other factor of production. But the assumption that every outcome bears a one-to-one correspondence to what is intended not only denies the relevance of market conditions but precludes the possibility of unanticipated consequences in the affairs of men (and women) generally. The conclusions of this book, then, are not the conclusions of social science, but reflect a sense of *Realpolitik* that pervades the official view of all things Soviet, and the "manpower field" generally.

WALTER PHILLIPS
Department of Sociology and
Institute of Labor and Industrial Relations, University of Illinois, Urbana

Theoretical Statistics

The Statistical Analysis of Series of Events (Methuen, London; Wiley, New York, 1966. 293 pp., illus. $7.75) is an excellent book. The authors, D. R. Cox and P. A. W. Lewis, provide an account of important techniques for the analysis of series of point events occurring haphazardly in space or time. The book is unique in providing many real-life examples together with copious data which are analyzed by different techniques in several sections of the book. The subject matter treated is somewhat limited in that essentially only stationary series of point events occurring along a one-dimensional axis are considered. However, this has allowed the authors to study in depth questions peculiar to this class of stochastic processes.

The book presents a great deal of penetrating discussion concerning the analysis of selected examples. It would be useful for the reader to have a knowledge of probability theory at the level of Feller's *Introduction to Probability Theory and Its Applications* (1957). However, much information may be absorbed with less technical background.

Chapter 2 presents an excellent summary of the statistical properties of the Poisson process. New techniques for analyzing trends in data are given in chapter 3, and failure data of air-conditioning equipment presented in a 1963 article by F. Proschan are analyzed. Unfortunately, no comparison is made with Proschan's own analysis, even though there seems to be some disagreement. Chapter 4 is devoted to stationary point processes, with special attention to stationary renewal processes. Here the reader must be careful to note the difference between the usual renewal process and a stationary renewal process. A more formal definition of a stationary renewal process would have been helpful. Results of Kuzretsov and Stratonovich, J. A. McFadden, and others are also summarized. In chapter 5 the authors use covariances or correlation, as well as the usual spectral analysis, for time series and make an interesting analysis of computer failure data.

The authors return to the analysis of stationary renewal processes in chapter 6. A clear and useful discussion of distribution-free tests of goodness-of-fit is given. Tests for Poisson processes which appear to be most useful against stationary alternatives are presented, as well as tests for renewal processes. The subject of renewal processes for distributions with monotone hazard rate is also discussed. It is incorrectly asserted that a monotone nondecreasing hazard corresponds to a convex log survivor function. (It should be concave instead of convex.) Also the t is omitted from the expression $M(t) = t/E(X)$, at the top of page 142. In general, however, errors in the book are few and of a minor nature.

Generalizations of renewal processes are given in chapter 7. One of the more interesting models is that of a branching renewal process and its application to computer failure data. A two-state semi-Markov process is used to fit traffic data. In chapter 8, on the superposition of renewal processes, the authors' investigation of the properties of the component processes in an observed process of superpositions is especially novel and interesting. Reference to the recent work of the Russians Grigelionis and Ososkov should be added to the references cited.

Techniques for comparing two Poisson processes are discussed in chapter 9. Extensive sets of data are given in appendix 1. The exercises in appendix 3 complement topics presented in the various sections. A computer program for some of the methods used is available from one of the authors.

In conclusion, this book can be highly recommended to statisticians and those in the field of operations research as a very readable and stimulating discussion of techniques of analyzing series of events. It will most likely be widely used and referenced.

R. E. BARLOW
Department of Industrial Engineering and Operations Research, University of California, Berkeley

Archeological Dating

Chronologies in Old World Archaeology (University of Chicago Press, Chicago, 1965. 569 pp., illus. $7.50) represents an attempt by 14 American archeologists, under the direction of R. W. Ehrich, to produce absolute and relative chronological systems for much of the Old World. The organization and presentation of the papers reflect a conscious bias in favor of the Ancient East, that tract of land occupying quite varied environmental regions from the Nile eastward to Iran. East central, northern, and western Europe and parts of the Aegean world on most reckonings clearly played a less eminent role in the development of culture and civilization in post-Pleistocene times. The same could not be said, however, of the great eastern provinces of the Old World, the Indian subcontinent, and particularly China, areas which, with recent advances in archeological expertise, including substantial quantities of radiocarbon dates, may well become a focus of new attention from the Western world.

Radiocarbon of course is the reason for a change in the title of this book, from a second edition of *Relative Chronologies in Old World Archaeology* to the more precise but in some ways less satisfactory *Chronologies*, dependent in areas where well-stratified sites are rare upon the establishment of magical absolute ages for sites and cultures through the radiocarbon dating method. Space precludes a detailed examination of specific areas where certain adjustments in the chronological tables beloved of most archeologists might be suggested, but two main points are, I think, worth making here.

It is a well-known fact that the half-life of carbon-14 was early estimated by Libby as 5570 ± 30 years, with certain laboratories employing values of 5568 ± 30 or 5760 ± 40. New calculations of this half-life have produced a value of 5730 ± 40 years, and most of the contributors to *Chronologies* have adopted the new value. Yet the Fifth Radiocarbon Dating Conference in 1962 decided to postpone the changeover from the old to the new until further studies were made, at which time all dates could be republished. This decision was reaffirmed at a conference in Washington in 1965, and has been adhered to in most syntheses that have appeared recently, including that for an area not treated

in *Chronologies*, sub-Saharan Africa [*Annals of the Cape Provincial Museum* **5** (1966)]. *Chronologies* is not alone in jumping the gun, and it is evident that a certain amount of confusion over the exact radiocarbon ages of a number of sites is bound to occur. Here the necessity for quoting the laboratory number of radiocarbon dates in any publication becomes apparent.

For the barbarian worlds outside the historically documented civilizations, the half-life change, if it is finally and universally accepted, is of little importance, but for those areas for which another basis for chronology exists, any proposed alteration to all of the radiocarbon determinations will clearly involve some serious reappraisals. Hence the inclusion, in all studies of this kind, of "archeologically inacceptable" radiocarbon dates is of importance. In certain areas known to me these may well outnumber those dates that seem to fit our crude systems of ordering. In general, the authors of *Chronologies* have cited "difficult" dates as well as those immensely pleasing ones that fit their archeological opinions.

Chronologies performs a valuable service in presenting in concise form the archeological systemization of cultural materials, sometimes in quite extraordinary depth and detail. I hope the authors and readers do not forget for a single moment that the establishment of a chronology is only one aspect of what we archeologists are trying to achieve.

JOHN M. COLES
Faculty of Archaeology and Anthropology, University of Cambridge, Cambridge, England

Sexuality in Fungi

Study of incompatibility in the higher fungi promises, and has promised over the last quarter of a century, to make major contributions to biology. In these organisms nuclear migration, outgrowths of cell walls, and ultimately the development of fruiting bodies are triggered by a series of alleles such that any two different alleles react to release the processes. As in the corresponding situation in flowering plants, a number of interesting experiments can be performed pairing wild and mutant alleles in various complex combinations using heterokaryons and diploids.

Some 15 years ago John R. Raper, then at the University of Chicago, began working with these organisms, and he and his students and collaborators in various laboratories now constitute an enthusiastic group that has amassed a large amount of data published widely. This, together with contributions of other workers, is now available in Raper's **Genetics of Sexuality in Higher Fungi** (Ronald, New York, 1966. 283 pp., illus. $12).

An excellent account of the biology of the higher fungi and a historical review are given in the first four chapters, which in many ways constitute the best part of the book. The next four chapters describe in detail the behavior of heterokaryons and mutants and make rather heavy reading despite the titillating style of the author. With a keen sense of the popular acclaim for developments in molecular biology, chapter 9 introduces a model based on two regulator substances. These react in complex ways to control an operator. An O^0 mutation is fitted into the model. Nothing is known of the chemical basis for any of the phenomena, and it would have been preferable to postulate unspecified inhibitors which might act on enzymes rather than to commit oneself to an operon. In any case, models based on antigen-antibody reactions or tissue incompatibility have more kinship with these phenomena. A comparative consideration of models proposed for flowering plants would have been useful.

A central issue is whether the incompatibility factors are controlled by single genes with a rather large amount of crossing-over in a localized region or whether there are two genes producing two molecules, regulator or otherwise. The claim is made that the gene *pab* lies between two incompatibility genes; this is crucial, and the evidence for the proposed ordering should have been presented and discussed, since the published data on this point are ambiguous.

HAIG P. PAPAZIAN
Department of Biology, Yale University, New Haven, Connecticut

Chemistry in England, 1557–1640

Its title notwithstanding, Allen G. Debus's **The English Paracelsians** (Watts, New York, 1966. 222 pp., illus. $5.95) is largely devoted to showing that from the first mention of Paracelsus in an English book in 1557 up to about 1640 there were scarcely any true English Paracelsians. On the Continent there were continual controversies between the followers of Galen and those of Paracelsus. The English alchemists and physicians remained almost unaffected by these disputes. In general they showed little tendency to accept the theoretical ideas of the founder of iatrochemistry, while they utilized those metallic medicines which he advocated whenever these seemed of value. This Debus calls the Elizabethan compromise, though it lasted into the reign of Charles I.

Of the two groups most concerned in this compromise, the alchemists sometimes gave lip service to the sulfur-mercury-salt theory of the composition of metals, but in practice they more often used the four elements of Aristotle. An extreme example of alchemists' thought is provided by the ideas of Robert Fludd, to whom considerable space is devoted in this book. It is significant that Fludd's elaborate mystical system received little attention in England but was widely discussed in Germany, where Paracelsus had a strong appeal.

The chemically minded physicians were more willing to accept Paracelsus, because they felt free to accept any remedies which appeared useful. They were concerned with laboratory studies of the composition of urine and of mineral waters, and so knew something of the chemistry of inorganic bodies. Thus metallic medicine did not appear strange to them. So it was that when the first national pharmacopoeia, the *Pharmacopoeia Londinensis*, appeared in 1618 it described both Galenical and Paracelsian drugs. This was a clear example of the Elizabethan compromise.

The present volume, then, is really a rather detailed account of the development of chemistry and chemical ideas in England over a period of 80 years. It reveals the British genius for taking the middle ground when controversies occur, and it shows the trends and currents which led up to the work of Robert Boyle in the latter half of the 17th century.

HENRY M. LEICESTER
College of Physicians and Surgeons of the University of the Pacific, San Francisco, California