emulate the molecular, biochemical, or biophysical pharmacologist, but the psychologist and ecologist (mentioned in the foreword) have not had an equal opportunity to make their colleagues aware of the principles with which they are concerned. In addition, the editors could have filled a most useful function if they had provided summaries of the principles they intended to relate in those chapters that deal primarily with methods but whose titles connote a more sweeping purpose. Finally, the publishers could have helped the student for whom this book presumably was intended by producing the book in a form that would have permitted a lower price.

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Biological Stereochemistry

Molecular Asymmetry in Biology. RONALD BENTLEY. Academic Press, New York, 1969–70. 2 vols. Vol. 1, xii, 324 pp., illus., $14; vol. 2, xvi, 568 pp., illus., $27.50. Molecular Biology Series.

Don't be misled by the title of the book. The subject is stereochemistry—the either/or world of *cis/trans, R/S, threo/erythro, chiral/achiral,* and *syn/anti.* The subject has its roots in the historical contributions of Van't Hoff, Pasteur, and Ogston. The books do not deal with macromolecules or to any great extent with the shape of molecules as a whole.

Volume 1 gives a rather complete and readable presentation of the principles of stereochemistry—the symmetry operations that define configurational isomers as distinguishable and determine whether identical substituents of a carbon atom are distinguishable.

The currently used (contending) nomenclatures are carefully detailed. This is perhaps one of the more important contributions of this volume, since translation of the current research literature from symbols and words into stereochemical reality is at stake. Especially important for biochemists are the ideas and terms used to define the asymmetry that only derives from isotopic substitution, prochirality. A large section of this volume is given to the preparation of optically active molecules by synthetic and resolution methods and to an enumeration of examples in which stereoisomers are known to have different biochemical properties.

The major goal of volume 2 is to provide a review of the facts and logic used in solving problems of the stereochemistry of the main classes of metabolites and of the stereochemical course of the enzyme reactions concerned with them. No reference has been left unturned in making the coverage as complete as possible. In general, the problems of stereochemistry for the biochemist have not been concerned so much with the determination of structures, although this still engages the natural products chemist; these problems were mainly solved by chemists before 1950, with notable exceptions such as natural isocitrate. Instead the concern has been to depict the steric course of reactions in which reactants or products or both have structures that are ambiguous with respect to the groups involved in the reaction. Thus, what could be more cryptic than the addition of acetyl CoA to oxalacetate to produce citrate? The challenge of such questions has been met with increasing sureness over the past 20 years, and progress toward completeness is so accelerated as to make this volume noticeably behind the times despite the best efforts of the author. Thus such important subjects as the stereochemistry of reactions concerned with the $-CH_2$ groups of glycine, pyridoxamine-P, and phosphoenol pyruvate or of proton replacement on $-CH_3$ groups already call for a supplementary volume. After this, the future lies in the mechanistic interpretation of this wealth of stereochemical detail when considered with other data.

The author has claimed that the discussion of reaction mechanisms is beyond the scope of the volume. In this he is at one with the vast majority of stereochemists who have preferred the either/or world to the mortal vulnerability of the curved arrow. Nor does the author tie these matters together in their biological frame—since the key to the choice between alternative courses in the stereochemistry of prochiral centers must lie in the natural evolution of enzyme mechanisms. However, the volume is not sterile of mechanistic content, since Bentley occasionally reviews a paper that puts its stereochemical conclusions in these terms. Unfortunately, the marriage of the two is often somewhat strained, as in the section on lactate racemase, where, since there is no stereochemistry to talk about, we get unabridged speculations on a number of unlikely mechanisms; and in the discussion of sugar isomerase, speculation on a role of lysine in ring opening is misinterpreted as evidence against a *cis*-enediol intermediate in the enolization. A greater regard for mechanism would have changed the context of many of the discussions—thus, for example, dioldehydrase would have been put in with the cobamide enzymes rather than the hydratases, and aldolases would have been taken up with citrate synthase.

The subjects covered include most of the classes of enzymes: dehydrogenases, condensation and elimination reactions, and the reactions of intermediary metabolism. There are also extensive reviews of the stereochemical course of reactions involving the isoprenoids, steroids, and alkaloids. Lengthy side trips into the analysis of substrate specificities of alcohol dehydrogenases, glutamine synthase, and chymotrypsin seem tangential to the main goals of the volume, but they provide instructive examples of a genre. On the whole the effort comes off well, and many students and workers will find it a welcome directory and guide to the literature through most of 1968.

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Botanical Relationships

Principles and Methods of Plant Biosystematics. OTTO T. SOLBRIG. Macmillan, New York, 1970. xiv, 226 pp., illus. $9.95. Macmillan Biology Series.

The employment of experimental methods to improve our understanding of biological relationships within and between species of plants and to their environment was begun about 50 years ago. Studies by workers in different countries have contributed substantially to this still relatively new and expanding field, now often referred to as biosystematics. Solbrig's book is a pioneer effort to bring together basic principles and techniques that have evolved from such studies in the form of a textbook suitable for undergraduates.

This attractive volume consists of 12 relatively short chapters. Part 1, The Process of Speciation and the Forces that Control It, consists of seven chapters. In the introductory chapter biosystematics is defined as "the application of genetics (and cytogenetics), statistics, and chemistry to the solution

of systematic questions in order to provide explanations about the diversity of organisms within the frame of the theory of evolution." A very brief historical outline of the development of plant systematics concludes the chapter. Chapter 2 is devoted to the structure of natural populations, mutations, recombination, selection, and gene flow. Chapter 3, "Patterns of phenetic variability," deals with the interaction between heredity and environment. Subsequent chapters are devoted to "Breeding systems," "Speciation," "Hybridization," and "The species problem and classification."

In part 2 four chapters are devoted to major experimental techniques—genetics, cytology, chemistry, and mathematics and statistics. The final chapter reviews the combinations of techniques that may be needed for interpreting biosystematic relationships among diverse groups of plants. A glossary and a bibliography follow.

The author has obviously devoted much thought to the organization and writing of this volume with the student reader particularly in mind. Carefully selected examples illustrate basic principles, and no attempt is made to be exhaustive. The clearly written text reflects the author's thorough mastery of his subject, and his frequent mention of the still very incomplete state of our knowledge of plant relationships should serve to stimulate students to explore on their own. Solbrig's book is most timely and fills an urgent need in teaching a relatively new and highly promising field of botany.

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