ken by dynastic change, foreign invasion, or other unfavorable political factors. In Europe, on the other hand, where the social and ideological background was quite different, the making of clocks (and later watches) could readily develop into a mass enterprise. As Needham himself points out, " . . . clock-making in China seems never to have become a mass industry before the time of the Jesuits (as it did in 15th- and 16th-century Europe)."

We look forward with keen anticipation to the appearance of part 3 of volume 4 (on civil engineering and nautical technology), as well as the projected three later volumes.

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Periodic Phenomena

Biological Rhythm Research. A. Sollberger. Elsevier, New York, 1965. xx + 461 pp. Illus. $25.

During recent years research on biologic rhythms has grown in volume and scope. Thus, temporal biology and medicine have become interdisciplinary fields. The physical, mathematical, and engineering sciences have contributed significant techniques and theories that facilitate the quantification of biologic rhythms and, thereby, the endeavors directed toward an understanding of the temporal coordination of physiologic functions as a whole.

The book here reviewed, *Biologic Rhythm Research*, constitutes a general survey of research on periodic phenomena within the animate world. The accents of presentation are placed on theoretical considerations intended to pertain to problems of analysis and to questions revolving around the factors underlying biologic rhythms. The topics discussed include principles of physics and engineering applicable to periodicity, the mathematical and statistical treatment of cyclic functions, cybernetics, and models of biologic rhythms. Applied research on biologic periodicity is referred to in the last chapter. An extensive bibliography accompanies the text.

The material covered in this well-organized, single volume is enormous. The elements of theoretical considerations are presented in the form of an outline, which does not communicate enough information for a thorough understanding of the complexities on hand. The selection of the material included and discussed is somewhat subjective. The author refrains from critical discussion. Unfortunately, "synonyms" for specific terms are used in a confusing fashion. Oscillatory instability in servomechanisms is not necessarily a vicious circle (Fig 1.12d), a square wave-shape does not define an impulse (Fig 1.30a), nor is feedback energy generally supplied by an amplifier (Section 2.25).

A multidisciplinary approach to biologic rhythm research requires familiarity with the scientific background of a diversity of theories and methods, and it requires clarity in the interpretation of terminology contributed by the various disciplines. Omissions along this line contrast with the intention of the book "to offer comprehensive information on biologic rhythm research, but also to provide a basic understanding of future problems."

This diligent and laborious volume is not a textbook for students and researchers starting work on rhythmic functions. It is recommended to the critical specialist in the field as an outline that provides an extensive and most helpful bibliography.

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Comprehensive Botany Text

Strasburger's Textbook of Botany. Rewritten by Richard Harder, Walter Schumacher, Franz Firbas, and Dietrich von Denffer. Translated from the 28th German edition (Stuttgart, 1962) by Peter Bell and David Coombe. Longmans, Green, London, 1965. xviii + 846 pp. Illus. 84s.

Although the major divisions of this text are nearly the same as those of the previous English version, which was published 35 years ago, the content has been greatly improved. In Morphology, the first of four parts, highly diverse subject matter is loosely integrated under such topics as cell size, possible isomers of polypeptides, electron micrograph of a root-tip cell, crystals in cells, interspecific grafts in the alga *Acetabularia* showing the role of the nucleus in determining the morphogenesis of cap regions, mitosis, meiosis, fine structure of cell walls, characters of tissues, morphology and anatomy of the plant body, reproduction, evolution, and grades of morphological organization; in all, this part is ultimately subdivided into 78 subject headings. Within the last-named topic the telome theory is presented lucidly. Anatomical descriptions and gross and microscopic drawings of mature plant organs are dominant, but developmental sequences in the origins of leaf, root, and stem apex are also presented.

Physiology in this text covers not only water relations, mineral nutrition, carbon dioxide assimilation, respiration, protein metabolism, translocation, and secretion but also growth of cells and organs and the transport of growth substances. Movements in plants, influence of environmental factors on plant development, photoperiodism, and heredity are also placed here. The biochemistry of many metabolic steps in higher plants and more universal sequences such as the citric acid cycle are given fairly complete treatment. Osmotic relations are presented more from the biologic than from the physicochemical viewpoint. Auxins are given very brief treatment, and leaf abscission is not correlated with auxin gradients. Kinetin is only mentioned, and the actions of gibberellin are briefly reported in widely separated contexts. Cell, tissue, and organ cultures are not discussed; phytochrome is not treated in appropriate contexts, nor is it in the index.

In the part on systematics, a survey of every major plant group is attempted, resulting in scant coverage of most. A redeeming feature is the survey that follows each division. A more complete presentation of at least one representative within each subdivision would be useful; such a beginning was made with *Funaria*.

Obviously the fourth part of the book, Plant Geography, is again too inclusive. Its second subpart concerns plant communities and would fit better under the heading "Ecology," a word that is used only a few times. Largely ecological are the discussions of succession and the life forms of Raunkiaer (the latter is located in the first part).

A list of references is appended, but only by inference is it possible to correlate superscripts at chapter headings with literature lists that are heavily weighted with older monographs. Owing to its main headings and the index entries this book appears to be more conservative than it really is. True, many topics lack the dynamic or action-spectrum approach, but enough of the experimental bases are alluded

to so that vistas are opened for those who have access to the advanced literature. The specialist, however, will be disappointed because so many topics are treated that none has been presented in depth.

This book has none of the superficialities that characterize so many introductory textbooks. It requires attentive reading and covers plant sciences in a fashion that establishes it as a basic reference text without equal. It deserves a place in every botanical library.

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Bayesian Statistics

Introduction to Probability and Statistics from a Bayesian Viewpoint. vols. 1 and 2. vol. 1, *Probability* (271 pp., $6); vol. 2, *Inference* (306 pp., $6.50). D. V. Lindley. Cambridge University Press, New York, 1965. Illus.

The author writes that "the content of the two parts of this book is the minimum that, in my view, any mathematician ought to know about random phenomena—probability and statistics. The first part deals with probability, the deductive aspect of randomness. The second part is devoted to statistics, the inferential side of our subject." The style is both concise and leisurely, with room always found for careful explanation of mathematical points. The mathematical knowledge assumed of the reader includes calculus and a little matrix algebra, but no measure theory. The book will be accessible and attractive to graduate students of statistics and mathematics and to some advanced undergraduates, as well as to more experienced readers.

In part 1 the axioms of probability theory are interpreted in terms of both objective frequencies and subjective degrees of belief. Bayesian arguments are used throughout part 2. The primary purpose of a statistical analysis of data is to obtain a posterior distribution for the parameters. Since it is necessary to stop somewhere, the author stops short of decision theory and contents himself with displaying properties of posterior distributions.

Excellence of exposition and the current interest in Bayesian thinking make the book welcome. I have read it with pleasure and admiration, mingled with alarm. Many previously published books have given the impression that statistical problems are to be treated in terms of a few glib concepts, notably "confidence intervals" and "significance tests." Surely the greatest merit of Bayesian theory, especially Bayesian decision theory, is that in order to apply it one must ask searching questions about purposes and circumstances, and these may lead to a better analysis. But Lindley seems to think that the traditional concepts are adequate and only need a Bayesian justification to make them thoroughly respectable. He has redefined "confidence interval" and "significance test" so that the old propositions shall have new Bayesian truth. Ingenious, but is this not to pursue Bayesian theory for the wrong reason? Will the next generation of students be just as rigid in concepts as their forerunners, but more confused about the meaning of terms?

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Mathematical Research

Lectures on Modern Mathematics. vol. 3. T. L. Saaty, Ed. Wiley, New York, 1965. x + 321 pp. Illus. $11.75.

This volume, the last in a three-volume series, contains six expository lectures sponsored jointly by George Washington University and the Office of Naval Research. Each speaker was invited to contribute to his description (for the nonspecialist) of a substantial research area of mathematics his individual evaluation of the esthetic and practical aspects of the field, its position in mathematical development as a whole, and its future.

The first article, "Topics in classical analysis" by Einar Hille, covers functional inequalities, functional equations, mean values, transfinite diameters, and potential theory. As Hille points out, the first two topics are closely related and the last three have much in common. Each topic is treated in an expert manner and is relatively easy to follow. Of great help is the short section on orientation that precedes each topic and indicates, in particular, how the problems originally arose.

"Geometry," by H. S. M. Coxeter, is a delightful account of some of the topics of especial interest to the author himself. These include Euclidean geometry, ordered geometry, sphere packing, integral quaternions, conics and k-arcs in a finite plane, hyperbolic geometry, and relativity. Some of these topics may seem a little out of fashion and, at one point, Coxeter remarks that the problem of packing equal spheres in Euclidean n-space has been found to have a practical application in the theory of communication. No excuse (if one were intended) is needed because the areas covered are intriguing to the nonspecialist. It is, in fact, comforting to learn, for example, that "the most natural geometric spaces to use for our four-dimensional diagram [the space-time of relativity theory] are real affine four-space and real projective four-space".

In "Mathematical logic," Georg Kreisel discusses set theory, intuitionistic mathematics, proof theory, impredicative (full) classical analysis, and foundational problems. There are more than 90 pages of text together with 46 footnotes and, as a decidedly *non*-specialist, I found this very difficult to read and to follow. (Several remarks are directed to the specialist.) Near the beginning, in discussing the notion of collection, Kreisel writes that "one speaks of a wood (collection) without or before having counted the trees . . . ." I am afraid that, throughout this article, I could not see the wood for the trees.

"Some recent advances and current problems in number theory," by Paul Erdös, is packed with items which, as the author freely admits, interest him personally. This is all to the good because, although number theory may not be fashionable in some circles, it is still one of the best areas in which to find unsolved problems and to make plausible conjectures. The topics discussed include the distribution of primes, primes in arithmetic progressions, the comparative theory of primes, the arithmetic theory of polynomials, combinatorial number theory, and (briefly) Diophantine equations and inequalities.

There are two parts to the article "On stochastic processes" by Michel Loève: (i) Traditional setup and (ii) Discussion. The first part, which sets the stage for the second, begins with basic vocabulary and notation especial-