paid by most electrochemists to the cleanliness of their surfaces, and, I believe, any correlation between theory and experimental results is either forced or accidental.

The final two chapters deal almost completely with the solution and double layer. There is a large amount of mathematics, and with a sufficient number of assumptions and simplifications the usual agreement between fact and theory is found.

All the chapters have excellent bibliographies and are mainly reviews. In some instances it is difficult to separate review material from original material without consulting the pertinent references. The main usefulness of the book will be as an overall picture of the solution and double-layer side of electrosorption as viewed by Bockris and his group in Pennsylvania. The book will be helpful for its references and as a guide to present knowledge of electrosorption. It is unfortunate that the price is high.

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Immunology

Germinal Centers in Immune Responses. Proceedings of a symposium, Bern, Switzerland, June 1966. H. COTTIER, N. ODARTCHENKO, R. SCHINDLER, and C. C. CONGDON, Eds. Springer-Verlag, New York, 1967. xvi + 499 pp., illus. $19.50.

As is noted in the introduction to this symposium, the study of germinal centers of lymphoid tissues has yielded a great deal of information in the last five to ten years, after a period during which much was said about these structures but little was known with reasonable certainty. During the era of speculation various functions were attributed to germinal centers, but all were disproven by further experiment. The participation of these centers in immunological responses has now been supported by numerous studies in various laboratories, however, and it is quite apparent that it can no longer be denied.

The bringing together of a distinguished group of investigators from several parts of the world for this first conference on the germinal centers in immune response was a timely and necessary undertaking. The publication that has resulted from the conference brings to investigators of immunological phenomena and of lymphoid function a wealth of contributions on various aspects of germinal-center function.

The book is divided into 18 sections, which deal with aspects of germinal-center function and structure ranging from the phylogenetic and ontogenetic development of the centers all the way to their role in neoplastic disease.

It is already apparent, from the initial contributions on the development of germinal centers, that the exposure of animals to environment, with its myriad of antigens, is important to the development of germinal centers and that—although no definite proof of this is offered in any of the contributions in this volume—these centers are therefore quite closely related to the development of immune responses. The excellent paper by Yoffey and Olson on the formation of germinal centers in lymph nodes goes a long way to clarify many ideas on germinal-center histology and histogenesis. Also of note is the group of contributions in which the ultrastructure of germinal-center cells is described. The active localization of antigen in and around germinal centers makes it appear that they are an important part of immune response. Whether this localization is more important in a primary response or in a secondary response is a question that is still under active investigation. The paper by Young and Friedman should be singled out for the very interesting technique it reports for demonstrating the presence of antibody in germinal centers. Young and Friedman's work is nicely supported by that of Pernis and of Burtin and Buffe. In fact, the entire section on antibody formation in germinal centers leaves one with little doubt that this is indeed a true and not an imagined phenomenon. Of course, there is still the open question of what happens to the cells that are formed in germinal centers and whether they migrate from the center or remain there; White points out well the importance of this problem. The turnover studies reported deal in detail with this question. Interesting data are presented on the kinetics of lymphoid cells within germinal centers and on the migration and death of the cells in immunized and in nonimmunized animals. Germinal-center cells appear to move freely in and out of centers, and antibody-forming cells which are contained in the centers may at later stages migrate out into cortical areas of lymph nodes of red pulp of the spleen. The book also deals at some length with the importance of germinal centers in another type of immune response, that related to delayed hypersensitivity. The examination of germ-free animals has revealed very few germinal centers, again pointing to the likelihood that germinal centers are involved in the development of responses to external antigenic stimuli.

In addition to the studies directly related to germinal-center structure and function, the book includes some papers that have to do with lymphoid structure and function in general. This combination is good, since the lymphoid tissue consists of several compartments intimately related to one another.

In summary, this is a well-organized, well-edited symposium which will be of great value in providing some answers but also in raising a large number of questions. One hopes these will be answered in future symposia of this kind.

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Limnology

The Biological Basis of Freshwater Fish Production. A symposium sponsored by the Sectional Committee on Productivity of Freshwater Communities of the International Biological Programme, Reading, England, Sept. 1966. SHELBY D. GERKING, Ed. Wiley, New York, 1967. xiv + 495 pp., illus. $15.

The limnologist deals with an alien world, the world of water, and perhaps the only methodological advantage he enjoys is that from the very beginning he has had access to a series of ready-made microcosms of graded size and complexity. Even though laboratory aquaria are not small fish ponds, fish ponds small impoundments, or impoundments small lakes (for each has its own peculiar characteristics), some general rules govern them all, and what the scientist finds out about one type of microcosm can be applied, with appropriate reservations, to the others. In addition, the common problems faced in working with water have encouraged the limnologist, the fish culturist, and the fisheries biologist to seek one another's help in both theoretical and practical matters. Any systematic study of freshwater fisheries is therefore likely to contain information of significance

to all ecologists. The present volume is certainly no exception.

Moreover, the book centers around productivity, which is one of the basic concepts of limnology, as well as a practical measure of success in fisheries management. The quantity of fish produced per unit time can be influenced by almost every conceivable kind of ecological interaction, but only those shown to be of major importance or amenable to new methods of study are considered. Growth, fecundity, metabolism, predation by and on fish, fertilization of waters, and density-dependent regulating factors are some of the "traditional" parameters treated. Migration and lesser movements, rate of digestion, larval behavior, and aggressive interactions with and without territoriality are some of the newer ones. The methods of studying all of these are discussed critically and in detail. The special problems encountered in sampling fish populations, estimating mortality rates and the numbers of fish, and measuring fish production itself are reviewed.

Of the 28 authors, 16 are from Europe, and Israel, Japan, and the Congo Democratic Republic are also represented. The non-English literature receives much more than the nod customarily accorded it, but the fishes and ecological situations dealt with are almost entirely those of the North Temperate Zone. Although the book could hardly be used as a text, because not all major aspects of the ecology of freshwater fish are given adequate treatment, it would serve admirably for supplemental reading. Professionals, especially those involved in fish production or conservation, are sure to find worthwhile reading in it.

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Deep-Earth Geophysics

The Earth's Mantle. T. F. GASKELL, Ed. Academic Press, New York, 1967. xiv + 509 pp., illus. $26.50.

Nearly eight years have elapsed since the Upper Mantle Project was brought into being at the Helsinki meeting of the International Union of Geodesy and Geophysics. In that period the quantity of research effort, both by institutions and by governments, has increased several times. It is no longer possible for a single investigator or group to hold effective leadership in all the many aspects of research on the earth's interior. Communication of progress to the earth-science community as a whole has not been as effective as it might, with the usual mechanisms of journal articles, textbooks, and review volumes. This book, although in the latter format, has a good deal of the cohesion of a textbook, owing to a substantial contribution, both explicit and implicit, by the editor. It may be recommended as by far the best single-volume reference-textbook on general matters of the earth's interior.

The subject matter is taken up in the conventional categories, and the authors are drawn from an equally unsurprising list of major names. By comparison with other review volumes, this one stands out for the way the parts fit together in a whole. Several topics are treated in more than one paper: heat flow by both Von Herzen and Lubimova; convection theory by Knopoff and Tozer; seismology by Bullen, Lehmann, and D. Anderson; density and composition by Kuno, Clark, and Ringwood and D. Anderson. The final two papers, by J. Tuzo Wilson and S. K. Runcorn, provide an appropriate frosting of theory and speculation. The student is given an opportunity to compare brands; it becomes unnecessary for the reviewer to offer dark warnings about papers with which exception might be taken.

The editor's excellent opening chapter provides an appropriate overview of the material. It is also recommended to the general reader, since it gives a good sense of the where and why of the public investment in deep-earth geophysics. By an accident of timing, this book was assembled just prior to the discovery of very strong evidence for sea-floor spreading, in the magnetic anomaly and earthquake source mechanism data. The implications of this are found in every area of earth science; in particular, the mantle must be regarded as the most important component of the heat engine which drives the horizontal motions of the lithosphere. This book is probably better for its innocence, however, since no good summary discussion of these implications will be possible until some of the dust has settled in a few years.

The only shortcomings worth bringing up may be laid at the door of the publisher. The price is, as usual, quite steep. The binding warps. The references are given without titles of papers, a real annoyance when the reference list must be frequently used. With respect to content, however, this book is recommended without reservation for both reference use and graduate teaching. I would also suggest that the teacher of general geology might find this a good way to bring himself up to date on recent progress.

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Denizens of Alaska

Eskimos of the Nushagak River. An Ethnographic History. JAMES W. VANSTONE. University of Washington Press, Seattle, 1967. xxiv + 192 pp., illus. $6.95.

In spite of the fact that more Eskimos live in southwest Alaska than anywhere else, extraordinarily little has been written about them. A few years ago James VanStone decided to join the very small group of anthropologists who are attempting to fill in this gap in our knowledge of the aboriginal peoples of North America. Utilizing a combination of archeological, historical, and ethnographic techniques over the course of several years of research, VanStone has turned his attention to the Eskimos of the Nushagak River region. The volume under review is based primarily on the documentary aspects of this research, supplemented in the appropriate places by ethnographic material. This is the first of what probably will be a series of monographs on this area by the same author.

The book is divided into two major parts. In part 1, entitled Agents of Change, the author treats in separate chapters the influences in the region of early Russian and American explorers, missionaries, traders, commercial fishermen, mining and reindeer herding, and educational and medical services. Each chapter consists of a chronological account of events related to the specific subject being considered. Part 2, in contrast, is comprised of three essentially synchronic studies. Under the heading Emerging Socioeconomic Patterns, VanStone deals in successive chapters with population groupings and settlement patterns in the 19th and early 20th centuries, the yearly cycle at about the same period, and the yearly cycle today. The book ends with a chapter devoted to comparison of developments following the arrival of Europeans in southwestern with those in northwestern Alaska.