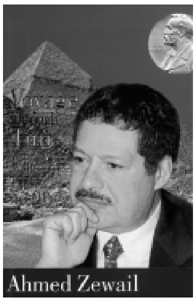
Life in the Fast Lane

Voyage through Time: Walks of Life to the Nobel Prize. By *Ahmed A. Zewail.* American University of Cairo Press, Cairo 2002. 288 pp., hardcover $ 22.95.—ISBN 977-424-677-2

On October 12, 1999, as the announcement of the Nobel Prize for Chemistry came out on the web, I sent a fax of congratulations to Ahmed Zewail (it was dawn in California). Later on, it was impossible to reach him by phone, so I decided to wait for another 24 hours and tried the next day. This time I did manage to talk to his secretary, who told me he couldn't attend as he was going through an article with two of his postdocs. Life as usual! I was flabbergasted! The following day he called me at 10 am (it was 1 am in California) to thank me for the fax and the call. I was deeply moved. Why would he bother to call back when he literally had "the world over him"? These two facts summarize for me Ahmed Zewail's personality: passion and rigor in science, generosity and *intelligence du coeur* in his relations with others. Reaching the acmes of prestige and international recognition did not change his character.



This conviction is confirmed throughout the pages of his recently published autobiography, where he tells us in a cogent and simple way about his walks through life. We read about the trajectory of a young man from the small town of Desuq in the delta of the Nile, crossing over to another culture and reaching the summits of science. Guided by his brilliant insight and his human qualities, he became the first Arab and Egyptian to get (unshared!) the Nobel Prize in science. Throughout, he enriches his *exposé* with anecdotes and stories, which he tells using the legendary Egyptian sense of humor. But the message is clear, it underlies a certain philosophy of life in his voyage as a scientist and a humanist.

The 1950s were a period of immense hope in Egypt and the Arab world, with President Nasser restoring pride and trying to shake Arab societies out of colonialism and its consequences. Furthermore, Egypt was (and still is) the lighthouse of the Arab world, because of its cultural, artistic, and journalistic creativity. Ahmed Zewail recollects specifically the atmosphere of those years, including his enchantment by Oum Kalthoum, the diva of Arabic music, who so deeply affected his life—later he was to be named the "Oum Kalthoum of Chemistry" by Berlin chemist A. Chemseddine, a title which I am sure he deeply appreciates. For the young Ahmed, aged 10, these words President Nasser wrote to him: "… I ask you to continue with patience and passion in harvesting science and knowledge, armed with good behavior and good thought so you can participate in the future of building the great Egypt", sound like a prophecy today. This drive towards excellence, matched with the simplicity and generosity of human relationships in his home town of Desuq, and later in Alexandria, have undoubtedly shaped his approach to life in general and to science in particular.

After obtaining his Master's degree in 1969, it was the style of his mentor at the University of Alexandria, who had been trained in the USA, that made him choose America for his PhD. His arrival in the USA in 1969 was the beginning of a whole new experience, it sounded like changing planets! Zewail reminisces vividly about this time of discovering a new way of life, with hurdles and challenges, from the language barrier to the new technology—he had never heard of lasers before going to the USA! Yet throughout, one feels his ability to adopt the best of the new culture, both in the social and in the professional life. The remarkable reflection is that none of the experiences he went through is told with a negative tone, even when it caused hardship and injury of feeling. These experiences turned out to be essential ingredients in the shaping of the personality and became an asset in facing new challenges.

By the end of 1973, Ahmed Zewail had obtained his PhD from the University of Pennsylvania. Moving from Philadelphia to Berkeley was as dramatic as moving from Alexandria to Philadelphia, especially when he set his eyes on Telegraph Avenue for the first time! But Berkeley had many opportunities to offer him, and the two-year "transition state" there was instrumental in shaping his future career. It was an opportunity to interact with an exceptional scientific environment, and to deepen his ideas about the concept of coherence and its implications for the behavior of atoms and molecules. It was also there that he started to work with the newly developed picosecond lasers, the springboard to the new research that he started at Caltech in 1976.

Coherence was on his mind, and in a series of papers which earned him tenure after two years at Caltech, he pioneered studies of molecular coherence with lasers and was the first to introduce shaped pulses for the study of molecular processes. This work was to culminate in creating the new field of femtochemistry, which is concerned with the visualization of nuclear motion in molecular edifices.

This means studying the breaking, making, and transforming of chemical bonds, processes which occur on the very short time-scales of femtoseconds ($1\ \text{fs} = 10^{-15}\ \text{s}$) to picoseconds ($1\ \text{ps} = 10^{-12}\ \text{s}$). 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.

Majed Chergui
Institut de Physique
de la Matiére Condensée
Université de Lausanne
Lausanne-Dorigny (Switzerland)

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.

  1433-7851/02/4123-4584 $ 20.00+.50/0