vitamin B_{12}. The detailed discussion of the B_{12}-catalyzed rearrangements is especially significant to a comprehensive understanding of biological stereoselectivity. The analyses of reactions catalyzed by diol-dehydrase and ethanolamine ammonia lyase emphasize that a given enzyme is capable of catalyzing reactions with different substrates via pathways that produce differing stereochemical results. As Rétey concludes, "The stereospecificity of most enzymes is based on the ability to differentiate between enantiotopic (or diastereotopic) faces or groups in metastable intermediates." Though this statement could serve as a conclusion for the book, other features of Rétey's chapter demonstrate some deficiencies of the volume.

Although the authors apparently read each other's manuscripts, it seems that the contributions were not modified as a result. For example, even though the introductory chapter describes the prochiral, H_S, H_R nomenclature of Hanson, Rétey chooses to use the H_{Re}, H_{Si} nomenclature of Prelog without explanation or definition. Furthermore, Rétey does not refer to Testa's extensive treatment of rotational barriers during his discussion of how "metastable trigonal intermediates" can result in the loss of enzymatic stereospecificity. Similarly, in a chapter on the stereochemistry of vision V. Balogh-Nair and K. Nakanishi do not utilize Testa's introduction of conformational equilibria even though a significant portion of their discussion examines the possibility that a *cis-trans* isomerization of retinal can be the primary event in vision. In a chapter on the stereochemistry of dehydrogenases J. Jeffery refers to the "belief" that (*R*)-[2-^{2}H]succinic acid is levorotatory even though in the previous chapter Bentley describes the stereospecific reaction sequence that was used to establish this correlation. Jeffery also refers to an enzyme in which the "stereospecificity" may not be "complete," although Bentley's chapter contains an extensive discussion of the various uses of the terms "stereospecific" and "stereoselective" and ends by recommending that biological processes be referred to as stereoselective, with qualifiers added when appropriate.

Scientists with an interest in stereochemistry, especially in biological stereoselectivity, will certainly want a copy of this volume in their libraries. Each of the chapters is a current review containing important information. It is unfortunate, however, that the book was not edited to provide a more consistent treatment. Though some of the inconsistencies may be dismissed as trivial the value of carefully defining stereochemical nomenclature or terms such as stereoselective is questionable if even one's coauthors fail to incorporate these concepts into their presentations.

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Synaptic Vesicles

Neurotransmitter Vesicles. RICHARD L. KLEIN, HUGO LAGERCRANTZ, and HERBERT ZIMMERMANN, Eds. Academic Press, New York, 1982. xvi, 384 pp., illus. $61.50.

It is hard to imagine the study of oxidative phosphorylation had no one isolated the mitochondrion, or of signal peptide recognition without stripped microsomes, or of breakdown processes without purified lysosomes. For many biological phenomena a crucial subcellular organelle has had to be isolated to allow further advances. The synapse has such organelles, the characteristic synaptic vesicles that cluster inside the presynaptic nerve terminal. Many hope that isolating and characterizing the synaptic vesicle will guide them to the molecules involved in synaptic transmission and to their functions.

Synaptic vesicles are identified biochemically by their high concentrations of neurotransmitters. The properties of three types of vesicle, those containing catecholamines, acetylcholine, and the hormones oxytocin and vasopressin, are detailed in *Neurotransmitter Vesicles*. By collecting information from quite diverse systems in one source the seven authors have generated a volume of considerable value. One is struck by how universally the authors stress the pitfalls of identifying true but minor vesicle components in vesicle fractions that must be at best only about 90 to 95 percent pure. The need for care in such cases should be self-evident but is not, as the authors point out. The authors note that when vesicles are isolated and characterized with some rigor incredibly high concentrations of transmitter are found inside them. Estimates of 50 to 100,000 molecules of acetylcholine per electric organ synaptic vesicle translate into internal concentrations of 0.5 to 0.8 molar. The norepinephrine concentration in large dense-core vesicles is about 0.2*M*, and there are about 1.8×10^5 molecules of oxytocin and neurophysin per vesicle in the posterior pituitary. Also remarked upon in the book is the simplicity of the vesicle membrane itself, at least in cholinergic vesicles, where the lack of protein contents allows more ready characterization of membrane protein constituents. Having few proteins, the membrane has one of the highest lipid-to-protein ratios in a biological membrane. Such simplicity is perhaps expected in a membrane with only two major functions, packaging transmitter and fusing with the plasma membrane.

Perhaps the most unexpected generalization to come from this juxtaposition of biological systems is that nerve terminals are not restricted to one type of synaptic vesicle. Cholinergic terminals can contain a subpopulation of vesicles, smaller and denser than the average, into which transmitter is more readily packaged. In the adrenergic system there are two types, large and small dense-core vesicles. Only the large vesicles have the enzyme dopamine beta-hydroxylase associated with them. Consequently the large but not the small vesicles can fill with norepinephrine when incubated in dopamine. Finally, labeled oxytocin and vasopressin first appear in dense granules in the nerve terminal, but with time these granules become less dense and osmotically fragile. Since they move to a new nerve terminal region rich in lysosomes it is possible that these vesicles are targeted for destruction, the phenomenon of crinopathy. These findings help resolve old conflicts and offer important insights into mechanisms.

The reader might wonder why only three types of neurotransmitter are discussed. The fault does not lie with the authors. Synaptic vesicles containing gamma-aminobutyric acid or the amino acid transmitters, for example, have remained elusive. As the book emphasizes, even cholinergic synaptic vesicles have not yet been isolated from brain with sufficient purity to allow decent characterization. The need here is obvious, and the prospects for rapid improvement are good, now that antibodies are available that are directed at the cytoplasmic face of vesicles. Unfortunately, since the literature review for this volume appears to end in mid-1981, recent advances in vesicle isolation by immunoadsorption are not discussed.

Reading the volume reinforces the prejudice that the best in this field is still to come. The major questions remain. How do synaptic vesicles package? How do they migrate down the axon? How do they dock and fuse with the plasma

membrane when the internal calcium goes up? The strength of *Neurotransmitter Vesicles* is the technical detail in which it discusses methodology. Some chapters, indeed, read like selections from a methods handbook, listing, for example, the 11 different ways of fixing and staining catecholamine-containing granules. Though rich in methodology, the book is not very deep in insight. No attempt is made, for example, to compare the synaptic vesicle with the homologous endocrine secretory granules. Nonetheless, if the book encourages new workers to plunge into this field, and equips them to do so with caution and competence, it will be a very worthwhile contribution. It may be hard work, but there is probably no better way to understand the molecular basis of synaptic activity.

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