Book Reviews

A Showplace for Blending Science and Technology

Copolymerization. George E. Ham, Ed. Interscience (Wiley), New York, 1964. xvi + 939 pp. Illus. $27.50.

Copolymers, that is to say polymeric molecules made up of two or more kinds of repeating units, are of enormous technical importance and, in the form of proteins and nucleic acids, make up the stuff of life itself. The reaction of copolymerization, by which such molecules are formed, has received intensive study and has generated a copious literature. Ignoring its biochemical aspects, not treated in this volume which is in fact concerned solely with addition copolymers derived from unsaturated molecules, copolymerization has attracted the attention of three somewhat separate groups of investigators—chemical technologists concerned with the development of economically useful copolymers; polymer chemists interested in understanding the nature of the reactions involved; and physical organic chemists who have recognized that copolymerization provides a useful tool for studying the relation between structure and reactivity in chain (chiefly radical chain) reactions. Central to all of these efforts has been the "copolymerization equation" developed independently some 20 years ago by Alfrey and Goldfinger and by Mayo and Lewis. The present book is a collective volume made up of 15 sections each written by a different group of specialists, and covering topics of current interest. The topics selected are the theory of copolymerization; the Q-e, scheme; copolymers of α-olefins (four sections); cationic, anionic, and block and graft copolymerizations; and copolymerizations involving the technically important monomers, styrene, acrylonitrile, vinyl and vinylidene chlorides, ethylene, and the acrylates and methacrylates. The volume closes with a comprehensive appendix (135 pages) of monomer reactivity ratios, and an extensive tabulation of Q-e values. In almost every section the close relation between theory and practical application is amply demonstrated, and, in fact, copolymerization has proved to be rather a showplace for the happy blending of science and technology. Although there is some duplication of the sort that seems inevitable in a collected work (the references to some authors in the index considerably exceed the number of their published papers), the result is a compendium which will be of great interest to polymer chemists and technologists and which brings together much recent material until now available only as scattered references in the original literature.

Since space does not permit detailed discussion of the many individual chapters, I will comment specifically only on my own particular interest—the treatment of the general theory of copolymerization and the factors that determine copolymer compositions. Although "Theory of copolymerization" is the title of the opening chapter by George E. Ham, the treatment is actually spread throughout the book. Factors determining structure and reactivity in radical copolymerization are well treated by Alfrey and Young in their discussion of the Q-e scheme, while structure and reactivity in reactions that proceed by other mechanisms appear in subsequent chapters.

Ham's chapter is actually a rather specialized treatment of extensions of the copolymerization equation to systems showing penultimate group (and more remote) effects or containing more than two types of monomer unit, both subjects to which he has made contributions. While the mathematics are general, discussion is restricted to free radical systems. In developing his expressions, the author uses a statistical rather than a kinetic approach, which sometimes simplifies the mathematics. However, I seriously doubt that this avoids "steady state assumptions of dubious significance" (p. 8). Actually, the steady state assumption merely requires (i) long chains and (ii) independence of relative reactivities of chain length, precisely the same conditions required for validity of the statistical method.

Ham uses his expressions for penultimate and more remote effects to interpret data on systems such as styrene-fumaronitrile where the simple copolymerization equation fails. Unfortunately, little direct comparison with experiment is given, and, in view of the uncertainties of polymer analysis, the reader may doubt that any effect of monomer groups lying more than one unit back down the chain has actually been demonstrated.

The treatment of multicomponent systems also suffers somewhat from shortage of data. On pages 35 and 36 Ham claims that the application of the Q-e scheme to terpolymerization is confirmed by the data of Tables III and IV. However, since the tables refer to the *same* experiments, and Q's and e's were calculated from the same data as were the terpolymer compositions, the scheme could hardly have gone wrong. The last part of the chapter is devoted to a rather puzzling examination of the relation $r_{13}r_{21}r_{32} = r_{12}r_{31}r_{23}$ which is stated to be an identity for many terpolymer systems with a constant value. Ham seems not to have realized that the identity is predicted by the Q-e scheme, and its value is determined solely by the e's of the three monomers. Accordingly it can have any value, and any constancy noted must be a matter of chance. Further, the use of the identity to estimate r's for unknown monomer pairs really amounts to using the Q-e scheme and is subject to the same uncertainties.

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Psychology

A History of Psychology. Erwin E. Esper. Saunders, Philadelphia, 1964. xii + 368 pp. $6.50.

Years ago the German psychologist Hermann Ebbinghaus made a statement that has been often quoted: "Psychology has a long past but only a short history." The present volume is built on the thesis that psychology's long past is also its history and, further, that this

history is properly the study of man as a biological organism. The author clearly states that it was his purpose to write "*a* history" and not "*the* history" of psychology.

The book well states the value of a knowledge of history for the present-day student of psychology. It begins with a consideration of magic and animism, and then more than half of the remaining pages of the book are given to a review and evaluation of the contributions of the Greek philosophers to the understanding of the nature of man. Heraclitus, Democritus, Pythagoras, Protagoras, Socrates, Plato, Anaxagoras, Empedocles, and the Greek physicians among others are discussed. Three chapters are given to various aspects of Aristotle's thought and teachings. These Greek writers are dealt with in the context of the origin and and development of naturalism and what the author calls antinaturalism. The author considers it most important for the modern psychologist to be aware of the richness, the acuity of observation, and the analytic ingenuity of Aristotle's scientific works. Plato, on the other hand, is viewed in a very different way. The author says: "I shall summarize only the main features of his philosophy as they appear more particularly in his later dialogues and as they have exercised an influence—almost wholly deleterious—on the historical development of science."

In these chapters that deal with Greek thought there are many helpful references to the relationship of specific ideas in each philosophy to modern psychological problems.

The consideration of writers of classical antiquity precedes three chapters entitled "Psychology as philosophy," "Psychology as social science," and "Psychology as a biological science." These chapters are devoted to tracing the first beginnings and the development of the basic concepts of present-day objective scientific psychology. In this treatment special emphasis is given to the biosocial psychology of the author's teacher, A. P. Weiss, who, "as a pupil of Max Meyer, was a product of the German tradition of anti-vitalistic physiology (Ludwig, Bois-Reymond, Brücke, Helmholtz), 'objective psychology' (Loeb, Beer, Bethe, Uexküll), and positivism (Mach and Avenarius)." The author emphasizes the naturalistic role of language as playing a part in the understanding of those phenomena of conduct which some philosophers have attributed to nonphysical forces.

In the final chapter reference is made to the development of modern neurophysiology with special reference to Russian reflexology.

The author specifically emphasizes, as is indeed proper, that he has been selective in deciding on the topics and the individuals to be considered in the book. I was a little puzzled by the omission from the book of some names, such as that of E. B. Holt. Probably, however, no two psychologists would fully agree on those individuals whose influence seems to have been so important as to deserve an unquestioned place in the history of psychology.

The book is certainly a challenging and an interesting one. Any psychologist concerned with the varied strands that make up the present-day character of his science will find this clearly written book full of important facts and refreshing insights.

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Cytology

Allgemeine Cytologie. Eine Einführung in die funktionelle Morphologie der Zelle. Ekkehard Grundmann. Thieme, Stuttgart, Germany, 1964. xii + 422 pp. Illus. DM. 59.70.

This new cytology textbook creates a very favorable first impression through its excellent illustrations, its choice of topics from the frontier fields of modern research, and its brilliant style of writing. The medical background of the author, a well-known anatomist and histochemist, is certainly one of the book's assets. There are many examples from pathology which should entice medical students to delve into general cytology (which is, after all, one of their basic sciences, according to Virchow).

Unfortunately, however, Grundmann's book, although well written and very readable, is not an adequate representation of the general principles of cytology. Let nothing be said about small errors of commission which seem to be the inevitable fate of first editions; claims to be general are more hampered by glaring omissions. It is hard to understand why there is not a single word about the strikingly uniform pattern of ciliary and flagellar ultrastructure or about the fine structure of basal bodies, although centrioles are both discussed and illustrated. Bacterial fine structure and cytology, a field whose importance is amply proved by the recent and spectacular advances in microbial genetics, is equally neglected.

Even stronger words of criticism are in order with respect to the treatment of cytogenetics, classically the backbone of every cytology course. Although meiosis and gametogenesis are described, there is not even a hint of how the behavior of chromosomes at meiosis is related to Mendel's laws of inheritance. In fact, Mendel is not mentioned either in the text itself or in the index. Classical experiments in cytogenetics, such as cytological proof of independent assortment or of segmental interchange as the basis of recombination, are omitted. There is one crude diagram of the different types of chromosomal rearrangements, but no indication of the consequences of structural alterations that occur at meiosis when crossing over takes place. In short, there is a noticeable lack of effort to establish a connection between the cytological behavior of chromosomes and Mendelian genetics—a subject that held the interest of a good many cytologists during the first 40 years of the 20th century. Although the author's freedom to choose his own topics is granted, no textbook can claim to be general and at the same time ignore the fruits of nearly 50 years of research, research that was vital to the development of the subject discussed.

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Molecular Spectroscopy

Spectroscopy and Molecular Structure. Gerald W. King. Holt, Rinehart, and Winston, New York, 1964. xiv + 482 pp. Illus. $10.75.

If a student is to understand the principles of molecular spectroscopy well enough to connect usefully molecular geometries and electronic structures, he should have reasonable instruction in the following topics: wave mechanics, and atomic and molecular electronic structures; group theory; and rotation, rotation-vibration, and rovibronic spectroscopy of diatomic and polyatomic molecules. But how many one-volume textbooks published during the past 20 years have attempted to satisfy this rather comprehensive need?