

fied by their ability to create mutations within the *lac* and *gal* operons of *Escherichia coli*, are known to be components of several transposable elements responsible for the dissemination of antibiotic resistance throughout the Enterobacteriaceae and their conjugal partners and to play a role in the organization of the R factors, which often contain nested sets of transposable elements. Transposable elements in yeast and higher eukaryotes are now important both as genetic tools and as clues to genome organization.

The present volume brings together current work on prokaryotic and eukaryotic transposable elements, and rapid publication has resulted in a book whose content is still timely. In it subjects not usually covered in current reviews figure prominently. It reports important data shortly in advance of journal publication (Clewett *et al.* on Tn916, a conjugative transposon in *Streptococcus*) or data from specialized systems (Chater *et al.* on the role of mobile antibiotic resistance determinants in genome flux in *Streptomyces*, Pays on DNA recombination and transposition in trypanosomes). There are general reviews on transposable elements in *Staphylococcus* (Murphy), the P elements in *Drosophila* (Rio), the yeast retrotransposons such as Ty (Kingsman *et al.*), and I-factors in *Drosophila* (Finnegan). Representative of the elegant in vitro analysis of transposition and resolution are papers on Mu transposition (Craigie *et al.*) and gamma-delta resolvase (Hatfull *et al.*). Phase and antigenic variation as a result of DNA rearrangements and the importance of such variation in the pathogenic properties of certain bacteria are reviewed by Meyer and Haas. The uses and properties of plant transposable elements are briefly treated by Schell (transfer of T-DNA from *Agrobacterium* into plants) and Schwarz-Sommer and Saedler. This important subject should have been covered in greater detail. Chapters with broader perspectives include those by Berg *et al.* on the mechanism and regulation of transposition and by Kuff and Leuders on the structure and evolution of retroviruses with homology to the transposable A-particle elements of mice.

The papers have numerous illustrations and references. For the reader who wants an introduction to the field, Shapiro's *Mobile Genetic Elements* is certainly more suitable (although an update of it is needed). But university and departmental libraries will want to have this current volume available for their faculty and graduate students.

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Lightning

The Lightning Discharge. MARTIN A. UMAN. Academic Press, San Diego, CA, 1987. xii, 377 pp., illus. \$49. International Geophysics Series, vol. 39.

Our technologically based society is rapidly becoming more susceptible to the effects of lightning. In his preface to *The Lightning Discharge* Uman states that his goal is to provide a self-contained reference source on the subject. He has achieved this objective; the book also contains hundreds of references to the scientific research on lightning up to 1986, including an alphabetical list of books containing information on lightning that reveals the void this book fills.

This book represents a major departure from Uman's 1969 book *Lightning* in its organizational structure. This time he presents topics by physical process, not by diagnostic technique. There is not much detail on instrumentation, and experimental techniques are only summarized briefly in an appendix. I find the new organization more helpful. The book should be a useful reference for any comprehensive course on atmo-

spheric electricity, and readers can easily glean from it general information about lightning. Each chapter has its own list of references, including some not cited in the text.

Topics covered by Uman include the components that make up a cloud-to-ground lightning flash, mostly related to the more common flash that lowers negative charge to the ground. In addition there is a chapter describing "positive lightning," that is, ground strikes that lower positive charge to ground, which are intriguing in their basic physics and have possible links with various weather phenomena, including severe storms and winter storms. In contrast to ground flashes, to which several chapters are devoted, cloud discharges are the focus of a single chapter, which adequately summarizes the historical data on the subject. Uman includes two chapters that cover relatively new areas of research, lightning on other planets and artificially initiated lightning. The latter phenomenon has recently become widely recognized as an operational problem for launch of all space vehicles and return to Earth of manned ones and is important in aviation because of the advent

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of composite materials for aircraft structures and the increasing dependence of flight control on microelectronics. Unfortunately, perhaps because of their newness, Uman presents almost no data on currents, rise times, and other physical characteristics of lightning strikes to airplanes, which are important in evaluating and protecting against the hazards they present.

I believe that *The Lightning Discharge*, owing mostly to its own high quality but also to the absence of any modern competitors, is a "must-have" book for all those studying problems associated with lightning. It should be useful in the engineering arena as well. Certainly it belongs in technical and scientific libraries.

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