This means studying the breaking, making, and transforming of chemical bonds, processes which occur on the very short time-scales of femtoseconds (1 fs = 10^{-15} s) to picoseconds (1 ps = 10^{-12} s). This can be understood if one considers the elongation or the contraction of a chemical bond, namely, a motion that corresponds to half a molecular oscillation. Thus in H_2 (the lightest molecule), the vibrational period is 7.6 fs, while in the much heavier I_2 molecule the period is 160 fs. To bring things to a "more human" scale, one femtosecond is to a second what a second is to thirty-two million years! On this very short time-scale the distance traveled is very small, typically tenths of an Ångström, and chemical and biological processes become frozen in time.

Even if the path of discovery is sometimes unpredictable, there is no doubt that Ahmed Zewail's contribution to science came from an insightful and coherent strategy. It led him to reveal and conceptually formulate, in a clear-cut fashion, the elementary dynamics at a scale never achieved before—the atomic scale in length and time. He shares with the reader, in a transparent yet rigorous language, the maturing of the new field and the joys of the new discoveries. From the famous anthracene experiment of the late 1970s, which revealed the first observation of coherent motion (energy redistribution in molecules) among vibrational and rotational states of large polyatomic molecules, to the breakthrough (now a classic) experiment on ICN in 1987, which marked the birth of femtochemistry, followed by the textbook experiments on NaI (charge transfer and bond breakage) and on $H + CO_2$ (bimolecular reactions), he takes the reader through the fascinating meanders of his scientific journey. These first striking examples of elementary reactions in simple systems sparked off a real explosion of the field. It is important to stress that not only were these important and great discoveries, but they also conveyed a clear message to the scientific community. It is his clarity of thought and judicious choice of the right systems, along with his enthusiasm and sense of communication, that made the impact of femtochemistry so strongly felt in a relatively short time.

Ahmed Zewail has another mission. In the last part of the voyage he concerns himself with the world of have-nots and the future, with special attention to Egypt and America. Like the late Abdus Salam (Nobel Prize for Physics, 1979), Ahmed Zewail regards the supporting of science in the developing world as being of paramount importance for the betterment of its humanity (he donated part of his Nobel Prize to provide scholarships and prizes in Egypt). He addresses social and economic problems of poor countries with the precision he uses in scientific problems, and he proposes pragmatic solutions. It is clear that implementing these solutions is a tedious (and bureaucratic!) enterprise, as humans are not molecules, and human societies are highly dissipative systems. However, this does not remove the bottom line fact that something needs to be done, by the very same people who live in these countries and whom he is in a position to help.

A few months after he received the Nobel Prize, I met Ahmed Zewail in Washington DC at a conference honoring him. He was engaged in a lively discussion with his postdoc about new results they had just obtained. He described them to me with the joy and fascination of a curious and brilliant student starting research. I confess I was amazed!

"Traveler, your footsteps make a way. By walking you make the path" (Antonio Machado). This is the lesson we learn from Ahmed Zewail's *Voyage through Time* and his Walks of Life.

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Name Reactions. A Collection of Detailed Reaction Mechanisms. By *Jie Jack Li*. Springer-Verlag, Heidelberg 2002. 416 pp., hardcover, € 85.00.—ISBN 3-540-43024-5

Who has not at some time, when preparing for an examination, or when reading an article in a journal or the title of a lecture, come across a named reaction and cannot remember what it is? This book is a source of help on such occasions, as it lists over 300 named reactions of organic chemistry in alphabetical order, giving in each case the reaction equation, details of the mechanism, and several relevant literature references (varying from 2 to 12).

Each named reaction is described either in a general form or by means of a specific example. No information about yields is given, and unfortunately the details of reaction conditions are very fragmentary in some cases. For example, the book fails to mention that the Bamford–Stevens reaction can also be carried out photochemically, or that the Wolff–Kishner reduction will not proceed without heating. For about a half of the reactions the information includes a textual description, but often it is very scanty, consisting of only one sentence (or even less). Information about uses of the reaction, its special peculiarities, or its limitations is rarely given, even though many of the pages have plenty of unused space to allow that.

The literature references often, but not always, include the earliest mention of the named reaction and some more recent publications and review articles, extending up to the year 2002. Unfortunately, these contain a variety of mistakes, especially for older publications, sometimes necessitating some detective work by the reader. In choosing which named reactions to include, the author has achieved a balanced mixture of classical and modern ones. However, some important classical reactions, such as the Clemmenson reduction, the Eglinton, Finkelstein, Grignard, and Wurtz reactions, as well as the Williamson ether synthesis, are missing, and the Claisen condensation is hidden away within its intramolecular version, the Dieckmann condensation.

The strength of the book undoubtedly lies in the many mechanistic reaction schemes shown for all the steps that are mentioned. They enable students to look up such details for any particular named reaction. On the other hand, one has to accept that there are many repetitions. For example, the base-induced deprotonation of a carbonyl compound to give an enolate is shown graphically several dozen times.

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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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