use of invariance under stereographic projection in the derivation of trigonometric formulas, his synthetic construction of conics and their tangents, and some criticisms of Descartes both for (small) errors and for his use of nonrigorous algebraic methods in geometry!

The two longest papers, constituting most of the last third of the book, are "Geometria Curvilinea" and "Matheseos Universalis Specimina." The former, in axiom, postulate, and theorem format, defines and develops formulas for fluxions and applies them to geometry including maxima, minima, tangents, and center of curvature. The latter, dealing with series expansions and their use in solving equations and computing, was probably stimulated by the receipt of a letter from young David Gregory telling of his forthcoming book extending the work of his uncle James Gregory. Newton apparently overestimated James Gregory's debt to his correspondence. Newton was also concerned to document his correspondence and relationship with Leibniz. It is probably the Leibnizian material included in this part which led the editor to dedicate the volume "To Joseph Ehrenfreid Hofmann, our master in all things Leibnizian."

The period ends just prior to Newton's embarking on the preparation of the *Principia.* The editor attributes to Newton's decision to undertake this work the fragmentary and incomplete nature of some of the manuscripts published here.

This volume is a fascinating mine of sidelights on Newton, his interests and methods, despite the fact that it contains only minor results and papers.

PHILLIP S. JONES
Department of Mathematics,
University of Michigan, Ann Arbor

Adrenergic Mechanisms

New Aspects of Storage and Release Mechanisms of Catecholamines. Bayer-Symposium 2, Grosse Leder, Germany, Oct. 1969. H. J. SCHÜMANN and G. KRONEBERG, Eds. Springer-Verlag, New York, 1970. viii, 302 pp., illus. $13.20.

This symposium brought together experts from all over the world, including recent Nobel prize winners J. Axelrod and U. S. von Euler. The proceedings contain a considerable quantity of new experimental results on norepinephrine metabolism, the origin and fate of synaptic vesicles, and the effects of drugs on these processes. Speculations and conclusions based on preliminary results that are summarized in the papers abound in the volume. In particular, there is much discussion of the origin and turnover of synaptic vesicles, the number of vesicles released per impulse, and the possibility that partial evacuation of vesicles occurs on nerve stimulation. Such discussions will be of considerable interest to the sophisticated expert, but the novice or uncritical reader must be frequently reminded that, like the Queen of Hearts in *Alice in Wonderland,* the authors draw conclusions from quite inconclusive evidence. The experimental results are subject to multiple interpretations, and it is usually the unproven assumptions, rather than the results, that determine the conclusion reached.

Reports of important recent findings are presented by several investigators. The storage and release of chromogranins have been studied by Geffen and co-workers using elegant immunohistochemical techniques. These workers have shown that chromogranins are released from the spleen after stimulation of sympathetic nerves. However, the observation that only a small amount of protein is released, relative to the norepinephrine released, throws some doubt on the view that release of neurotransmitter from nerve endings is entirely analogous to the exocytotic process by which the release of catecholamines from chromaffin granules of the adrenal medulla apparently occurs. The latter process is well summarized in this volume in a communication by Kirshner.

Thoenen *et al.* describe their excellent studies on the effect of 6-hydroxydopamine on adrenergic nerve terminals. Muscholl gives a résumé of experiments concerning the role of acetylcholine in the release of norepinephrine at sympathetic nerve endings. He presents evidence to suggest that nicotinic agents can release norepinephrine from nerve endings, but the process appears to be different from that by which nerve stimulation releases norepinephrine, since agents that block the action of the nicotinic agents do not block the release that follows nerve stimulation. Furthermore, muscarinic agents appear to inhibit norepinephrine release due to nerve stimulation, a finding that raises the interesting possibility that acetylcholine released from parasympathetic nerve endings may inhibit norepinephrine release from adjacent adrenergic nerve terminals.

Axelrod presents an excellent review of the effects of hormones and nervous stimulation on the concentrations of enzymes involved in catecholamine synthesis, notably tyrosine hydroxylase and phenylethanolamine-*N*-methyl transferase. Interesting papers on the effects of drugs on uptake and release of catecholamines are contributed by von Euler, Trendelenburg, Carlsson, and Glowinski.

All in all, this volume is a valuable addition to the abundant literature on adrenergic mechanisms. The spontaneity and liveliness of the exchanges among the participants are very well revealed in the published discussions following each paper and in the general discussion at the end of the volume. The considerable number of typographical errors, the inappropriate use of some English words, and the poor structure of some sentences may tend to confuse the reader at times, but perhaps this reinforces the impression that the discussions were both lively and spontaneous.

NORMAN WEINER
Department of Pharmacology,
University of Colorado Medical School,
Denver

Stages of Development

Embryology of the Baboon. ANDREW G. HENDRICKX. With contributions by Marshall L. Houston, Duane C. Kraemer, Raymond F. Gasser, and Joe A. Bollert. Illustrations by Gerald T. Rote, Jr. University of Chicago Press, Chicago, 1971. x, 206 pp. $15.

To establish the precise sequence of events in development and their timing, it is necessary to employ a system of staging. Despite the introduction of such systems for various species during the past three-quarters of a century, even such a commonly studied embryo as that of the domestic chick still lacks a monograph based specifically on staging. The appearance of such a work on the baboon (*Papio* sp.) therefore is to be welcomed.

The first seven weeks of prenatal development have been arranged by the author in 23 stages patterned after Streeter's developmental horizons in human embryos. Although the term "horizon" has with benefit been replaced by "stage," Roman numerals have unfortunately been retained even

though Arabic numerals are used for other species, including nowadays the human.

The description of the later stages contains much useful information and many illustrations of organogenesis, although, as in the rest of the book, the reproduction of photographs is not of high quality. The least satisfactory portion of the book is that pertaining to the early stages, which admittedly have not yet been fully depicted in the human. Furthermore, quite a number of the criteria used for the early stages are far from clear, and it would scarcely be practicable for a reader to assign a new embryo to its appropriate stage. A clearer indication is needed throughout the book that a number of the topics mentioned are still imperfectly understood and that several of the designated stages are quite provisional.

Chapters on reproduction and laboratory procedures and a succinct account (by Houston) of the placenta are included. The treatment of the fetal period is limited to a series of tables and graphs relating to measurements.

This book summarizes much information that is of interest not only to primatologists per se but also to embryologists and teratologists in general. It is an interesting book despite its deficiencies, and a need exists for further monographs based on the staging of other vertebrate embryos.

R. O'RAHILLY
Department of Embryology, Carnegie Institution of Washington, Baltimore

Eyes and the Like

Invertebrate Photoreceptors. A Comparative Analysis. JEROME J. WOLKEN. Academic Press, New York, 1971. xii, 180 pp., illus. $9.50.

Jerome Wolken has been studying photoreceptors for over ten years in an attempt to understand photobehavior through investigation of photoreceptor structure and pigment molecules. This book is a summary of his group's research and his current ideas, similar in content to his earlier book *Vision* (Thomas, 1966) but reorganized, updated, and improved. Wolken describes and illustrates photoreceptors of twice as many animals as were shown in the earlier book; more than half the figures are new. In this book he compares photoreceptor structure and pigment of animals from Protozoa to frogs in an effort to determine evolutionary trends.

He explores photoreceptor evolution by considering the protozoan eyespot-flagellum system as a primitive "retinal" cell. This interesting idea is developed in a chapter devoted to a detailed discussion of the "photomotion," morphology, and pigments of *Euglena gracilis*. The following chapters contain well-illustrated descriptions of the compound eyes of ten species of insects and Crustacea and of the refracting eyes of squid and cuttlefish. Wolken has expanded his discussion of the remarkable scanning eye of the copepod *Copilia* to include a second species and to show that a posterior lens attached to the open rhabdom functions to increase the light-collecting efficiency by a factor of five.

He reviews knowledge of structure and pigment of the vertebrate rod, to which he compares the invertebrate systems. This includes a detailed chapter on the visual pigments that contains many graphs of absorption spectra.

Wolken finds no smooth phylogenetic development from eyespot to ocellus to compound eye to refracting eye because of wide variation among species of the same phylum. To him, the two most important observations from these studies are that all photoreceptors employ closely packed membranes and that they all contain a common photopigment molecule—a carotenoid or its degraded derivative.

Some of the common features of photoreceptors suggested by Wolken are natural and interesting, but a few of his generalizations are forced and possibly misleading. He states that in all compound eyes adjacent rhabdomeres have perpendicular microtubules. This untenable conclusion is based on inconsistent use of the term "rhabdomere," which is defined as the photoreceptor of a retinular cell. He states that the fly ommatidium has seven rhabdomeres when it actually has eight, as has been shown by Trujillo-Cenóz, and that the bee and wasp have four, whereas they are known to have eight, one for each retinular cell. Also, he compares the amphibian rod outer segment to the fused rhabdom, and although there is a superficial resemblance there is an important functional difference: several retinular cells contribute photoreceptors to a fused rhabdom, whereas the rod outer segment is the photoreceptor of only a single retinular cell.

"Don't bite my finger, look where I am pointing" is a quotation from the late W. S. McCulloch found on the dedication page. Having looked, one may perhaps be permitted a nibble or two.

GARY D. BERNARD
Department of Ophthalmology and *Department of Engineering and Applied Science, Yale University, New Haven, Connecticut*

Books Received

Adaptation and Learning in Automatic Systems. Ya. Z. Tsypkin. Translated from the Russian edition (Moscow, 1968) by Z. J. Nikolic. Academic Press, New York, 1971. xxii, 294 pp., illus. $16.50.

Advanced Experimental Techiques in Powder Metallurgy. Based on a symposium, Pittsburgh, May 1969. Joel S. Hirschhorn and Kempton H. Roll, Eds. Plenum, New York, 1970. viii, 254 pp. + plates. $15. Perspectives in Powder Metallurgy, vol. 5.

Akmak. An Early Archeological Assemblage from Onion Portage, Northwest Alaska. Douglas D. Anderson. Munksgaard, Copenhagen, 1970. 80 pp. + plates. Paper. Acta Arctica, fasc. 16.

Biochemical Evolution and the Origin of Life. Proceedings of a conference. E. Schoffeniels, Ed. North-Holland, Amsterdam, and Elsevier, New York, 1971. xiv, 398 pp., illus. + foldout tables. $23. Molecular Evolution, vol. 2.

Bioinorganic Chemistry. A symposium, Blacksburg, Va., June 1970. Raymond Dessy, John Dillard, and Larry Taylor. American Chemical Society, Washington, D.C., 1971. x, 436 pp., illus. $14. Advances in Chemistry Series, vol. 100.

Conservation. Now or Never. Nicholas Roosevelt. Dodd, Mead, New York, 1971. xii, 238 pp. Paper, $1.95. Apollo Editions reprint of the 1970 edition.

Development Anthropology. Glynn Cochrane. Oxford Univesity Press, New York, 1971. xii, 126 pp. $5.

Diseases of Fishes. Stanislas F. Sniezko and Herbert R. Axelrod, Eds. T.F.H., Jersey City, N.J., 1971. 202 pp., illus. Paper, $7.95.

Electromagnetic Fields and Life. A. S. Presman. Tanslated from the Russian edition (Moscow, 1968) by F. L. Sinclair. Frank A. Brown, Jr., Transl. Ed. Plenum, New York, 1970. xx, 336 pp., illus. $25.

Elements of Econometrics. Jan Kmenta. Macmillan, New York, 1971. xiv, 656 pp., illus. $14.95.

Federal Funding and National Priorities. An Analysis of Programs, Expenditures, and Research and Development. Leonard Lederman and Margaret Windus, with the assistance of Battelle Memorial Institute, Columbus Laboratories. Praeger, New York, 1971. xxiv, 216 pp., illus. $15.

Fluorocarbons and Their Derivatives.

(Continued on page 266)