is authoritative and complete in its coverage of gas-phase and heterogeneous chemical reactions of oxygen allotropes, nitrogen and hydrogen oxides, the halogens, and sulfur oxides. A concise history of theories of ozone perturbations due to human activities and natural causes is presented. One wishes only that more field measurements had been reviewed and compared to model predictions. An intervening chapter on the troposphere by T. E. Graedel presents a very useful broad view of atmospheric chemistry—that diverse chemical transformations represent only different pathways of chemical oxidation. It is shown that atmospheric oxidation, whether gaseous, liquid, or solid phase, is initiated not by O_2 but by radical species, O_3, H_2O_2, and others. From this perspective Graedel outlines how spatial and temporal patterns in chemical concentrations result from the interplay of source locations, chemical transformation rates, meteorological factors, and the types and rates of removal (deposition) processes. The reader may quibble with some of the distance scales that are proposed to characterize certain processes, but this chapter is conceptually clear and illuminating. Its drawings are especially insightful and educational. Considering the complexity and heterogeneity of the chemistry of tropospheric air and the surfaces to which it is exposed, this chapter is remarkable in its coverage, accuracy, and conciseness. Graedel's comments on corrosion of materials by air pollution are eye-opening but too brief.

A later chapter by W. R. Kuhn concerns the connection between atmospheric chemical composition and climate. This chapter is exceptionally good as a tutorial on physical principles, but it suffers from some outdated data and examples. Kuhn's exposition of the laws governing atmospheric infrared radiation, how these laws are used in mathematical models, and the basis of the greenhouse effect is clear and well based. His inclusion of data on the global increase of CO_2 only through 1975 weakens his case unnecessarily, as does an unclear statement of the potential greenhouse effect of tropospheric ozone (currently thought to be substantial) and too little emphasis on CH_4. Readers of Kuhn's account could profitably consult a paper by Ramanathan *et al.* in the 20 June 1985 *Journal of Geophysical Research* for updating on specifics. D. G. Torr's chapter on the upper atmosphere reviews the overall properties and morphology of the high-altitude neutral atmosphere and ionosphere through exposition of the interactions of atoms and molecules with solar radiation and each other. This long and complete chapter includes many pages of well-selected solar and spectroscopic data. It could become a textbook itself with further augmentation, such as an expanded discussion of the escape of light gases to space. Historical reasons for attention to the upper atmosphere (radio communications, satellite orbits, auroras) could be provided as well.

The remaining half of the book contains chapters on Venus (R. G. Prinn), Mars (C. A. Barth), outer planets and their satellites (D. F. Strobel), and comets (W. F. Huebner). One is struck by how much has been learned about the (sometimes exotic) photochemistry of these atmospheres through Earth-based and satellite remote sensing, flyby missions, landers, laboratory experiments, and scientific ingenuity. The value of a planetary perspective for scientific studies of Earth emerges from these chapters.

Fundamentals of photochemistry and spectroscopy that underlie their application to the study of atmospheres are not covered in this book. Calvert and Pitts's classic *Photochemistry* (Wiley, 1966) or Okabe's *Photochemistry of Small Molecules* (Wiley, 1978) are suitable references. One other topic is shortchanged in this book: the sources of chemicals in the atmosphere. One major impression left with me is how far the study of atmospheric photochemistry has come. A measure of how rapidly this field is developing is that none of these authors, whose contributions to the field are well recognized, is a photochemist by training (only one is a Ph.D. chemist). The sheer size of the questions to be addressed continues to attract good scientists from other disciplines.

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Brain Dysfunction and Repair

Hope for a New Neurology. FERNANDO NOTTEBOHM, Ed. New York Academy of Sciences, New York, 1985. x, 238 pp., illus. Paper, $50. Annals of the New York Academy of Sciences, vol. 457. From a conference, New York, April 1984.

The promise of this volume is that "recent clinical and animal work points to new opportunities for the identification and correction of brain disorders." The 13 papers included address highly selected areas of clinical investigation and basic neurobiology. The late Norman Geschwind, who participated in the planning of the conference, describes in the first chapter examples from clinical neurology of central nervous system damage and recovery. This little essay points to several problems awaiting solution, emphasizing how incomplete our current understanding of recovery is.

The chapters on clinical issues include a description of the BEAM (brain electrical activity mapping) technique, a diagnostic method producing computer-generated images that has been developed by Frank Duffy and colleagues. Early results from the study of patients with dyslexia, dementia, and schizophrenia suggest focal electrical alterations that might not be revealed by conventional electroencephalography. The BEAM technique remains controversial and further careful, controlled studies are required to validate its application in clinical neurology and psychiatry.

Donald Price and collaborators provide a short summary of the neuropathologic and neurotransmitter changes involved in Alzheimer's disease. The material contained in this chapter is well known to the neurologic community.

The chapters on basic neurobiology focus heavily on current models of regeneration and plasticity. Björklund and Gage review their work on neural grafting in animals. These remarkable studies, described in considerable detail, document the surprising capacity of fetal tissue implants to sprout, grow, and reinnervate regions of the central nervous system. Prominent in these studies are the corrections of experimental cholinergic and dopaminergic deficiencies in the striatum and hippocampus. Cotman and Nieto-Sampedro describe progress in facilitating the recovery of function after central nervous system trauma. Their studies show attempts to quantitate the neurotrophic influences triggered by injury. They emphasize the importance of glial cells in both initiating and limiting regeneration. Olson and colleagues from the Karolinska Institute describe work on experiments to restore dopamine after lesions of the nigrostriatal system. Autologous transplantation of adrenal medullary tissue to two patients with Parkinson's disease is described. These clinical trials have been criticized as premature, since similar studies in subhuman primates have not been completed.

The olfactory system is unique in its regenerative capacity—the sensory neurons are the only elements of the adult nervous system known to undergo turnover and to be replaced after experimental degeneration. This interesting work is reviewed briefly by Graziadei and Graziadei. The elegant studies of Nottebohm on brain mechanisms of song control in canaries offer a model of investigation of hormonal influences on learned behavior. Male hormones determine brain changes and the subsequent behavioral repertoire of the songbird. Neurogenesis is not limited to the period of development but

can also be modified by testosterone treatment in adult animals.

The possibilities of neuronal division and neurogenesis in adults are discussed in more detail in four chapters authored by Bayer, Kaplan, Rakic, and Anderson and Waxman. All present evidence for adult brain plasticity greater than would be expected on the basis of classic views of the potential for regeneration in mature brain.

This volume is easy to read, summarizes a substantial portion of current thought about brain recovery, and is, for the uninitiated, a useful review. The material covered is well known to most neurobiologists, and the treatment does not provide new insights. Rather, the volume serves as an entry for those outside the field who are curious about where studies of central nervous system regeneration are going.

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Membrane Transport

Transport and Diffusion across Cell Membranes. WILFRED D. STEIN. With a contribution by W. R. Lieb. Academic Press, Orlando, FL, 1986. xviii, 685 pp., illus. $79.50.

Wilfred Stein's new book is successor to his *The Movement of Molecules across Cell Membranes*, published in 1967. The book is an excellent introduction to current research in traffic across membranes. The author writes well and has an infectious enthusiasm for his subject. The treatment is molecular, biochemical, descriptive, and therefore easy to understand. Stein does not address questions of physiological function related to membrane transport, nor does he deal with theoretical problems, even such simple ones as thermodynamic requirements in bioenergetics. The book contains a wealth of biochemical reaction schemes and kinetic data to support them, and it has extensive (and useful) tables of V_{max}'s and K_m's and other such parameters. It is an ideal "starter" book for students who have had a course in biochemistry.

Stein devotes successive chapters to passive diffusion across bilayers, channels across membranes and their regulation, simple carriers (here he uses the old-fashioned term "facilitated diffusion"), cotransport systems, and primary active transport (the treatment of which is concerned almost entirely with ATP-linked systems). Good examples are provided for each category of molecular movement, with copious literature references. The most interesting part is the chapter on diffusion across bilayers, which is coauthored by W. R. Lieb. Not only is its topic a relatively neglected one (there are frequent symposium volumes on other types of transport), the authors give the reader a feeling for exciting unresolved controversy—though they don't mention that essentially the same issues have been debated since Overton's classic paper in 1899. (Overton, the "father" of membrane permeability, is in fact not cited anywhere in the book.)

Other chapters, though they correctly quote what might be called current dogma, tend to be too pat (controversy and unresolved problems slid under the rug), and the text is not always accurate as to detail. For example, in the chapter on primary active transport Stein refers to the binding of two rubidium ions per molecule of the Na,K-ATPase, which, he says, "is just the number one would expect for an enzyme that pumps two potassium ions per molecule of ATP split." The cited reference, however, gives a rather different picture: "our results suggest that three rubidium ions are occluded per alpha chain. That is embarrassing . . . because it does not fit with the stoichiometry of pumping." This is not an isolated example.

Unlike its predecessor, the book lacks an author index, and that limits its usefulness as a reference volume. I wanted to see what the book said about the Goldman equation and the Hodgkin-Huxley equations. The journal articles are listed in the bibliography, but I could not find where in the text they were discussed.

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Basic Concepts in Population, Quantitative, and Evolutionary Genetics. James F. Crow. Freeman, New York, 1986. xiv, 273 pp., illus. $28.95; paper, $15.95. A book characterized by the author as "a shortened, less mathematical, updated version" of Crow and Kimura's *Introduction to Population Genetics* (1970).

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