dearth of extensive examples of symmetry applied to quantum chemical problems is not a deficiency. The formal theory is in any event presented in such a manner that its relevance to practical problems is usually apparent. Topics in the theory of radiation-matter interactions and in solid state physics are not considered explicitly, but graduate students in chemical physics will find this excellent book to contain a useful coverage of the general principles needed for most formal applications of symmetry to chemistry.

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Orbital Symmetry

Symmetry Rules for Chemical Reactions. Orbital Topology and Elementary Processes. RALPH G. PEARSON. Wiley-Interscience, New York, 1976. xii, 548 pp., illus. $24.50.

The "conservation of orbital symmetry" is today such a familiar part of our chemical vocabulary that it is a surprise to remember that the seminal papers on this subject by R. B. Woodward and Roald Hoffmann appeared as recently as 1965. From the rationalization of the stereospecificity of electrocyclic reactions, the theory has been expanded to explain diverse chemical reactions, from simple isomerizations and dissociations to transition metal catalysis.

Pearson was one of those who very early recognized the wide applicability of symmetry rules for chemical reactions. The present book appears to be an outgrowth of a summary of the subject Pearson published in *Accounts of Chemical Research* in 1971. This mature book is written with enormous insight and with grace and style.

As is implied by its subtitle, the book is based on the molecular orbital approach. It is a tribute to the author's skill that, despite the mathematical rigor, a knowledge of the pictorial shapes of the molecular orbitals is often all that is required to follow the arguments. In particular, knowledge of the symmetry of the frontier orbitals (Fukui, 1952), that is, the highest occupied molecular orbital and the lowest unoccupied orbital, frequently allows one to determine whether a reaction pathway is allowed or forbidden, that is, whether the energy of activation is low or high. Reaction is most readily achieved when the new bond that is formed has the same symmetry as the bond that was broken, that is, when the orbital symmetry is conserved. Pearson takes up the reaction coordinate of a variety of interesting reactions and examines the symmetry landscape along the way. Although symmetry rules are best expressed in the language of group theory, once again the author's skill allows the reader to manage the arguments with only a thorough knowledge of character tables, symmetry species, and their manipulation.

The book consists of six chapters. Included in the first two insightful chapters, dealing with selection rules, are procedures for determining orbital and state correlations, the latter being essential for the derivation of the noncrossing rules. Chapter 3 explains the shapes of simple molecules of various symmetries and chapter 4 deals with reaction pathways for some of these. The mechanism of more complex reactions is discussed in chapter 5. Of special interest to organometallic chemists is the analysis of oxidative-additions, ligand migrations, and oxidative cyclizations. The final chapter deals with photochemical reactions.

The book is remarkably free of errors, and the drawings are simple and clear. One could sometimes wish that Pearson would restrain his penchant for abbreviations. A glossary of these would be useful. This book will take its place with two earlier important books by Pearson and collaborators, *Kinetics and Mechanism* and *Mechanisms of Inorganic Reactions*. Chemists will be grateful to him for putting into perspective one of the most powerful tools for understanding and predicting reaction pathways.

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Brain Chemistry

Neurotransmitter Amino Acids. NEIL DAVIDSON. Academic Press, New York, 1976. viii, 180 pp., illus. $12.75.

Some useful books open new fields; others restate what is known, presumably for the benefit of people who already realize that they should know it. *Neurotransmitter Amino Acids* falls squarely in the second category: It describes evidence accumulated during the past two decades that glutamate, aspartate, gamma-aminobutyric acid, glycine, and taurine function as neurotransmitters in the mammalian central nervous system. It is, in general, well written, well illustrated, and of a size compatible with the dimensions of the human hand. It should provide a good starting point for students and investigators seeking entree to the literature; it accurately describes what believers believe.

Had the author chosen to venture beyond currently accepted paradigms for neurotransmitter amino acid research, his book might have been a lot more. Most of these amino acids also undergo important reactions in the brain which seem worth describing for their own sakes, and which must somehow be related to their roles as neurotransmitters. An imaginative discussion of their fates could have generated a book that opened a field or two, and didn't simply celebrate what is already known. But this opportunity is largely missed. For example, the author makes much of the relatively high concentrations of glutamate in the brain but fails to comment on the similarly high glutamate concentrations in most proteins and in such body fluids as plasma and milk; the index refers to "incorporation [of glutamate] into proteins and peptides," but the discussion thus referenced (six words on p. 37) says nothing about the charging of brain glutamic acid transfer RNA or about the prevalence of glutamate in specific brain peptides or proteins (including the all-important pyroglutamyl residues in several of the hypothalamic releasing factors); and there is no mention of the gamma-glutamyl cycle, of the much-discussed neurotoxicity associated with very high doses of glutamate, of the mechanism within brain capillaries that mediates the uptake of glutamate (and other acidic amino acids) from the blood, and so forth. The interactions of glutaminergic neurons with neurons that don't utilize amino acids as their transmitters are mentioned only in a single context, in connection with the poorly understood enhancement by reserpine of brain glutamate turnover; the brief discussion of the effects of "dietary factors"—limited (surprisingly) to vitamin B_6—on "neurochemical systems" fails to mention the involvement of pyridoxal phosphate in reactions (other than synthesis of gamma-aminobutyric acid) involving glutamate.

Again, *Neurotransmitter Amino Acids* is a small book, and it amply satisfies the mandate implied in its title. Perhaps someone else will write the book that integrates our knowledge of amino acids as neurotransmitters with that of the numerous and important *other* things these compounds do in brain.

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