

Dorothy Hodgkin

and

Linus Pauling

A Tribute

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No language is adequate to describe the two Titans we are remembering today. They had more than the Midas touch. They continually opened up golden gates to new knowledge. It would be impossible for me to describe their science in the few minutes I have. I shall therefore try to give you a few glimpses of some of my personal experiences with them.

Long long ago in simple cubic lead nitrate and trigonal barium perchlorate trihydrate we discovered the icosahedral coordination. We found that in the early editions of his *magnum opus* Linus Pauling had forgotten to include this twenty-faced Platonic solid as a possible coordination polyhedron. When we wrote to him, he replied to us. It was a most gracious letter of thanks.

Like the squirrel in our epic *Ramayana*, I too can claim to have helped the great man and Ava Helen in their antinuclear campaign. I collected for them quite a few signatures of Indian scientists.

I have heard Linus Pauling lecture, twice in India, and several times elsewhere. It would be impossible to name anyone who could excel him in showmanship or clarity of presentation. He was one of the greatest expounders of science I have ever heard. I shall never forget the wonderful meeting I had with the Paulings in the Woodstock Road home of Dorothy Hodgkin.

In 1952 I was to build a school of X-ray crystallography in Bangalore. My students and I started working on small structures; we used and tried to master the then novel methods of *minimum function*, *vector superposition*, etc. We also devised the multi-wave length anomalous scattering method, we think for the first time, for phase determination. In 1954 it dawned on me that the major role of X-ray crystallography was to solve structures that are completely unknown. I therefore dreamt of hitching our wagon to a star -- Dorothy Hodgkin, who was undoubtedly supreme in this field and whom I had never seen or met. Miraculously this dream came true. I myself went to Oxford for a year, ostensibly to look after Dorothy's Ph.D. students when she was away in Ghana with her husband Thomas. Over ten years at least seven of us from Bangalore worked with her. Most of these were either my students or my students' students!

It is remarkable how Dorothy could gauge the talents of her collaborators and make them extend themselves to their ultimate capabilities. The formula she used was simple -- a few gentle words and the incredible magic she had. That is how novel theoretical ideas and experimental techniques poured forth from her laboratory.

We too from India obtained quite exciting results. For example, K.Venkatesan (with David Dale) solved the structure of cobyric acid using the anomalous scattering technique. Dorothy quoted this work extensively in her Nobel lecture. I suggested that by incorporating special isotopes, neutron anomalous scattering could be used for solving structures of very large molecules. M.A.Viswamitra (with Bryan Anderson) solved the structures of thioestrepton using vector superposition methods; and Dorothy in her Patterson memorial lecture gave this as the supreme example of the power of the Patterson technique. Kalyani (with Bryan Anderson and others) solved the structure of Cephalasporin. M. Vijayan had the unique privilege of being in Dorothy's team that finally solved the structure of Insulin.

In the ultimate analysis it was not the work that we did with her or in her laboratory that mattered. What was invaluable to us were her approaches to science and her general attitudes. Some of these we could acquire in a small way by osmosis, and transmit them on in turn to our

students. The net result of this experience was that most of the major schools of crystallography in India are now led by the members of this Bangalore group.

Dorothy visited India several times. She was the Raman Visiting Professor; she delivered many of our National lectures, like the Gandhi Memorial lecture, the Nehru Memorial lecture, *etc.* She visited most of the laboratories in India where crystallography was being done, however remote they were (about eighteen places in all) and stayed at each for a few days. I invariably took leave from my work and accompanied her on these visits, mainly to look after her comfort. How can one describe the manner in which within three or four days of her stay she could inspire young scientists at these places to become first rate crystallographers?

Only twice have I heard her asking for something for herself. She wanted to see Halley's comet. It was truly a droll sight to see this frail woman standing on a rickety ladder to reach a shaky telescope. The low-lying clouds suddenly cleared up (as if for her). She saw the comet a few degrees above the horizon just before it set. She then had the satisfied look of a cat that had swallowed the cream.

Again, she wished to see our high Himalayas. After she visited the remote North Bengal University in Siliguri (from where the Naxalites operated), I hired a ramshackle car and drove up the mountains. She could not stand those rare heights. She was awfully sick. I was frightened and she knew the dilemma I was in; but with foolhardiness I drove on to Tiger Hill very early in the morning. The sun, before it actually became visible began to pick out the highest peaks starting from the great Everest, and each of them appeared one after another shining like pink ballerinas against the magnificent twilight mountain backdrop. Dorothy said breathlessly "Thank you Siv for not cancelling this visit. I shall never forget it".

After 1982 much of her *joie de vivre* drained away. Her beloved Thomas had died. Kausalya and I visited the place in Tolon, Greece where he died. He came out of the building, and just before he fell down dead he saw the incredible beauty of the Bay of Argolis. One could almost envy his death.

In the renowned and much appreciated painting of Dorothy by Maggi Hamblin which is in the National Portrait Gallery, London, she resembles one of the fierce many-armed goddesses of the Hindu Pantheon. It seems as though the Almighty had created her solely for solving impossible structures that no other mortal could. However for me there is something missing in this picture.

Many may think that Dorothy's greatness rests only on her solving structures which many could not. No, her real greatness lay elsewhere. When we see Dorothy we see someone filled with joy. We cannot but feel the peace that reigned in her heart. This peace she attained by the same path chosen by Gandhi or Mother Teresa. By having compassion and personal love for every individual fragment of humanity, young and old, in whichever corner of the earth it be found.

She truly was a very great scientist but she was, by far, a much greater human being.