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## Like mother, like daughter

Purnima Sinha and Supurna Sinha

**T**he most significant influence that led me to pursue science has certainly been my mother, Purnima Sinha (née Sengupta), a physicist, the first woman PhD from Kolkata University in Physics. She had the great privilege of working with Prof. S. N. Bose, the discoverer of Bose statistics and a product of the Bengal renaissance. Infact, he had insisted that she fabricate her X-ray equipment from scratch. She did this from surplus army equipment which was sold as scrap on the footpaths of Kolkata after the Second World War. [See *Box* where she has reminisced about her experiences of working with S.N. Bose].

After her PhD., she worked in Biophysics at Stanford University, U.S. on the 'Origin of Life' during the year 1963–1964. This work was at the interface of biology and physics, studying structures involving clay and bases appearing in the DNA double helix. She worked at the Geological Survey of India and the J.C.Bose Institute for twenty years. After that she worked at the Central Glass and Ceramic Research Institute on physics of ceramic colour. She is now retired and continues to popularize science by translating books like Schrodinger's 'Mind and Matter' and Kamenetskii's 'Unravelling DNA: The Most Important Molecule Of Life' in Bengali.

Let me flash back in time and take a look at the family atmosphere she had grown up in. Her father Dr. Naresh Chandra Sengupta was a constitutional lawyer and a progressive writer who had written over sixty five books and several essays in Bengali as well as in English, some of them on Women's Education. Many of his novels centered around themes related to emancipation of women. He had an overwhelming influence on the family.

Around the middle of 1951 I started working on my Ph.D. with Prof. S. N. Bose at the Khaira Laboratory in Kolkata. He advised me to carry out an investigation on the structure of clay from various parts of India. He suggested that I could use techniques of thermal and chemical analysis along with X-ray scattering and also suggested that I fabricate my own X-ray tube of the Coolidge kind so that the parts could be dismantled and put together at will.

At that time about ten of us were involved in experimental research at the Khaira laboratory. Each of us used to fabricate his or her own instrument according to individual need. This was an unwritten rule in our laboratory. The more experienced research students used to initiate newer students in this mode of doing research and Prof. Bose would routinely keep track of the problems we faced in the lab as well as our progress. There was constructive cooperation between fellow students and people working in related departments. We all enjoyed the excitement of doing science in this manner. Because of the desire to hasten the pace of doing research there has been a trend towards buying easily available expensive imported equipment. It would have perhaps been possible to develop a much more self sufficient and confident scientific culture in the applied sciences in our country – in spite of the slower pace – if the ideal set by Bose had been followed.

The high voltage transformer used for our X-ray equipment was fabricated in the applied physics department of our university. We had put together our X-ray equipment from the

World War II surplus gathered in the lane behind Dr. Bidhan Roy's house. The rest of the parts were put together at the workshop in our department.

Our efforts in the X-ray laboratory finally led to a complete classification of about fifty clay samples into categories like Kaolinite, Montmorillonite, Illite, Vermiculite, Chlorite and so on. The results of this investigation were put together in 1955. In 1956, Prof. Bose retired from Kolkata University and we did further detailed X-ray studies of the structural characteristics of these clay samples in collaboration with Prof. Kamalaksha Dasgupta.

Since that time years, many publications on X-ray analysis of clay samples have come out of the Geological Survey of India, Central Glass and Ceramic Research Institute, Indian Institute of Technology and many other institutes. Few will realise that it was S. N. Bose, one of India's finest theoretical physicists, who first initiated research in X-ray based structural analysis of clay samples from different parts of this country!

**The photograph on page 1 shows Purnima Sinha (n`ee Sengupta) with S. N. Bose and P. A. M. Dirac during Dirac's visit to Bose's laboratory in the mid 1950's when Purnima was doing her PhD. research with Bose.**

**Purnima Sinha**

His four daughters, my mother who is now 80, and my three aunts pursued Physics, Economics, Mathematics and Chemistry. This significant thrust on focussing on higher education for women had percolated to the next generation as well. Among my maternal cousins there are several women scientists pursuing Mathematics, Molecular Biology, Statistics, Medical Sciences and so on. Consequently, I grew up with a perspective which I now realize, is significantly different from what most people grow up with. My world view has been shaped by these exceptionally emancipated

women and I have grown up to believe that such women are the norm rather than the exception.

Coming back to the present and the nuclear family that I have grown up in, I have been very fortunate. My anthropologist-artist father and my mother who has been as much of an artist as a physicist, had fostered an atmosphere for my sister Sukanya (now a physicist at ISI, Bangalore) and me, where learning, understanding and creating were an integral part of our lives. Visitors at home included poets, theatre personalities, filmmakers like Satyajit Ray, visual artists, musicians and scientists like Nirmal Bose, my father's mentor and Satyen Bose, my mother's mentor. In my younger years I had as much interest in the Fine Arts as in Mathematics. At home we had access to a large collection of excellent Physics books which my mother used to study. However, my real appreciation for Physics as a subject with a unique blend of logic and connection with the natural world happened a bit later. During my preuniversity years Anjan Dasgupta, our Physics teacher in South Point High School, Kolkata, showed many of us what this beautiful subject is all about.

I left India and joined the Physics department at Syracuse University for a MS-PhD. in Physics after completing my BSc. in Physics in India. Around the end of my course work at Syracuse I increasingly found theoretical condensed matter physics as a more attractive subject to pursue because of its greater connectivity to experiments compared to High Energy Physics or Gravity. My teacher Ranjan Bhattacharya and my uncle Shyamal Sengupta have had a definite influence in my making this choice. A theoretical condensed matter physicist named Maria Cristina Marchetti joined the Syracuse Physics Department and she was a natural choice for a research guide for my PhD.

Till the end of my PhD. years, my experience in doing Physics has been very positive. All my teachers, as well as my fellow students across gender have been encouraging and have often appreciated my style of doing Physics and my point of view in solving problems.

In my later years I have grown to admire Cristina's courage, doggedness and motivation in her pursuit of science,

balancing her dual identities as a scientist and a mother. I did not appreciate these issues until much later when I faced gender based discrimination myself. One great source of inspiration during my PhD. years was Rafael Sorkin, with whom I worked on a paper on quantum diffusion. His penetrating mind and open minded thinking in Physics and beyond has greatly influenced me. During my PhD. years at Syracuse I met Joseph Samuel, a theoretical physicist whom I married later. After my PhD., I had got postdoctoral offers from Europe, the United States, TIFR, Mumbai and IISc, Bangalore. I chose to join IISc. as a postdoctoral fellow because my research interest was closer to the research focus at the Physics Department at IISc. and also to be with my husband. My husband and I have had Physics as one of the most important links which bind us. Our daughter Roshni who was born in 1996, also shares our enquiring spirit. What has kept me going in Physics against all odds is the support of my husband and my parents in law.

So far I have emphasized the positive influences and not dwelt upon the negative experiences that I have had during my pursuit of Physics as a career. Unfortunately there have been many obstacles in my efforts to establish myself as a research scientist. The discrimination that I have faced has been mainly from the male dominated scientific establishment whose prejudices influence both men and women. I have faced discrimination from other women scientists which has often been as bad as the discrimination I have faced from men scientists. Whenever I have tried to have a rational discussion on this issue, I have come across dismissive reactions. One typical reaction is “Well, men suffer discrimination too”. This is hardly a justification. It would be like using Casteism to justify Racism, or the other way round.

I chose to be a scientist. I chose to live and work in India. I chose to have a child and a family. If the Scientific establishment chooses to discriminate against others like me, they are losing about half the brains that this country produces. This is a natural resource India cannot afford to waste.