

PIONEERING THE FEMTOWORLD OF MOLECULES

Ahmed Zewail, *Voyage through time*. American University in Cairo Press, 2002.
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The subtitle, *Walks of life to the Nobel Prize*, given to this autobiography by Ahmed Zewail, represents, in my view, an excellent overview description of its content. The author gives us a fascinating insight into the early experiences and thoughts of a boy growing up in Damanhur, an Egyptian delta town about 60 km southeast of Alexandria, through to his most exciting and re-

warding days of scientific discovery at California Institute of Technology (Caltech). As he started out in life, he explains, the enjoyable environment of his home town and the close support of his extended family were tangible and major influences in determining his strong sense of belonging and spiritual attachment to his origins. In acknowledging his indebtedness to the local mosque

as a place to study it is clear from this account that the young Ahmed was determined to succeed in his school work and to adhere to the Islamic instruction that he should read.

An ability to combine an excellent sense of fun with dedication to work shines through as he describes his period of growing up in Egypt. Indeed, he pays a warm tribute to his father as his role model in helping him to develop an ability to balance serious work effort with enthusiasm and enjoyment of life. (For those of us who know Ahmed Zewail, it is clear that he has retained and even amplified this ability over the years!) Additionally, the important influence of his *special* uncle, Rizq Dar, is given a suitably elevated acknowledgement because of his active encouragement of his nephew in matters of education and learning. It was he who also introduced the young Zewail to the singing of Umm Kulthum that proved to be such a powerful linkage to his heritage when he had moved far from home to embark on his research career in the USA.

It is interesting to recognize how, as a freshman at the University of Alexandria, Ahmed had such a well-developed understanding of the continuity between ancient scholarship and the pursuit of a higher education in that city's modern university. Importantly, the dedication of the professors as teachers is highlighted as he pays a special tribute to their attention to detail, preparation and promptness. As we consider why so many students nowadays shy away from studies in the physical sciences, his descriptions of interesting lecture courses as well as fun-packed, university-sponsored trips to locations such as

Luxor and Aswan might offer some ideas that should be adapted and implemented more widely! This training environment together with the discipline and respect of students for their professors no doubt contributed to the self-discipline and professionalism for which this Nobel laureate is well known.

His key transition to graduate research at the University of Pennsylvania in Philadelphia was enabled by the encouragement, vision and imagination of Professor Robin Hochstrasser, the supervisor of his PhD research project. Just as he had been inspired by his university professors in Alexandria, Ahmed Zewail as a novice researcher was immediately and rightly inspired by Hochstrasser, who has been a major figure in photochemistry and photobiology research for more than the past three decades. Indeed, only someone with the energy and stamina of Robin Hochstrasser would have forgiven the inexperienced Zewail for calling him out of his sleep and back to the laboratory at 4.00 a.m. to sort out a problem with a new superconducting magnet! The multinational structure of this research group in Philadelphia was also an unambiguous statement of the worldwide and seamless appeal of scientific research, and so Ahmed was rapidly integrated into a research-oriented community that knew no national or cultural boundaries.

Professor Zewail describes his move, first as a postdoctoral researcher and later as a full-time IBM Fellow, to the University of Berkeley to perform research with Professor Charles Harris. It is clear from his account that this stimulating intellectual environment together with its state-of-the-art facilities

led him to understand the importance of centres of excellence as places where cutting-edge research could be undertaken most efficiently. In his subsequent move to a professorship at Caltech he was therefore motivated to establish a high-profile research centre that could boast uniquely powerful facilities that would attract the best researchers, of both junior and senior status. His initial studies were aimed at the measurement of the rate of vibrational energy redistribution in an isolated molecule by using a laser that produced picosecond (10^{-12} s) optical pulses, and observations were made of fascinating and intriguing quantum coherence effects in large molecules. Subsequent experimental and theoretical studies revealed to Zewail that much greater insights into the transition states of molecules could be deduced from experiments performed in the shorter, femtosecond (10^{-15} s), regime. After a talk that he presented at Rochester on 'Intramolecular vibrational energy redistribution', Ahmed received funding for the purchase of a femtosecond ring dye laser that had been developed at Bell Laboratories.

With his new laser system and his expertise in molecular beams, Professor Zewail and his research colleagues were now ready to take snapshots of molecular changes with a time resolution in the femtosecond domain. Thus, the new field of femtochemistry was born because this work led to the observation of the photodissociation of the triatomic molecule ICN. He uses the following couple of sentences in his autobiography to describe this definitive breakthrough:

We went back to the ICN dissociation reaction, snapping away at 10 fs intervals, which were fast enough to record enough

frames of the I-C bond breaking, little by little, the first time such a thing had ever been witnessed in real time. Those were thrilling moments with my students and postdoctoral fellows, and I wasn't sleeping at night!

As a result of this truly pioneering work, femtochemistry is now well established such that the breaking and formation of chemical bonds can be observed and understood in detail. Indeed, it is expected that the techniques introduced and so ably demonstrated by Professor Zewail will lead to many other advances in biology and materials science.

In this autobiography, Ahmed Zewail makes frequent references to Egypt and its people. He is keen to point out that revolutions in science should affect the developing world as well as the developed world. While acknowledging the central role of key contributions from individual scientists, he takes the view that the world can be a better place through science, especially when this is conducted in team efforts and global partnerships. His views on his own nation have not really changed since he quoted from Landau in his thesis: 'There is no reason to assume that Arabs have lost any of those gifts of faith, intellect and imagination that, at one time, enabled them to serve as the intellectual yeast for the West'. It is clear to me that Professor Zewail has delivered yeast in splendid measure. His *Voyage through time* conveys the thrill of pioneering scientific endeavour set against the backdrop of the many contributing facets of a modern scientist's life. Importantly, this account also demonstrates the place of hard work and commitment as well as the inspiration

that sets a few apart as Nobel Prize winners. I greatly enjoyed reading this book and I am delighted that Ahmed Zewail

has taken the time out of his busy life to give us this opportunity to share his *Walks of life to the Nobel Prize*.