The reaction schemes include mechanistic details in the form of "electron shift" arrows for each step, although in a few cases there are good reasons to regard alternative mechanisms as more plausible, for example, in the Wohl–Ziegler bromination. Also the mechanisms shown here for the Staudinger reaction and for diazo group transfer by Regitz's method are highly questionable.

The visual layout is very clear and attractive in general, apart from a printing error on page 374. However, that is not true in cases where spatial relationships have to be shown, for example in asymmetric syntheses. The description of the carbon atom in carbenes as $C^{\pm}$ is unusual to say the least, and the frequent use of the word "chelation" in connection with simple complex formation is incorrect. In addition to many trivial printing errors, one unfortunately finds mistakes that alter the meaning in many places: for example, [3,3] sigmatropic rearrangements are confused with electrocyclic reactions, and retro-en reactions are confused with [2,3] sigmatropic rearrangements. In the Bartoli indole synthesis an intermediate suddenly seems to have gained two hydrogen atoms from an unidentified source, and in the Corey–Winter olefin synthesis an additional carbon atom appears temporarily out of nowhere. On finding that the abbreviation Bu is used for $-CH_2CH_2CH_2-$ without any explanation, and that reaction arrows are confused with mesomerism arrows in various places, I cannot, with a clear conscience, recommend this book to students as a reference work on named reactions. It can at best serve as a useful source of information for the expert, at least because of the literature references.

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Directed Molecular Evolution of Proteins. Edited by *Susanne Brakmann* and *Kai Johnsson.* Wiley-VCH, Weinheim 2002. 357 pp., hardcover € 129.00.—ISBN 3-527-30423-1

How to find catalysts for specific chemical reactions? This is probably one of the greatest challenges in contemporary chemistry. It is also the main focus of this book. The field of directed enzyme evolution is growing at an exponential pace, and the reviews in this book are mainly about experimental results obtained in the last 15 years. The very few earlier evolution experiments are also described in a short history of the field which is included in this book.

Most of these reviews have been written by pioneers in their respective fields, and accordingly the scientific accuracy is excellent. Whereas several authors have preferred to summarize their own research field, others provide wider reviews. In the area of in vitro selection for catalysis, which I know best, I found very useful summaries and tables, which have not been previously published in scientific journals to my knowledge. The subtitle is important: "How to improve enzymes for biocatalysis". Only one review out of the 14 does not correspond to the subtitle. It deals instead with the well-known yeast two-hybrid system mainly used for the identification of protein–protein interactions. It is the only review whose references section is not very well done, and strangely enough it turns out that this chapter does not appear in the contents list.

I appreciated very much the way in which the book highlights a remarkably large diversity of fields. The subject of enzyme engineering includes theoretical approaches, physical and analytical chemistry, organic and inorganic chemistry, automated screening technologies, structural biology, molecular biology of eukaryotic cells, microbiology, and microbial ecology. This book provides the reader with a minimum of knowledge in most of these fields, which is probably required to perform successful directed enzyme evolution experiments. I found it a pleasure to read these reviews which detail one or a few of these very different fields. For example, one comes across concepts such as "ee trees", which relates to the enantiomeric excess values in organic chemistry and phylogenetic trees applied to enzymes. As expected from the title of this book, the reader will find information about topics such as library construction starting with DNA from natural or from synthetic sources, various genotype–phenotype linkages, in vivo and in vitro protein selection, amplification strategies and their biases, cycles of evolution, sequence–structure–function relationships, applications of engineered enzymes, Darwinism, and other biological concepts applied to macromolecules.

This book also contains useful data of a kind that is hard to find in scientific journals, such as reports on experiments that did not work. The reader will also find interesting estimations, such as the number of bacterial species on earth or per gram of soil, the numbers of classified fungal and bacterial species as Novozymes, or an estimation of the market for chiral organic compounds.

It is so far unclear whether a single method will appear as a universal strategy for the isolation of tailor-made enzymes. Time will be needed to select, from the tremendous diversity of presently developed techniques in the field of directed enzyme evolution, those which are most efficient, as occurred, for example, during the drastic selection of a few phyla among the many that existed in the Cambrian period. One of the authors even comments that "[the success] of evolutionary approaches may someday contribute to their own obsolescence in favour of in silico rational design. That day is far off, however." I rather like the idea of a suddenly emerging formalism for protein folding, which would render trivial the prediction of three-dimensional structure, dynamics, and function for proteins.

I recommend the book to researchers in academia or in industry, who will certainly find in at least one of the reviews an idea or an interesting reference they might have missed in the literature, or which they cannot find in

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scientific journals. The field is a hot research topic. It is worth noting that the book summarizes very well the field up to 2002, and that most cited publications are from 1999 to 2001. The book will also be useful to any student interested in biological chemistry, especially because of the clear and concise introduction by the editors.

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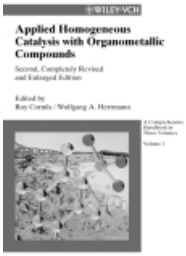
Applied Homogeneous Catalysis with Organometallic Compounds. Vols. 1–3. 2nd. Edition. Edited by *Boy Cornils* and *Wolfgang A. Herrmann.* Wiley-VCH, Weinheim 2002. 1450 pp., hardcover € 499.00.—ISBN 3-527-30434-7

The immense interest in homogeneous catalysis since the "roaring sixties", and its capability to illuminate new fundamental issues and to address new challenges of chemical technology, has led to this new edition of THE comprehensive handbook of homogeneous catalysis, which was first published in 1996 (see *Angew. Chem. Int. Ed. Engl.*, **1997**, *36*, 1547–1549). Within six years several breakthroughs have been achieved, including the introduction of neoteric reaction media, new tailored catalysts, high-throughput approaches, etc. Therefore, as stated on the cover, this second edition is "completely revised and enlarged". This is true for the second point, but much less for the first one. The treatise now comprises 1450 pages which are divided into three volumes. The first one is mostly dedicated to proven catalytic processes. The other two deal with recent developments in homogeneous catalysis and conclude with an enlarged "Quo vadis?" and a comprehensive subject index. Each volume starts with a list of contents of the complete set.



The book has kept its partition into four chapters, with the central ones devoted to proven catalytic processes (Chapter 2, "Applied Homogeneous Catalysis", now 597 pages instead of 568) and exploratory research (Chapter 3, "Recent Developments in Homogeneous Catalysis", 741 pages instead of 588). The editors have assembled a team of 123 well-known contributors from academia (74) and industry (59). This larger team brings some completely new contributions (5 for Chapter 2, 14 for Chapter 3) and others that are updated versions of articles in the first edition (8 for Chapter 2, 9 for Chapter 3).

The introduction has been slightly modified, with additions on the synoptic presentation of the development of organometallic chemistry and homogeneous catalysis. In the portrait gallery, the Nobel Prize laureates are introduced, and the importance of homogeneous catalysis demonstrated by the endowment of a third award.

Chapter 2 deals with basic transformations using transition-metal species. They are arranged according to either reaction types (hydrogenation, oxidation, hydrosilylation, hydroamination, asymmetric syntheses) or reactants (carbon monoxide and synthesis gas, unsaturated compounds, hydrogen cyanide, hydrocarbons). This chapter too has been slightly modified and reflects the mature state of most of the reactions described: the newly introduced BP Cativa process is described in the section on acetic acid and acetic anhydride written by P. Torrence. Metathesis is reviewed by J. C. Mol, but unfortunately, despite rapid developments in the area, no examples of the use of ROMP and RCM for the synthesis of complex structures are provided. The major additions are related to the synthesis and/or use of new ligands and complexes, extensions of the reactions to new families of products, and new trends and prospects. The contribution by L. Resconi et al. from Basell provides a good overview of the industrial syntheses of Group 4 metallocene catalysts, and reflects the strong increase of commercial interest for the polymerization of olefins. In the same way, the short contribution by W. A. Herrmann on "Ferrocene as a gasoline and fuel additive" comments on practical large-scale routes to ferrocene and its application as a catalytic fuel additive. Several articles describe how the development of new concepts such as large bite-angle ligands (hydroformylation), hemilabile ligands (hydroformylation, oligomerization), etc. lead to increases in selectivity and very often in activity. However, the use of late transition metal complexes for oligomerization and polymerization of olefins is not covered, despite the rapid developments in the last ten years. As expected, new examples of asymmetric syntheses are provided by R. Noyori et al.: more than 60 additional citations refer to the enantioselective synthesis of secondary alcohols, carboxylic acids, alkaloids, and sulfoxides. The contribution by R. A. Sheldon emphasizes recent developments and compares homogeneous catalysts with the Enichem TS-1 heterogeneous catalyst which has reached the industrial stage. The review on hydrosilylation has been completely rewritten by B. Marciniec and, with the incorporation of more than 50 recent references, provides a clearer view of a field that is still very active. Finally, a new contribution by W. A. Herrmann points out the feasibility of the Suzuki coupling for the synthesis of pharmaceutical intermediates and materials for nonlinear optics.

Some articles have moved within the book. Only one sentence (the last one) has been added to the former contribution by E. Drent et al., "A clean route to methacrylates via carbonylation of alkynes"; is that related to a shift towards commercial operation? Another "movement" concerns oxidation using palladium(II) species: the well-merited introduction of the article by I. I. Moiseev on "Homogeneous oxidative acetoxylation of alkenes" has resulted in the comprehensive (and updated) contribution by R. Jira on "Acetoxylation and other palladium-promoted or palladium-catalyzed reactions" being moved to the end of Chapter 3.

Chapter 3 (in Vols. 2–3) has been considerably expanded, gaining 145 pages and more than 700 citations. The chapter keeps the division into three parts devoted to development of methods, special catalysts and processes, and special products. Development of methods takes the lion's share, with updated surveys of immobilization in the aqueous phase (B. Cornils and W. A. Herrmann) and of fluorinated phases (I. T. Horvath), and new reviews on ionic liquids

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