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Science – a joyous playing field

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What was called my stubbornness in childhood finally paid off as persistence when it came to dealing with research problems later in life. Born in Ahmednagar, Maharashtra, I studied in half a dozen schools around the country. In high school it seemed natural for me to opt for science, probably due to the influence of my father, who is a scientist and my mother's belief in my choices. His constant and systematic style of questioning practically everything around him influenced me profoundly. I studied chemistry at the undergraduate level, and my self-confidence reached a new high when I was ranked among the top five in the final state-level examination.

I went on to complete my post-graduation in organic chemistry from the University of Pune. Exposure to research activity and teaching at the chemistry department of the University fascinated me. I was excited by the clarity with which stereochemistry (three-dimensional structure) was taught, and it took me a while to imagine and build the three-dimensional structures, but what I learned then stayed with me. The problems posed during classes and the imaginative questions that were asked in the examinations made this topic really enjoyable. It was a true case of

having fun while learning. I saw the total involvement of research scholars with their work in the laboratories, and was in awe of their depth of knowledge. I particularly liked going to the library and pouring over Beilstein and Chemical Abstracts. Subsequently I began to understand the questions in organic chemistry which they were trying to answer. I shared my hostel room with a Ph.D. student of philosophy who taught me a lot of stuff other than chemistry through various discussions. I value the time I spent with her, most importantly our friendship has lasted till today.

The magnificence of nature's designs (including colours) in the smallest of living organisms; the magical organization of a living cell and the enchanting diversity of living things always attracted me. The complexity of molecules which comes from simple elements that almost miraculously all come together to constitute life never ceases to amaze me.

I went on to do my Ph.D. in organic chemistry at the Indian Institute of Science, (IISc), Bangalore. Combining my interests in the fields of chemistry and biology, I chose to deal with problems at the interface of these two subjects. For my Ph.D. I worked on xenobiotic metabolism. The molecules we investigated were the constituents of spices and flavouring agents in food. Simply put, my work examined 'xenobiotic molecules and what happens to them because of enzymes; and enzymes and what happens to them because of these molecules.' This thesis gave me the opportunity to deal with interdisciplinary problems – I used facilities in almost all the departments!

At an international conference on Redox Systems, held in IISc, Bangalore, I presented my Ph.D. work. It was my first such presentation and the appreciative comments made by some well-known scientists in the field made me feel good about my work, but the moment my Ph.D. supervisor congratulated me and said he was proud of me, I was truly happy. I knew he had forgiven me for my 'stubborn' behaviour: following my own style and doing my work according to my own timetable.

My time at IISc, Bangalore was full of a variety of rich experiences which shaped my career and life. Most importantly too, at a deeply personal level, I met my husband and lifetime

companion there.

For my post-doctoral work, fortunately, I had an opportunity to spend some time in the Bioorganic Laboratory as a post-doctoral at the National Institutes of Health (NIH), Bethesda, USA. We studied polycyclic aromatic hydrocarbons, pollutants that are present in smoke. On metabolism these can get converted into cancer-causing molecules as shown by *in vitro* tests conducted in the lab. However, in the body, all these molecules are not found to be carcinogenic. There is a need to establish a direct correlation between chemical structure and the incidence of cancer, for polycyclic aromatic hydrocarbons: the challenge was to find a pattern in the stereochemistry of the metabolites formed and correlate them to chemical carcinogenesis.

At the end of my post-doctoral training I was convinced that natural enzymes are the most efficient catalysts. These amazing protein molecules catalyse thousands of reactions in biosystems, while maintaining their specificity in structure and function. They need special care while handling because they are sensitive to harsh conditions; It has become fashionable for people to refer to enzymes as ‘Green Catalysts’.

I understood the need for such catalysts in the chemical industry and on getting an opportunity, I set up a Bioorganic Laboratory for a pharmaceutical company as part of my first job. I continued to do research in the R&D department, and if it was not considered proprietary information by the management, I insisted on publishing my findings.

While working with the pharmaceutical industry I went to Germany on a Humboldt Fellowship. This experience helped me formulate my ideas on the use of enzymes in organic synthesis. Visits to industrial plants in Europe, which use enzymes on an industrial scale, helped me realize the potential of these wonderful biomolecules.

After some fruitful years in the industry which gave me an insight into the real world of research, manufacturing and business, I joined the Indian Institute of Technology, Madras (IITM). This position gave me the opportunity to utilize academic freedom to pursue research in the area of biocatalysis – exploring the

world for new biocatalysts for known organic reactions and known biocatalysts for new reactions. The IITM also provides a very good environment for teaching young smart kids – some of whom are fresh out of school and are starry-eyed about the world that is waiting for them and others who join for higher degrees and research.

All this adds up to trying to offer 'green' or environmentally benign synthetic methods to manufacturers. As a scientist I feel privileged both to understand the science of biocatalysis and to gain the satisfaction of knowing that this work is linked quite directly to societal issues i.e. the environment.

My parents always respected my desire to be independent, and as a child I never felt that I was treated very differently from my three brothers. My early childhood memories are of being encouraged to be fearless and do things alone if others were not willing to join in. As I grew older, I realized the value of this training as I began to understand the problems of other women in our society and the factors which kept them from pursuing their dreams of a serious career.

The relentless pursuit of serious work is not easy for women in a patriarchal society. I am deeply grateful to my family and friends who have at various times helped me discover my inner strengths that allowed me to carry on and never say die. Being married to a scientist helps, as we both understand the nature of our work and our involvement in it.

I encourage young people, especially young girls, to take up research in science as a professional activity and work together with other researchers to build strong centers of science. For women this is the real challenge of equality. I am also committed to supporting the entry and participation of young women in public life as citizens.

I have enjoyed every moment of my life in science and look forward to many more years relentlessly exploring the unique excitement of innovative work. I am happy that as a scientist I have the opportunity to appreciate the ability of human beings to uncover the deeper mysteries of the physical world and am humbled at the realization that the best is yet to come.