histology that was opened up by the electron microscope. The book therefore covers a field more familiarly known as molecular biology. The book is well made; almost all the electron micrographs are excellently reproduced.

The overall coverage, though broad, is uneven. The subject of lipids and membranes, the author's principal interest, is covered *in extenso*; it is unfortunate that the present vigorous research activity relating to membranes and the conformation of proteins within membranes should have arisen while the book was being written or after. The subject of mineralization and calcification is presented succinctly and well, and its treatment fills a gap which many books of this nature have left open. The subject of striated muscle is well covered in an up-to-date manner, although little is said of smooth muscle. Nothing is said about the mitotic apparatus, although an attempt is made to resolve the present complicated picture of the mammalian chromosome structure. The structure and conformation of collagen and elastin are discussed in some detail, but no mention of cross-linking is made with respect to either protein. The structure and function of enzymes are discussed, allosterism is mentioned, and the chapter is brought right up to date by the example of the interaction of lysozyme with its substrate as defined by recent x-ray data, but no mention is made of feedback inhibition.

The book includes a summary of methods of ultrastructure research, and here too the coverage is uneven. The subject of x-ray investigation is covered in a very broad manner; in many cases the breadth exceeds that necessary to give an appreciation of the power and limitations of the method, which surely is the justification for presenting the topic. By contrast, ultracentrifugation is barely mentioned, and although electron microscopy is covered in some detail, little reference is made to freeze etching and none to the scanning microscope.

The book is intended for students as well as research workers in molecular biology, and for the needs of the former the chapters close with lists of well-chosen sources for further reading. For the research worker the lack of direct reference for many of the statements in the text is annoying; some snippets of information are given which a worker might well wish to pursue, but no reference or comment on authors is given to aid in the identification. Some such reference should be given to validate the statement that the 60*S* ribosomal subunit in mammalian cells contains two RNA molecules

In summary, this book presents an informative discussion of the roles of small molecules and macromolecules in cell function and in the building up of tissue. The fundamentals of intermolecular relationships, including the subjects of solvation and micelle formation, are discussed, and the more important methods of investigation are reviewed. The author has successfully condensed this mass of information into an easily read book of reasonable size.

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Neuroembryology

Aspects of Neural Ontogeny. A. F. W. HUGHES. Logos Press, London; Academic Press, New York, 1968. xii + 249 pp., illus. $12.50.

Hughes deserves our gratitude for authoring the only book devoted exclusively to neuroembryology to appear in recent years. This short but fact-laden book of four chapters is concerned primarily with the interactions between the nervous system and the periphery during development of the vertebrate limb, and features Hughes's own research on amphibians. Two other subjects are discussed. One, the history of the neuron concept and description of the genesis and growth of neurons and Schwann cells, occupies the first chapter. This chapter is presumably intended to serve as a background for the following chapters, but its themes are rarely integrated into later sections. The other, the famous experiments on regeneration of cutaneous and optic nerves, is briefly summarized in the final section of chapter 4. Despite the narrow focus, Hughes has laced his account with bibliographical references to a somewhat wider field. Perhaps the best feature of the book is that it will serve as a useful guide to the literature.

Although its very uniqueness makes it valuable to the student of neuroembryology, this work has two major shortcomings. First, without being otherwise subjective, it is centered squarely upon Hughes's personal interests and provides no evaluation or even enumeration of the major problems with which neuroembryologists are grappling. Unless the reader has some background in the neurosciences, he might forget that there are other major areas of research in neuroembryology, such as the role of the nervous system in insect morphogenesis and the development of the vertebrate brain. Second, and more disappointing, although the chapters are subdivided into discrete topics which follow a logical order, the material in each subdivision is presented in an undigested manner. The contributions of individual investigations are briefly summarized, often with verbatim quotes from the publications. These summaries are strung together with virtually no evaluation or synthesis. Thus one is usually left with a puzzling assortment of hard and soft facts. Such extreme objectivity is hardly more useful than a simple bibliography. Hughes has forfeited his opportunity to advance valuable opinions or to excite the reader with interesting speculations and hypotheses.

Hughes's book is offered not only as an account of limb and spinal cord development but also as an enticement to prospective biologists to become neuroembryologists. Those students who survive the struggle with the difficult prose and the often conflicting data may emerge irritated and frustrated and aroused enough to do just that—in which case Hughes's book will have been a great success.

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Surface Phenomena

Contact and Frictional Electrification. W. R. HARPER. Oxford University Press, New York, 1967. xii + 369 pp., illus. $11.20. Monographs on the Physics and Chemistry of Materials.

The author writes that this book is intended solely to present arguments that the charging of insulators is not due to electron movement. Nevertheless, the reader will find that it is in general an excellent review of the field as well as a significant contribution to a rather complex subject. The author has been active in the field for many years, and a considerable fraction of the experimental results presented are his own. His arguments are convincing and well thought out, though he tends to oversimplify the problem somewhat

(for instance, he says little about the possible roles of crystal imperfections in surface charging).

The book consists of three parts. The first introduces the basic problems, the second is devoted to the theoretical aspects, and the third consists of interpretation of the experimental data in light of the considerations of the first two parts. Parts 1 and 2 will be of interest even to those readers not directly concerned with surface charging, for the author tackles such fundamental problems as the nature of solid surfaces and surface phenomena. His treatment of the quantum mechanical aspects is one of the most lucid (and readable) I have seen. His treatment of the nature and behavior of solid surfaces is also clear, and he demonstrates considerable insight into the subject. The author's only fault in this instance is that he makes virtually no reference to the important advances of the 1960's.

The reader will find Part 3 somewhat anticlimactic. The author tends to forget the basic purpose of the book and ends with a rather unnecessary discourse on textiles. This reviewer feels that the pages devoted to textiles could much more profitably have been spent on a summary of the problem, logic, and conclusions (no such summary appears in the book). The book also suffers from an extremely meager subject index. Nevertheless, the book's readability, its clear exposition of the subject, and the author's obvious familiarity with the field make it a worthwhile contribution. Those concerned with such apparently diverse subjects as atmospheric electricity, nucleation, mine and industrial safety, adhesion, and surface physics in general will find this book to be of considerable interest.

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Cosmologist and Critic

Le Livre du Ciel et du Monde. NICOLE ORESME. Albert D. Menut and Alexander J. Denomy, Eds. With a translation from the French and an introduction by Albert D. Menut. University of Wisconsin Press, Madison, 1968. xiv + 778 pp., illus. $17.50.

Nicole Oresme completed his *Livre du ciel et du monde* in 1377, at the request of Charles V of France. It consists of a French translation of Aristotle's *De caelo* (*On the Heavens*), accompanied by Oresme's commentary interspersed throughout the text. In Oresme's opinion, "never in this world was there a book on natural philosophy more beautiful or more powerful." In this superb new edition, Albert Menut and the late Alexander Denomy have supplied us with the medieval French text and a modern English translation on facing pages, preceded by several brief introductory chapters. Their scholarship, from beginning to end, has been of the highest order, and we are in their debt for this contribution to the growing corpus of medieval scientific works in modern editions and translations.

In his commentary Oresme attempts, in the first place, to make Aristotle intelligible to the educated layman by explaining and illustrating the text of *De caelo*. But often Oresme finds the Aristotelian theory untenable, and on such occasions he vigorously attacks the Philosopher by calling attention to flaws in the argument, describing observations that teach otherwise, and noting inconsistencies between this and other Aristotelian works. It is thus evident that Oresme's Aristotelianism was far from rigid. Indeed, he was in the forefront of the attack on Aristotle in the 14th century; he was a leader among those who, without formulating a systematic alternative, were with increasing vigor expressing their dissatisfaction over the details of the Aristotelian system. Thus Oresme reveals himself to be an original and creative thinker not by formulating a new philosophy of nature but by advancing many novel and creative criticisms of the old philosophy of nature.

Some of Oresme's novelties are already rather well known: for example, he argues at considerable length for the diurnal rotation of the earth, before concluding against it (pp. 521–39); in the course of this exposition, he presents several of the arguments later advanced by Copernicus for the mobility of the earth. He also discusses the plurality of worlds, arguing that if there were more worlds than one, each would have its own center of gravity (pp. 167–79); he affirms the possibility of a void space beyond the heavens (p. 177); he even speculates about the possibility of oval planetary spheres (p. 391). His ideas about local motion are of particular interest: he argues, for example, that a perfectly smooth sphere rolling on a perfectly smooth table can be moved by any force however small (p. 493); he imagines a tunnel piercing the earth and notes that whatever makes a heavy body descend to the center of the earth will also cause it to ascend after passing the center (p. 145); as an alternative to Aristotle's simple ratio relating motive power, resistance, and speed, he defends Bradwardine's exponential function (pp. 111–13). Finally, among the topics that most fascinated Oresme were the mathematical perplexities associated with incommensurability and infinity, to which he returns repeatedly (pp. 103–11, 119–21, 197–205, 427, 599–603).

This volume will not be light reading for the 20th-century scientist; not only is the conceptual framework unfamiliar, but the commentary form of the treatise demands a maximum of concentration if the reader is to follow the argument. It is therefore likely to be of greatest value to professional historians of science. Nevertheless, for anybody who perseveres there are many treasures to be found and much insight to be gained regarding the nature of medieval thought.

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Philosophical Trends

Boston Studies in the Philosophy of Science. Vol. 3. In Memory of Norwood Russell Hanson. Proceedings of the Boston Colloquium, 1964–1966. ROBERT S. COHEN and MARX W. WARTOFSKY, Eds. Reidel, Dordrecht; Humanities Press, New York, 1968. xlx + 489 pp., illus. $18.50. Synthese Library.

Norwood Russell Hanson was an internationally known philosopher and historian of science who met an untimely death last year in the crash of the plane he was flying. The almost two score brief homages included in this volume dedicated to his memory testify to the high regard and warm affection in which he was widely held, and give the reader a good sense of Hanson's tempestuous intellectual and physical vigor. The volume also contains a useful list of his publications, and reprints an essay by him in which he states at some length and in characteristic style the logical grounds for his forthright atheism.

But the bulk of the book is made up of 18 other papers, most of them originally presented at meetings of the Boston Colloquium for the Philosophy of Science, together with comments on a number of them by participants in the