Anatomy of a genius

ON July 31, 1930 a bright young Indian lad left the shores of India for higher studies at Cambridge, England. His purpose was to get the Ph.D. degree and then return to his native land for a successful scientific career. Instead, he settled down abroad in the University of Chicago, where he continues to be even today, with numerous achievements to his credit.

A typical NRI story albeit dating back to the thirties? Hardly! Kameshwar Wali has done an excellent job of telling the story of this exceptional person in his recent biography of S. Chandrasekhar. In *Chandra*, he succeeds in portraying the many facets of the man behind the legend.

How difficult the job must have been can be glimpsed from the Prologue wherein Kamesh describes how he approached the 'scientist in exile' who was 'extremely private and someone whom everyone held in great awe'. It was on December 17, 1977 that he began tape recording conversations with Chandrasekhar. He also had access to Chandra's files of correspondence. And, of course he had discussions with some of Chandra's former students and associates as well as other scientists and individuals from other fields who knew him. Twelve years may appear a long time to write a biography but the long wait has been well worth it.

The book opens with a broad outline of Chandra's personality and character, his scientific contributions, the crisis events in his life and his eternal quest for excellence as an unending phenomenon. In his brief after dinner speech at the Nobel Award Ceremony Chandra himself said "...But I am grateful for the award since it is possible that it may provide a measure of encouragement to those, who like myself, have been motivated in their scientific pursuits, principally, for achieving personal perspectives, while wandering, mostly, in the lonely byways of science...."

This pursuit started very early on. Chapter 2 describes the origins of Chandra's ancestral family in the evolving background of the British Raj in the Indian subcontinent. The picture emerges of a highly cultured ancestry which was unconventional in spite of social pressures. Chandra's own early period – the first twenty years spent in India – is described in the next chapter. There one begins to see the emergence of a dedicated scientist: a college student him to go to. So Chandra decided to make a transition to the United States – to the Yerkes Observatory at Williams Bay in Wisconsin.

The later chapters describe his (and Lalitha's) stay in Williams Bay and later in Chicago. In spite of many inducements Chandra has remained at the University of Chicago where he is now Morton D. Hull Distinguished Service Professor Emeritus. As he mentioned in his Nobel after dinner speech he has worked in 'lonely byways' where others dared not enter. In each byway he has brought to bear his mathematical abilities and physical insights on forbiddingly difficult problems. In the end he writes a comprehensive textbook or a monograph that becomes the last word on the subject. He brought the same thoroughness to the editorship of the *Astrophysical Journal* which became a world class journal as a result of the high standards he set for the papers appearing in it.

Although I have described the book in the sequential way, let me warn the reader that he will find it difficult to read it that way, unless he is very disciplined himself! For, if you open it at any page and start reading you will find it absorbing enough to continue doing so. To scientists of course, but also Shakespeare and Beethoven. Not all the lectures are delivered at the same pedagogical level: the Milne, Eddington and Schwarzschild lectures contain considerable technical detail. If you are a relativist you will (in any case you ought to!) enjoy them; if you are not you may have to tunnel through the mathematics.

The underlying theme that runs across these lectures – a theme that has guided the speaker through his own highly creative life – are the motivation for doing pure science, the aesthetic appeal of the basic laws of nature and the pattern of scientific creativity. The author's prefatory remarks express these ideas so much better than I can. They also give us a rare insight into the working of a great mind and its evolution across the four decades that span the lectures.

There are anecdotes about modern scientists as well as excerpts from the literature of preceding centuries, throughout the lectures. The author personally interacted with so many great scientists who have now been immortalized in text books. Not all his interactions were



Chandrashekhar at Cambridge: in pursuit of excellence

CHANDRA
A biography of S. Chandrasekhar
By Kameshwar C Wali
Viking, Penguin India
Rs. 250



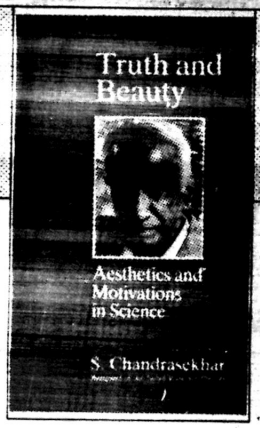
who was already reading advanced texts and doing his own research with publications in the *Proceedings of the Royal Society* and the *Philosophical Magazine*. The chapter ends with Chandra getting ready to go abroad for higher studies in Cambridge.

The next few chapters describe his student and post-doctoral years at Cambridge, 1930-36. It was in the early part of this period that Chandra perfected his white dwarf model in which he derived an upper limit for the mass of a white dwarf star. This is now known as the Chandrasekhar limit. The turning point, however, came with the clash with Sir Arthur Eddington on the question of the basic assumption of the model, namely, *relativistic degeneracy*. Eddington simply did not believe that matter in a massive white dwarf star could reach that state. The book gives a graphic account of the January 11, 1935 meeting of the Royal Astronomical Society where Eddington launched an unexpected and bitter attack, after Chandra had presented his results. Coming from such a well established scientist this was a devastating blow, not only to the scientific idea but also to its originator.

Subsequently, Chandra was vindicated and Eddington proved wrong – but it took many years for this to happen. What happens to massive stars that are beyond the Chandrasekhar limit for white dwarfs? The answer, guessed but rejected by Eddington as too absurd to be real, that the star would continue to undergo a gravitational collapse and become a black hole, had to wait till the sixties to be considered respectable.

Chapter 8 takes us to Madras in 1936 when Chandra returned to India. Two crucial decisions awaited him: marriage and a job. The first, which he had been postponing became accomplished when he met Lalitha, his intended bride, again after six years. The second could not materialize. Although his Government of India Scholarship to Cambridge required him to serve the Madras Government for at least five years, there was no suitable job for those of us who admire Chandra from a distance and find him a towering personality this book brings revelations of a warm human being with a deep sense of humility in spite of unparallelled achievements.

TRUTH AND BEAUTY
Aesthetics and Motivations in Science
by S. Chandrasekhar
Viking, Penguin India
Rs. 175.



The Epilogue brings that personality closer to the reader and is perhaps the most engaging part of the book. Here are transcripts of conversations with Chandra on various issues like motivations of science in India, Srinivasa Ramanujan, Von Neumann and Fermi, visit to Russia, the NRI connections with India, the Nobel Prize and, most importantly, a lookback at his own life. I only wish that Kamesh had included a few more topics from his vast collection of taped conversation.

IN *Truth and Beauty* we have a collection of lectures delivered by Chandra on different occasions. The earliest was the 1946 lecture under the 'Works of the Mind' series at the University of Chicago and the most recent one is the Karl Schwarzschild lecture delivered in 1986. All lectures are about highly creative people, most of them happy ones. Nor were all the interactions between the scientists described here happy ones. The scientists, in their objective search for truth and beauty, can be dogmatic, insecure, domineering, cussed and what not: for after all, they are human beings!

The lecture that stands out somewhat separate from the rest is that on Shakespeare, Newton and Beethoven. Creativity manifests itself in different forms. The author has selected three individuals who 'by common consent, have, each in his own way, scaled the very summits of human achievement.' In a highly personal but masterly account of the different patterns of creativity in these three cases the speaker expresses his puzzlement as to why the patterns are different between the arts and the sciences. I wish he had offered an explicit viewpoint of his own. Coming from one who has also scaled the summit, the view would have been well worth pondering over. Instead he contents himself with views expressed by poets, writers and scientists that may be pertinent.

A danger to scientific creativity now looms. It is in the form of scientific funding. Paradoxically creativity began to be threatened with the increasing facility with which science began to be funded after the World War II. Even in basic sciences the impression has grown that big money is needed to make big progress. To attract funds one's ideas must go through a peer review system and that means that only those who conform get the money. So a Copernicus or a Galileo would find it as hard (if not harder) to sell his ideas today than in the 15th-17th centuries.

The author has not worried about conformism or funding in his search for truth and beauty. His uncompromising stand on these issues has taken him away from the mainstream. That he has scaled the summit in this environment enhances the value of the ideas he has expressed in this book.

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