Book Reviews

Glaciological Updating

Glacial and Quaternary Geology. RICHARD FOSTER FLINT. Wiley, New York, 1971. xiv, 892 pp., illus. $24.95.

This is the third revision in 24 years of the widely adopted and appreciated text by Flint. The title has changed somewhat with each revision, reflecting a changing emphasis in Quaternary science. In 1947 when Flint wrote his *Glacial Geology and the Pleistocene Epoch* the great majority of workers were equating the Great Ice Age with the Pleistocene Epoch of the Quaternary Period, the youngest major subdivision of geologic time, and that epoch was generally said to have begun a million years ago. In 1957 when his *Glacial and Pleistocene Geology* was published, the precise correlation of ice ages with the Pleistocene was being questioned. During the last decade or so, which has seen the application of potassium-argon and uranium dating methods to Quaternary (Pleistocene) rocks, the trend has been to push the beginning of the Pleistocene back to at least 2 million, and maybe 3 million, years ago. Moreover, the expansion of the great Antarctic ice sheet and of high-latitude glaciers in the Northern Hemisphere is recognized to have begun as early as 10 million years ago, that is, well into the Tertiary Period. Thus the identification of ice ages with the Pleistocene can no longer be maintained.

In his new book Flint repeats the plea that he made as early as 1947 for putting the Pleistocene Epoch into a period separate from the several epochs of the Tertiary Period. Dropping the formal terms "Tertiary" and "Quaternary" would greatly play down the importance of the boundary between the Pliocene and Pleistocene epochs, currently a source of much dispute among Quaternary scientists. It is a logical conclusion from Flint's remarks that the next version of this book, if there be one, will be entitled "Glacial and Late-Cenozoic Geology." The author, however, has chosen to use "Quaternary" in his title because it identifies with numerous scientists and organizations of the same name.

Anyone who has used the previous versions of this book will readily recognize this new one. Basically the format and organization of the book have not changed. It begins with a detailed treatment of glaciers and glacial geology (340 pp.); there is an intermediate section on stratigraphic and chronologic techniques (100 pp.); and this is followed by some 325 pages dealing with the Quaternary stratigraphic sequences around the world. Much of the text has been taken bodily from the previous version, but the author says in his preface that the book "contains about 80 percent new material." *Glacial and Quaternary Geology* has 809 pages of text whereas its predecessors had only 535 and 509, respectively. Of the 300 new pages, 100 have been added in the sections on detailed stratigraphy; in particular, the treatments of the stratigraphy of deep-sea floors and of areas outside North America and Europe have been more than doubled in length. These additions, along with a new chapter on "Late-Cenozoic climates" (28 pp.), indicate clearly the broadening in perspective, both geographical and temporal, that has taken place within the past decade or so.

Some other welcome additions are more detailed treatment of glaciology (chapter 3), of the reconstruction of past snow lines (pp. 67–70), of the recognition of till among other diamictons (p. 182), and of stratigraphic procedures (chapter 14). The general expansion is best seen in the list of references, which has expanded from 35 pages in the 1957 book to 70 in the current version; and these are highly selected references.

This book will certainly be widely adopted, although perhaps somewhat less so than its predecessors because of its expanded price. There is no other book under one cover that can claim to give it serious competition in scope, quality, and recency. *Glacial and Quaternary Geology* is a very welcome summary long awaited by all Quaternary scientists.

WILLIAM R. FARRAND
Department of Geology and Mineralogy, University of Michigan, Ann Arbor

Work before the Principia

The Mathematical Papers of Isaac Newton. Vol. 4, 1674–1684. Edited by D. T. WHITESIDE, with the assistance in publication of M. A. Hoskin and A. Prag. Cambridge University Press, New York, 1971. xxxiv, 678 pp., illus. $55.

This fourth of eight volumes merits the same praise for its scholarly analysis and commentary and its excellence in format and production that was bestowed on the earlier volumes when they were reviewed in *Science* (**158**, 245 [1967]; **159**, 1345 [1968]; **165**, 578 [1969]). The editor properly characterizes its content as "important minor papers." These together with the editor's comments have given the reviewer a much enlarged view of the range of Newton's mathematical interests as well as an improved insight into his character and outlook.

Newton was in almost continuous residence at Cambridge as Lucasian Professor during 1674–1684. From a publication viewpoint this was an unproductive period and his major interests seem to have been chemical and theological. Nevertheless these mathematical manuscripts reflect the teacher preparing lectures and giving instruction to "a select company in his own private chamber," perhaps to satisfy the obligation upon the Lucasian Professor to be available to his students twice a week.

The papers reproduced and translated in this volume deal with some topics not normally associated with Newton (number theory, plane and solid trigonometry, annuities and factorization, conics, pure and analytic geometry) as well as with interpolation and finite differences, cubic curves, fluxions, and series. Most of the material in the book has not been published before. The editor carefully notes the internal relationships between different drafts on the same topic as well as their relationship to Newton's published work.

Of particular interest are Newton's

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