthesis as they relate to membrane biochemistry. The problem Hendler faces, along with the rest of us, is to bring some unity out of the present welter of discordant observations. The value of this chapter is largely that its author has taken the trouble to examine the contents of the wastebasket and remind us that we have yet a long way to go in learning how the cell does the job.

Careful attention to isolated observations of more complex systems involving membrane elements will likely bring new insight into biosynthetic mechanism. Hendler has performed a valuable service in the constructive application of his skepticism and wide acquaintance with a voluminous literature.

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Thin Films

Optical Properties of Dielectric Films. Proceedings of a symposium, Boston, 1968. NORMAN N. AXELROD, Ed. Electrochemical Society, New York, 1968. vi + 290 pp., illus. $9.

Most of the 16 contributions contained in this volume have the character of very short review papers. The first contribution, by H. Ehrenreich, gives an excellent intuitive explanation of the different characteristics of semiconductors and ionic crystals that give rise to the observed differences in band gap, even though some features of the band structures remain similar. A good simplified explanation of the rationale behind the pseudopotential method is given. Thereafter the author makes the comparison between the observed and the calculated optical spectra, with particular emphasis on the importance of the critical points of the joint density of states of the electron hole pair. He might have stressed that the experimental identification of many of the critical points in the reflection or absorption spectra is frequently based on a comparison of their energies with a theoretical band structure. The agreement between the observed and calculated energies is not always good. Only in a very few cases has there been an independent determination of the symmetry of the observed critical points.

In the succeeding paper, by K. J. Teegarden, the problem of the identification of the symmetries of the states giving rise to exciton peaks is again evident for alkali halides. Comparison of the spin orbit splittings of the uppermost filled *p*-like orbitals of the different halide ions is used as a guide for the identification of the *s*-like exciton states described by a hole in a Γ_{15} band and an electron in a Γ_1 band. The Γ_{15} band is split by spin orbit interaction. Frequently one of the terms of this exciton doublet is close to the energy necessary to create other excitons. Here again, a more direct determination of the symmetries of the exciton states would be welcome. Teegarden gives a particularly interesting discussion of the ordering of the Γ'_{25} and Γ_{12} band states in fcc and bcc crystals.

H.-E. Gumlich's review paper treats the case of optical transitions in II-VI compounds (primarily ZnS) containing transition elements of the iron group. Crystal field theory has been extensively used to calculate the energy level scheme of the impurity ions. By a comparison of absorption and emission spectra, many of the energy levels that give rise to the optical spectrum are identified. The effect of different external perturbations on the energies of the lines and on the selection rules for optical transitions are extensively illustrated.

A brief review of differential optical techniques developed in recent years is given by W. E. Engeler. These techniques show particular promise for the study of symmetries and details of electronic bands in both thin films and bulk materials. K. H. Beckmann and N. J. Harrick describe an internal reflection spectroscopic technique that appears to be very suitable for studies of surface states, particularly in conjunction with strain or electric field modulation techniques. Papers by R. Jacobsson, by Burgiel, Chen, Vratney, and Smolinsky, and by P. Mark illustrate the difficulties in obtaining thin films with the required stochiometric composition and the effects of chemisorption on their electrical properties. M. Balkanski and R. Le Toullec present data that stress the importance of boundary conditions on the optical measurements of thin films. Organic