Astronomy: Extension of Oppolzer's Canon

Oppolzer's *Canon der Finsternisse*, published in 1887, has long been the standard source of information on solar and lunar eclipses, both past and future. In **Canon of Solar Eclipses** (Pergamon, New York, 1966. 757 pp., illus. $32), Jean Meeus, Carl C. Grosjean, and Willy Vanderleen have extended the calculation of future eclipses to March 2510, three and a half centuries farther in the future than Oppolzer's *Canon*, and have limited themselves to solar eclipses. Their starting point is near the beginning of the present century with the eclipse of 1898 July 18, which is number 7401 on Oppolzer's list. They have wisely not introduced a new numbering system, but have adopted Oppolzer's system and extended it beyond number 8000 to number 8850.

A 31-page introduction gives an explanation of the numerical values printed in the *Canon*, discusses the basic theory and computational details, and gives notes on the practical utilization of the Besselian elements, with numerical examples. Three appendices give numerical comparisons with Oppolzer and with the *Astronomical Ephemeris* for the period 1960–65, and a chart arranging the eclipses according to Saros number and Tritos (135 lunations).

Sections of general data (29 pages), Besselian elements (242 pages), central line data (364 pages), and charts with central lines (58 pages) complete the volume. The tables of Besselian elements and central line data are printed by photo-offset from the original IBM 1620 printout, thus excluding printing errors.

This is a highly specialized work of the greatest importance for observers of future eclipses of the sun. It will probably not find its way into many personal libraries because of its cost, but it should be in every college and university library, or other reference library, which has an astronomy section.

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Interdependency among Organisms

In the preface of **Symbiosis**, vol. 1, **Associations of Microorganisms, Plants, and Marine Organisms** (Academic Press, New York, 1966. 496 pp., illus. $16.50) the editor, S. Mark Henry, states that the treatise considers symbiosis in its broadest meaning, giving equal rank to mutualism, commensalism, and parasitism. This vast area of biology is discussed in eight chapters entitled "Intermicrobial symbiosis" (S. W. Orenski), "Lichens" (V. Ahmadjian), "Bacterial symbiosis with plants" (R. T. Lange), "Mycorrhiza and other plant symbioses" (F. H. Meyer), "Endozoic algae" (J. J. A. McLaughlin and P. A. Zahl), "Symbiosis in marine organisms" (R. P. Dales), "Cleaning symbiosis in the marine environment" (H. M. Feder), and "The experimental analysis of behavior in symbioses" (D. Davenport). All these chapters are well written and authoritative and contain a wealth of data which have not hitherto been available in book form. Many of the accounts provide a historical perspective and may serve as excellent reference sources for the older literature as well as for recent contributions. Most of the classical examples of symbiosis, such as lichens and mycorrhiza, are described in great detail, but there are also many other associations discussed which force one to examine the meaning of the term symbiosis. The Man-Dog relationship is discussed by Davenport to illustrate evolutionary aspects of symbiotic associations. Orenski considers the old type of bakers' yeast to be a symbiosis consisting of various yeast and bacterial species, in spite of the fact that this mixture of microorganisms arose by chance contamination and has merely been preserved by food technologists to ensure a better food product. Perhaps the baker should be included in this symbiosis. It is obvious that even symbiologists are not agreed upon interpretation of terms, as S. Mark Henry calls for a reestablishment of De Bary's original definition of symbiosis, which requires that "the relationship must be constant, intimate, and between dissimilar species." Though there is a lack of uniform definition of terms in this book, most readers will recognize that the ambiguity of terms is unavoidable because of the complex and variable nature of interactions between two or more organisms.

The preface states that this treatise might well serve as a textbook in courses in plant physiology and biochemistry. The contents of volume 1 fall far short of such an objective, not for any lack of competence on the part of the authors, but because of the limited number of topics discussed. Certainly one of the crucial areas of biochemical study of symbiosis is concerned with the control mechanisms whereby cells of one genetic constitution can affect the genetic character, enzyme complements, or cellular activities of other cells. Research in parasitism and virology can contribute much information for the understanding of this aspect of symbiosis, but these are the very areas which the authors have been directed to omit if possible from any discussion. It would seem appropriate that a treatise on symbiosis would attempt to lay a foundation for the understanding of cellular interactions by including one chapter dealing with the molecular basis of how cells may influence the rate or pattern of metabolic reactions in other cells. It would also have been most interesting to have a section on the possible evolutionary development of the eucaryotic plant cell as a result of formation of permanent organelles by one or more endosymbionts. There is a considerable amount of physiological and biochemical data in most of the chapters, but in general Lange's conclusion that "physiology is rarely known beyond superficial qualitative description and biochemistry is typically quite uninvestigated" seems very appropriate. There are a few statements in the text which might surprise some readers, such as "The reduction of nitrogen (N_2) to ammonia is an exothermic process and therefore requires no energy," or "Algae in general are slow growing organisms when compared to other forms of life."

In addition to being a valuable reference source for people working in these areas of symbiosis, this book could be read with interest and enjoyment by anyone associated with the biological sciences. Of particular value to students, perhaps, is the fact that many sections emphasize the great variety and complexity of unsolved problems involved with the interactions of diverse organisms in nature.

Volume 2 will deal with invertebrates, birds, ruminants, and other biota.

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