analysis applied to ovulation, ultrastructure of endocrine glands, mechanism of hormone action with a molecular biology approach); enigmas (do uterine luteolysin, ectopic neoplastic tissues, and the pineal gland have endocrine activity?); hormone precursors (proinsulin and vasopressin); metabolism of steroid and protein hormones (thyroxine, corticoids, placental lactogen); hormone methodology (assays of protein binding, steroid dynamics). As is to be expected, the quality of the writing varies from scientific gobbledegook to simple, lucid prose; the chapter by Murphy on protein binding and the assay of nonantigenic hormones is a good example of the latter.

One of the delightful features of this series is the discussions following the formal papers. They always provide fascinating glimpses of the sociology of science. One encounters new territory being staked out; irate speakers who feel slighted because *their* research was not cited; completely irrelevant research introduced (the "I have a slide" syndrome). Sometimes the comments are actually pertinent to the papers. The book is highly recommended to anyone interested in recent developments in endocrinology.

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Immunocytes

Cellular Recognition. Fourth Developmental Immunology Workshop, Sanibel Island, Fla., Feb. 1968. RICHARD T. SMITH and ROBERT A. GOOD, Eds. Appleton-Century-Crofts, New York, 1969. xviii + 334 pp., illus. $18.

"Cellular recognition." Most of us, I suppose, know a cell when we see one, but this symposium shows many of us new aspects of the recognition functions of cell membranes. The book should be useful to students and research workers in several areas of cell biology, each of which has some fragment of the nature of the cell surface under its special protection. Though only a beginning in a necessary direction, the volume places many experiments of cellular immunology in the wider realm of all surface-mediated reactions of cells and elucidates some of the wider implications of these experiments. Even more usefully, it will enable students of morphogenesis and differentiation to review some of the literature on the special surface reactions of lymphocytes, reactions which, if they cannot charm their way, will soon force their way into the general literature on cell contacts and interactions.

The book is divided into five sections, each containing both formal papers and informal discussion edited from tapes and transcripts of the meeting. The first section deals primarily with examples of nonimmunologic aspects of the cell surface membrane, ranging from membrane structure and isolation, through membrane chemistry and turnover, to consideration of pinocytosis by magophages and to theoretical and experimental studies on contact inhibition and on the specificity of cell adhesion. Some of these exemplary papers are summaries of extensive and definitive work in the subjects discussed, whereas others, such as that on cell membrane structure, are expositions of one particular point of view on the topic, to be examined rather critically and in the context of others' experiments. All in all, the section serves to remind immunologists that others are and have been puzzling over recognition of the cell surface.

The remainder of the volume is given over in greater or lesser degree to the immunologists. In parts both papers and discussions deal narrowly with their subject. However, in the sections on lymphocyte "homing" in vivo, dealing with these cells' selection of the place and time to leave the circulation and with some of the chemical factors determining this selection, and especially in those sections on the phenomenon termed "allogeneic inhibition," membranologists in general will find much to consider that may direct their thinking about surface specificities in new ways. In the section on homing, Fichtelius and Trentin report observations on the traffic and homing of lymphocytes and bone marrow cells, and Gesner offers strong suggestions that it is carbohydrate molecules on these cells that are responsible for their selective passage from bloodstream to lymph nodes. In the papers on allogeneic inhibition, two family teams, the Möllers and the Hellströms, argue out with Holm and Perlman the mechanism of a particular sort of target cell killing in culture that occurs when allogeneic lymphocytes are mixed with other lymphocytes or with tissue or tumor cells as targets. The experiments presented and their interpretation should be of greatest interest to the membranologists, though the evidence that intimate contact between structurally unlike surface membranes may cause cell death is not yet as strong as it might be. It is to be hoped that the discussion in this area, together with the useful summary of "Direct effects of stimulaton of lymphoid cell populations" supplied on page 271 by the editors, will set many to reading the literature of immunology with new interest.

The collection is recommended as a useful summary to immunologists, though they may be acquainted with the versions of the papers presented which have since been published in immunology journals, and though it barely touches on very recent developments in the study of lymphocyte membrane receptors for antigens and the place of receptor cells in the immune response. The book is highly recommended to nonimmunologists, who may find more to interest them in the literature on immunocytes than they might have expected.

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The Nonneutral Atmosphere

Introduction to Ionospheric Physics. HENRY RISHBETH and OWEN K. GARRIOTT. Academic Press, New York, 1969. x + 334 pp., illus. $16. International Geophysics Series, vol. 14.

Ionospheric research is now about four decades old. During the first three decades, the ionosphere was investigated primarily by radio methods from the ground; in fact, the existence of the ionosphere was established as the result of interpreting the early radio transmissions of Marconi at the turn of the century. For many years, ionospheric investigations were largely the domain of workers concerned with radio propagation. Fundamental theoretical work in this field was performed in the early 1930's primarily by S. Chapman and later on by many others. During the past ten years ionospheric physics has

also become a "space science," since sounding rockets and satellites make *in situ* measurements of the ionosphere possible. In addition, a new and powerful ground-based technique, the incoherent backscatter radar, has extended the capability for observing the characteristics of the ionosphere. These new methods have greatly increased the number of observables of the ionosphere, which were previously restricted to the charged-particle density distribution. Furthermore, the relationship between ionosphere and magnetosphere and the role which the neutral atmosphere dynamics plays in affecting the ionosphere have recently been elaborated.

The present book gives an excellent introduction into these aspects of ionospheric physics. It reviews the properties of the neutral atmosphere whose ionization by various sources of radiation leads to formation of the ionosphere, as well as chemical and transport processes. The book also covers in a concise way the morphology of the ionosphere, a subject which has usually been treated in great detail in previous books, special effects, such as eclipses and solar flares, and the role of geomagnetic disturbances in the ionosphere. The authors have discussed adequately the experimental techniques and have provided a good description of the physical processes and their relation to the observations, giving a broad view of the present understanding of ionospheric physics.

Unfortunately, the book contains some misleading nomenclature. One of the upper regions of the ionosphere where helium ions are thought to be important is called "heliosphere." This term, however, is now reserved for the sphere of influence of the solar wind. There is also some inconsistency regarding the upper boundary of the ionosphere, which is sometimes identified with the "magnetopause" and sometimes with the "plasmapause."

This book is the first comprehensive treatment of the ionosphere since the IGY and provides an excellent and up-to-date survey of ionospheric physics. It can be highly recommended as an introduction for graduate students and nonspecialists, but it will also be a worthwhile addition to the libraries of all researchers in this field.

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