it is not easy to locate the same headwords if they are discussed in several different chapters. Many chapters are very dense in the numbers of facts given (vol. 3, chapters 1-15). Some other chapters have been already published by the same authors in review form elsewhere during the past four years and thus represent an updated overview. A few of the reviews do not cover the field a reader could expect from the title (e.g. vol. 4, Glycobiology of the Immune System). However, such a criticism can often be raised with such multi-author books or series aiming at a complete overview of the entire field. This however, is only achievable by consulting the mostly adequate and updated references at the end of each chapter.

The four volumes provide a very useful collection of mostly excellent overviews in glycoscience disciplines and can be recommended to anyone wishing to aquire a more detailed knowledge of the state-of-the-art in glycochemistry and in the rapidly developing field of glycobiology.

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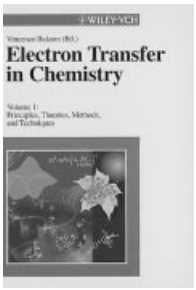
Electron Transfer in Chemistry. Vol. 1-5. Edited by *Vincenzo Balzani.* Wiley-VCH, Weinheim 2001. 3992 pp., hardcover € 1599.00—ISBN 3-527-29912-2

Electron transfer plays a central role in life science as well as in the synthesis of several interesting intermediates. Therefore, the investigation of electron transfer is of particular interest.



V. Balzani organized numerous well-known scientists in their respective fields to write contributions for this interdisciplinary book series consisting of five volumes. Every individual book contains 42 pages of contents but only the last volume includes the carefully made index. The topics covered by this monograph extend from theoretical aspects of electron transfer to the application of supramolecular devices for molecular circuits. The book deals particularly with single-electron transfers. Processes involving multiple-electron transfers, to which most oxidation and reduction reactions belong, are not covered, but will be found in the cited literature.

Volume I: Principles, Theories, Methods, and Techniques
Volume II: Organic, Organometallic, and Inorganic Molecules
Volume II: Biological and Artificial Supramolecular Systems
Volume IV: Catalysis of Electron Transfer, Heterogeneous and Gas-phase Systems
Volume V: Molecular-level Electronics, Imaging and Information, Energy and Environment

The editors emphasize throughout the entire book series the theoretical basis. Although a solid theoretical foundation is built by the first volume, the reader will find small theoretical summaries which will help quickly clarify this field for nonspecialists or those requiring more background information. The quality and consistency of the graphics contained in individual chapters varies. The number of errors in the written part and in the schemes is at a tolerable level.

M.D. Newton's introduction to basic theory opens the first volume. Starting with the transition-state theory, the treatment of electron transfer in computational chemistry is discussed. This chapter cannot be recommended as an introduction to readers who are not familiar with quantum chemical and physical terminology and models. However, the abundance and topicality of the references make this part a rich source of information. H. Sumi extends the description of electron transfer to the adiabatic and diabatic limit as well as to intermediate cases. Current topics, for example, the role of solvent relaxation after electron transfer, are also discussed here. The short third chapter by S. S. Skourtis and D. N. Beraton bridges the gap to biomolecules: intramolecular electron-transfer processes over large distances demand an expansion of the simplified donor-bridge-acceptor model described in the first two chapters, thus the concept of multistate electron transfer is introduced. D. Vanmaekelbergh's text deals with electrodes and reactions on surfaces. The author puts much effort in an introduction to the electronic structure of solids, followed by the presentation of the classical work of Gerischer. Even readers with no prior knowledge of the subject will profit from this discussion of processes on metal and semiconductor surfaces. The coupling of electron transfer to proton transfer in biological and chemical redox systems is treated with valence-bond approaches by S. Hammes-Schiffer in chapter 5. P. Piotrowniak draws parallels between electron transfer and the singlet and triplet energy transfer of excited states, in both of which energy transfer over large distances (50-100 Å) is possible. The seventh chapter (J. F. Endicott) focuses on transition metal complexes. Charge-transfer properties of these can often be correlated with their redox behavior. A particularly modern (and inspiring) topic is presented by M. A. Fox in chapter 8: photocatalysis by semiconductors. Irradiation with ultraviolet light can initiate electron transfer on their surfaces. The subsequent reactions of the adsorbates are even exploited in commercial processes, for example, the fission of water and organic transformations. The recombination of an anion with a cation may form an electronically excited product after charge transfer. A. Andersson and R. H. Schmehl give both a basic introduction and examples (luminol reaction) in their chapter about electroluminescence. S. F. Nelson's dense but very informative overview of electron-transfer reactions in organic reactions is well-structured and reviews synthetic and mechanistic works. Nevertheless, the chapter (10) is misplaced, as it discusses works of Schmittel, Roth, Bauld, and Gao, who are authors in Volume II. The second part of Volume I is smaller than the first one and deals with electrochemical techniques which can be used instead of classical kinetics. The first two chapters may be read as an introducing overview and include modern trends (ultramicroelectrodes). Two chapters describing the interaction of molecules and condensed phases with highly energetic radiation conclude this volume: radiation ionizes

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solvent molecules in the primary process, which is followed by various redox reactions. A number of organic solvents are given as examples. This introduction to pulse radiolysis, a rather exotic technique to the average chemist, is well done.

The first part of the second volume was edited by J. Mattay and deals with organic molecules. The useful concept of electrophores and its application to the prediction of radical reactions is explained. The subsequent chapter gives a detailed discourse on the radical formation of alkanes. It is a pleasure to read the vivid report of scientific results about the radiolysis of alkanes. The following chapter on electron transfer of multiple-bond systems is particularly important, but has several irregularities in the schemes: Different sets of characters were used in the title and in the schemes (II/pages 133 and 135). The quality of the formulas is low since bond lengths differ widely and the structures are distorted (II/pages 134 and 139). Furthermore, the systematic nomenclature for heterocycles is not used correctly (II/pages 147 and 148). Unfortunately, with the exception of one scheme, the chemical yields of the depicted transformations are missing. A thorough revision of this specific part by the editor/publisher would have been in the reader's interest. G. Gescheidt and Md. N. Khan report in a very informative chapter about radical cations and anions. The subsequent discourse is devoted to the electron transfer in fullerenes which fits in perfectly since these compounds undergo multiple ionizations and represent electron buffers. The following four chapters deal with the electron transfer in specific classes of compounds. The second part of the book is devoted to organometallic and inorganic materials. A repetition of the theoretical background is followed by a detailed discussion of inner-sphere and outer-sphere electron-transfer mechanisms. D. Astruc carefully edited this specific part of the book and gives a remarkable review of electron reservoir complexes. These are the organometallic equivalents of the fullerenes which were discussed in the first part of this book. The described metallocenes have potential uses as redox mediators. The following section summarizes polypyridine-metal complexes according to the periodic table of elements. Unfortunately, only abbreviations were used for the ligands and the reader will find the structures of the mentioned polypyridines only by chance in the appendix. The two following chapters deal with enzyme models. The book finishes with a discourse upon ESR spectroscopy of inorganic and organometallic radicals.

The first part of the third volume deals with biological redox systems. The chapter containing information about the bacterial reaction center for photosynthesis does not exceed the content of a modern biochemistry textbook and has—unusual for this series of books—only a few references. The subsequent reviews focus on respiration and enzymatic oxidations mainly performed by cyctochrome oxidase. The survey on the three known NO synthetases shows clearly how these enzymes distinguish between the different oxygen-containing intermediates. The biological aspect of this book is completed by a broad chapter devoted to charge transfer in DNA. Since DNA double helices are currently discussed as molecular wires, the topicality of this book series is emphasized. The next four sections deal with donor/acceptor diades and triades. Starting with theoretical aspects of superexchange, electron transfer through space and bonds is discussed. Unfortunately, some parts of previous chapters are repeated (III/pages 238-243). The topic is extended to systems containing metal complexes. Compounds such as metalloporphyrins were of particular interest for light-induced electron transfer in studies of photosynthesis. The following chapter deals with a similar topic in which hydrogen bonding is used to arrange the redox-active species. The properties and advantages of the supramolecular approach are discussed in detail. Unfortunately, only a few recent examples are mentioned. Since polyamine ligands are of particular interest for the generation of redox catalysts the review summarizes azacrones, crytands, and thiacrones. The chapter is finished off with a section about "cage compounds". Most of the presented examples are not cages at all. The editor has written two splendid reviews on rotaxanes and pseudorotaxanes. Since threading and shuttling of the ring can be controlled by electron transfer, molecular-level devices such as switches, sockets, and machines are feasible. Some schemes look as if the molecules will turn in a preferential manner, but only a statistical movement is possible. J.-P. Sauvage wrote a contribution on the metal-mediated construction of catenanes, rotaxanes, and molecular knots. By using phenanthroline-modified copper complexes, the research group from Strasbourg demonstrated the synthesis of intertwined molecules. Since the different oxidation states of the employed transition metals prefer specific geometries they offer the direct control of the structure through electron transfer. The straightforward synthesis of these molecules and their interesting properties will be beneficial for applications. Redox-active species which represent the core of dendrimers are advantageous since the redox system is protected and no direct contact to the electrode surface is possible. New developments in this area are outlined in the last chapter.

The fourth book starts with a discourse on the fundamental concepts of catalysis electron transfer. The part by S. Fukuzumi has textbook qualities and is essential for understanding radical chemistry. The acid-base catalysis of electron transfer is discussed in detail. The second chapter is devoted to the modulation of redox potentials in supramolecular systems. A survey about the influence of hydrogen bonding, π-interaction, and electrostatic effects is given and completed by several examples of computational chemistry. The following chapter treats the catalytic fixation of carbon dioxide by organometallic complexes. Since some key steps are not yet solved, an application is unrealistic. Another interesting challenge is the regeneration of the co-factors for redox enzymes. The fourth chapter describes transition metal complexes as mediators for the electro- and photochemical activation of enzymes. Even recent developments such as wired enzymes and their application in fuel cells are mentioned. After a small intermezzo dealing with electron transfer in proteins, the heterogeneous photocatalysis of semiconductors is discussed. When such materials (e.g. CdS) are irradiated, the resulting charge separation can be employed for electrochemical reactions. Therefore, an interesting alternative for the direct use

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of sunlight opens up. Since the second part of this book deals with related topics, a later placement in this monograph would be ideal. P. Qu and D. J. Meyer report the coating of electrodes with dyes that effect sensitization of the surface. A combination of photo- and electrochemistry is possible and systems which might replace the known photovoltaic devices could be developed. Unfortunately, the current examples show a low efficiency. The following chapter deals with electron transfer in the solid state, repeating some parts from the second Volume (IV/page 446). If layered oxides with Perovskite-related structures or clays are combined with sensitizers, materials are formed having similar properties to the previously mentioned semiconductors. Since these materials are readily accessible they are promising for several applications where electron transfer plays a central role. Instead of inorganic materials, a self-assembled structure can also be used. J. K. Hurst and Khairutdinov discuss the advantages of micelles where the donors and acceptors for the electron transfer are specifically placed on different sides of the membranes. In the third part of the volume, five chapters are devoted to spectroscopic and spectrometric methods giving a deep insight into electron-transfer processes. The examples discussed are well-chosen and demonstrate the power of these methods. This part was edited by Y. Haas and gives a nonspecialist an easy start in this field. However, the quality of some schemes is low (IV/pages 649 and 658).

The last volume starts with a discourse on molecular wires. The second chapter provides an excellent survey on optical switches and antenna molecules. Some schemes are not clearly arranged and the size of the formulas sometimes differs (V/pages 52 and 53). Sections on different electronic molecular-level devices such as rectifiers, logic gates, antennas, and memories succeed. These devices will be crucial in the future for molecular electronics. However, the reader will be surprised how far the development has already gone. The lack of clear definitions between the devices results in a strong overlap of these reviews. The four following chapters deal with imaging and the storage of information. In two impressive essays of 90 pages each, the silver halide photography and photocopy process are reported in detail. A discourse on photorefractive and laser-induced polymerization completes this part of the volume. The third part of the book focuses on the environmental aspects of electron-transfer processes. Beside artificial photosynthesis, which was already discussed in previous chapters, battery systems are presented. The survey on modern systems based on polythiophene and lithium/polymer materials is a highly recommended read. The 80 pages index is rich and carefully made. Looking for specific subjects, even in overlapping chapters, involves very little effort.

In summary, the five volumes provide an excellent overview on the recent developments in electron transfer in chemistry. In the covered topics the books fills in the gaps of previous reviews in the literature. The chapters on the more mature topics, such as imaging, will be a compulsory read for chemists working in these areas. The single volumes are not textbooks but more a collection of excellent reviews providing a good overview of hot topics in the interdisciplinary field of electron transfer. Despite its low quality in some schemes this valuable monograph will have its place in every good library collection.

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The Amide Linkage. Selected Structural Aspects in Chemistry, Biochemistry, and Materials Science. Edited by *Arthur Greenberg, Curt M. Breneman,* and *Joel F. Liebman.* John Wiley & Sons Inc., New York 2000. xii + 653 pp., hardcover £ 126.00.—ISBN 0-471-35893-2

The Amide Linkage provides a unique and fairly comprehensive overview of the vast importance of the amide functional group to chemistry, biochemistry, and materials science. The editors have brought together a broad spectrum of contributors with varied interests and different perspectives on the chemistry of amides. The book starts off with a scholarly discussion of electronic structure provided by one of the editors. Kenneth Wiberg contributes Chapter 2 on the origin of the amide rotation barrier; it should be required reading for students of amide chemistry. Another editor, Arthur Greenberg, presents an interesting contribution (Chapter 3) on distorted and strained amides that provides a nice follow-up to Wiberg's primarily theoretical chapter.

In Chapter 4 Robert Brown presents a retrospective account of his work and that of others on amide hydrolysis. A chapter on the thermochemistry of amides then follows. Chapter 8 is on a related topic, namely sterically hindered and twisted amides. Chapter 6 contains a very interesting discussion of α-lactams, which focuses on synthetic and stereochemical issues in the chemistry of these very reactive, yet relatively unexplored chemical entities. The editors made a wise choice in including this chapter, which gives an individualistic perspective to the book.

Two chapters involve β-lactam chemistry. The first (Chapter 7) provides a historical overview of β-lactam chemistry as well as synthetic routes to β-lactams. The second (Chapter 11) discusses computational aspects of the chemistry of β-lactams as antibacterial agents. My only regret is that relatively little attention was given to new classes and uses of non-natural β-lactams and general inhibitors of serine protease enzymes. It should be stated that this is an important direction in which β-lactam chemistry is headed, countering the widespread belief the β-lactams are only of importance as antibacterials.

Chapters 12 and 13 follow up on computational aspects of amide chemistry, including the design of enzyme inhibitors and ab initio based conformational analysis of protein subunits. The gas-phase chemistry of amides is discussed in Chapter 14, and a very interesting discussion of β-sheet interaction between proteins follows in Chapter 15. Chapter 16 presents a timely discussion of cyclic-peptide libraries, and the last two chapters, 17 and 18, follow up with a discussion of specialized aspects of protein folding.

In summary, this book would provide an excellent addition to the libraries of organic chemists of all subdisciplines. It

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