deals mainly with the chemistry and metabolism of glycerides, and appears under the authorship of William Lennarz (bacterial lipids), Edward Hill and William Lands (phospholipid metabolism), and G. Hübscher (glyceride metabolism). Again the division of labor is somewhat arbitrary. The organization might have been more successful had the chapters on bacterial lipids and phospholipid metabolism been combined.

A third group of chapters, on the biosynthesis and metabolism of prostaglandins (Bengt Samuelsson), steroids (P. Holloway), aromatic substances (John Corcoran and F. Darby), and polyisoprenoid quinones (Ronald Bentley), rounds out the book and makes it much more comprehensive than most books on lipids. Thus, the general impression is of a substantial effort to present in a relatively brief form a considerable amount of the latest information on lipid metabolism.

Although the separate ways in which the material has been treated by the various authors may lead to some inconvenience in the use of this book for teaching purposes, there is no question that it has permitted each author to deal in a personal way with his subject and to inject new insights that might otherwise have been lost. The literature appears to have been covered up to and including part of 1969. Because of this and because of the sophisticated level of discussion, I would expect this book to be highly useful to the research specialist and the graduate student in biochemistry or molecular biology.

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Chemical Deduction

Problems in Organic Reaction Mechanisms. HERMANN HÖVER. Wiley-Interscience, New York, 1970. x, 470 pp., illus. $24.95.

Most organic chemistry texts at both the elementary and the advanced level have aimed at a logical and compact exposition of a vast and burgeoning body of knowledge. The result has all too often been a bloodless and dull classified directory, categorizing facts and advertising theories—fine for the stranger in town, but of little use to the student who aims to stay and find the action by learning how theories are formulated and tested. How then are chemists trained? They are trained in the classroom by talking about problems, solving them on paper by deciding what experimental measurements have bearing on what theoretical and practical questions. Students are launched at the blackboard and in the laboratory with small, well-defined problems whose goals are clear and which invite certain modes of attack, and by a combination of intellectual and manual effort they are gradually advanced toward more subtle and difficult problems. Learning chemistry is therefore more the Socratic dialogue as embodied in the give-and-take of seminars than the mere transmission of information, to which conventional texts and most lecture courses seem devoted.

Here in Hermann Höver's *Problems in Organic Reaction Mechanisms* we are given within the covers of a book the elements of a seminar. In the first section of just 52 pages are brief descriptions, consisting of information about starting materials, reaction conditions, and reaction products, of some 200 reactions. The reader is invited to deduce from this information the mechanisms by which these reactions take place. Then follow 400 pages explaining how reaction mechanisms can be deduced which account for the observed data given in the problems, mechanisms which are in accord with, and exemplify, general principles of chemical reactivity.

The deduction of the detailed pathways by which chemical transformations take place is less a matter of discovering "truth" than of constructing a heuristic framework which correlates chemical structure with chemical reactivity. It is important to all organic chemists, as an end in itself to those who are theoretically inclined, and to those who are more practical as a means for extending analogies from the known to the unknown.

To use this book is to undergo a true bootstrap operation. By thinking about the information given with a view to fitting it into a consistent picture, the student learns how deductions are made and what minimum information is necessary to make and substantiate a particular kind of conclusion. This is the heart of chemistry as it is practiced.

Höver asks a great deal of his readers, but their effort will be richly rewarded. Höver's discussions of specific problems exemplify much of current mechanistic thought and, more important, give a student a feeling of how these ideas develop—how fact and imagination interact. The selected literature references and the index are also admirable. Best of all, the book provides a new approach for reducing to paper our teaching of what goes, somewhat pretentiously, under the name of "theory" in organic chemistry.

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Biometeorology

Biometeorological Methods. R. E. MUNN. Academic Press, New York, 1971. xiv, 336 pp., illus. Cloth, $12.50; paper, $6.95. Environmental Sciences series.

The methodology of biometeorological research cuts across many disciplinary lines, as does biometeorology itself. Researchers must concern themselves with the whole range of meteorological measurements and analysis, but must also be knowledgeable about relevant aspects of biological research. Too rarely have researchers been experts in both fields. If primarily biologists, they have tended to accept meteorological data uncritically and used naive methods of data analysis and interpretation. Meteorologists approaching biological problems have often made similar errors in the interpretation of biological data.

This volume by Munn should go a long way toward correcting these inadequacies. It is a useful synthesis of methods from a very broad range of disciplines, showing how many diverse methods can be used to solve biometeorological problems.

A considerable portion of the book deals with problems of sampling the atmosphere in time and space, and it includes a useful discussion of instrument response and time constants. Statistical methods are considered somewhat cursorily, but in enough detail to indicate the range of applications. Methods of dimensional analysis and physical modeling of biological phenomena receive brief treatment, along with useful illustrative examples. Applications of synoptic climatology to such diverse problems as forest fire weather forecasting and the large-scale dispersal of insects and birds il-

lustrate the usefulness of this standard climatological tool. Munn even discusses the application of economic analysis to biometeorological problems.

It is obvious that the book covers an extraordinarily wide range of topics. No one can read the book without obtaining ideas for new approaches to old problems. I think it would be useful as a textbook, but probably primarily in conjunction with a book such as W. P. Lowry's *Weather and Life: An Introduction to Biometeorology*.

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Cyclic Variations

Geomagnetic Micropulsations. J. A. JACOBS. Springer-Verlag, New York, 1970. viii, 180 pp., illus. $9.90. Physics and Chemistry in Space, vol. 1.

Natural sinusoidal phenomena have always been especially attractive to physical scientists. One of the last unexplained phenomena of this type is the smooth cyclic variation or pulsation of the geomagnetic field. Just over 100 years ago systematic records were begun for these small-amplitude, relatively rapid (periods from a fraction of a second to several hundred seconds) variations. Very few facts can be stated with certainty about them today. The body of observational knowledge of their behavior is now exceedingly large and has been summarized in a number of review articles. The origin and behavior of these pulsations are described by quasi-statistical rather than direct cause-and-effect theories. The elusive nature of the phenomenon has discouraged many investigators who were initially attracted by its basic simplicity.

J. A. Jacobs' contributions to micropulsation research have been consistent, fundamental, and significant. Here he writes on the subject in an easily readable treatise. Only one long chapter, a review occupying about a third of the book, is devoted exclusively to the observational knowledge. Other chapters cover relevant aspects of the earth's main magnetic field, characteristics of magnetohydrodynamic waves, theories of the origin of micropulsations, and the possible use of micropulsations to diagnose the state of the magnetosphere. In many cases there is no attempt at mathematical completeness, but enough theoretical background is included to make the theories fully understandable and creditable. The author treats the various theories of origin, attenuation, and propagation, but does not attempt to reconcile theories that are somewhat at variance with one another.

Jacobs divides the subject matter into continuous pulsations (Pc's) and irregular pulsations (Pi's) following the classification guidelines of the International Association of Geomagnetism and Aeronomy. Theories of the higher frequency and more persistent Pc 1 are discussed separately from those of Pc 2–5 and Pi. There is no treatment of very low frequency phenomena, nor is there any discussion, at the other end of the spectrum, of magnetic storm theory. There is no discussion of the instrumentation used in the recording or analysis of micropulsations, although references are given to such discussions.

A completely coherent book on micropulsations is impossible to write. This book is the clearest and most well-balanced account that has been written to date of this complex subject.

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Two Years' Discussions

Quantum Optics. Proceedings of the International School of Physics "Enrico Fermi," course 42, Varenna, Italy, 1967. R. J. GLAUBER, Ed. Academic Press, New York, 1969. xx, 762 pp., illus. $31.

Quantum Optics. Proceedings of the 10th session of the Scottish Universities Summer School in Physics, 1969. S. M. KAY and A. MAITLAND, Eds. Academic Press, New York, 1970. xiv, 568 pp., illus. $23.

Two books with the same title should present no difficulty for a simultaneous review. However, *Quantum Optics* edited by Glauber is a presentation of a summer school held in 1967, and *Quantum Optics* edited by Kay and Maitland presents seminars given two years later. The emphasis and selection of topics in the volumes are different and represent the development of the field over the span of two years.

Glauber's volume covers a wide range of topics with emphasis on the use of the laser as a new tool for laboratory studies. It lacks coherence in the selection of topics, and for the quantum physicist it is not up to date. For the laser physicist or experimentalist it is a much better review. The sections on scattering include discussions of resonance scattering and scattering by density fluctuations and a general overview by H. Z. Cummins of laser light scattering. Also included is a discussion of scattering by magnons, excitons, and density fluctuations. The two reviews of nonlinear optics are of more historical interest owing to the recent rapid advances in the field. However, taken as a group the chapters by J. Ducuing, Y. R. Shen, and J. A. Giordmaine present a very readable account of nonlinear interactions. The final sections of the book include a treatment of the quantum theory of the laser by M. Scully. The book is useful as a reference and belongs in the library for that purpose.

Kay and Maitland's volume is better edited and presents a more organized discussion. In some cases the same authors participate (Glauber, Haken, Louisell, Pike, and Toraldo di Francia) as in the earlier summer school. In general, the articles are better presented the second time, which may be a result of proper aging. Of particular interest is a seminar on "Quantum theory of coherence" by Glauber. This article is in the style of a lecture and gives needed relief from the mathematical detail of quantum theory. The use of transcribed taped lectures is a welcome, humanizing trend in the proceedings of the summer sessions.

The session was attended by A. Kastler and optical pumping was therefore a topic of discussion. G. W. Series reviews the field in a chapter entitled "Optical pumping and related techniques." The chapter is significant in a discussion of quantum theory now that the techniques can be extended by use of recently developed tunable laser sources. This book is well presented and is of value as a collection of reviews.

Together the two *Quantum Optics* volumes provide a graphic proof of the tremendous growth of the field. They give the reader an opportunity to study a field and gain some perspective of its development. The discussions for the most part are not available elsewhere, and the books serve as useful references of specialized fields of quantum electronics.

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