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EDITORIAL

Science and Music: Truth and Beauty

*'The simple is the seal of the true
Beauty is the splendour of truth.'*

— Subrahmanyan Chandrasekhar
Nobel Lecture, 1983

*'The story of Meera is the story of India, the story of Indian
faith and devotion and ecstasy. Subbulakshmi's performance
shows that she is not an interpreter of Meera, but Meera
herself.'*

— Sarojini Naidu quoted in *MS: A Life in Music*
(T. J. S. George, HarperCollins, New Delhi, 2004, p. 176)

1984 was a difficult year in India. On the 31st of October, Indira Gandhi had been assassinated by her own personal security guards. The riots that followed in the next few days resulted in the killing of large numbers of innocent people; acts of barbarism that have been emulated in later years. On the 3rd of December, methylisocyanate leaked out of the storage tanks in the Union Carbide factory at Bhopal, killing thousands of people and maiming thousands more. We have just marked the 20th anniversary of these tragic events. 1984 was also the year that marked the Golden Jubilee of the Indian Academy of Sciences. Founded in 1934, the Academy planned to celebrate the passage of half a century since its founding, with a meeting at Bangalore scheduled to begin on 7 November 1984. The date was chosen to coincide with the birth anniversary of the Academy's founder, C. V. Raman (1888–1970). Subrahmanyan Chandrasekhar, fresh from the 1983 Nobel prize in Physics, was to deliver the inaugural lecture. Indira Gandhi's death resulted in a postponement of the meeting, pushing it to the first week of February 1985. When the meeting began on February 6 at the Indian Institute of Science, the Academy marked the completion of 50 years, returning to the site of its inaugural meeting, which had been held on 31 July 1934. Almost exactly twenty years later, I remember little that was discussed at this meeting but two events remain vividly in my memory; Chandrasekhar's inaugural lecture and M. S. Subbulakshmi's Carnatic music performance in Bangalore's Chowdaiah Memorial Hall. I have no pretensions to understanding the nuances of astrophysics or music, but that day, 20 years ago, provided a remarkable glimpse of creativity, genius and accomplishment in science and music.

The Academy's Golden Jubilee meeting surfaced in my mind when M. S. Subbulakshmi (MS to her legion of ad-

mirers) died in Chennai on 11 December 2004. That day, the TV channels featured clips from many of her past performances, including a screening of the 1945 film *Meera*, which really launched MS on the national stage. I saw the Hindi version, which had an introduction by Sarojini Naidu, curiously enough, delivered in English. While a young and shy MS stands by her side, Sarojini Naidu hails her as a star, who will soon be known all over India; a prophecy that was to quickly be proved correct. I could not help wondering if scientific genius has been so quickly and publicly recognized, with such grace and generosity in recent times. I do not have a ear for music and would consider myself a Philistine in matters of art, culture and music. At times when I have been in the company of connoisseurs of classical music, I have wondered whether Shakespeare's famous warning might indeed apply to me:

*'The man that hath no music in himself,
Nor is not moved with the concord of sweet sounds,
Is fit for treasons, stratagems and spoils;
The motions of his spirit are as dull as night,
And his affections dark as Erebus:
Let no such man be trusted.'*

Lorenzo in *The Merchant of Venice*

But, my secret worries have been dispelled when I heard MS singing, most notably twenty years ago in Bangalore in the midst of a scientific meeting and again a few days ago when I watched *Meera* late into the night. Of the many tributes to MS that have appeared in recent times, I must draw attention to an essay by the historian and writer, Ramachandra Guha on 'Redeeming the Bharat Ratna'. Guha writes about the moment he heard that India's highest civilian honour had been conferred on MS and notes that H. Y. Sharada Prasad had once written that 'MS had long ago been anointed Bharat Ratna by the people of India, with her art recognized and cherished by anyone with a modicum of cultural intelligence' (*An Anthropologist Among the Marxists and Other Essays*, Permanent Black, New Delhi, 2001, p. 168).

The other memory that remains from the Academy's anniversary meeting in 1984 is Subrahmanyan Chandrasekhar's lecture '*The Pursuit of Science: Its Motivations*', the text of which has appeared in this journal (*Current*

Science, 1985, **54**, 1) and also as part of a marvellous collection of essays by Chandrasekhar on *Truth and Beauty: Aesthetics and Motivations in Science* (The University of Chicago Press, 1987, 1990). So much has been written about Chandrasekhar, including the eminently readable biography by Kameshwar Wali (*Chandra: A Biography of S. Chandrasekhar*, Penguin Books, 1992), that there is little new that can be said. He was the dominant figure of 20th century astrophysics, a man of formidable scholarship, and unmatched achievements in his areas of research. When he died in August 1995 in Chicago, a truly remarkable and inspirational chapter in science ended. Writing about Chandrasekhar, a year after his death, S. Ramaseshan notes: 'He had chosen perceptively, fields which were seemingly unfashionable which later were to blaze new trails. He had produced 50 or more remarkable students who were dotted all around the world. He had written essays on science, literature and the arts which were masterpieces. He had said to me – My work is finished and it seemed to me as though he had arranged with Providence for his passing away' (*Bull. Astron. Soc. India*, 1996, **24**, 537). But Chandrasekhar's approach to science is best summarized in his own words, in the autobiographical sketch that is found on the website of the Nobel Foundation: 'After the early preparatory years, my scientific work has followed a certain pattern motivated, principally, by a quest after perspectives. In practice, this quest has consisted in my choosing (after some trials and tribulations) a certain area which appears amenable to cultivation and compatible with my taste, abilities and temperament. And when after some years of study, I feel that I have accumulated a sufficient body of knowledge and achieved a view of my own, I have the urge to present my point of view, *ab initio*, in a coherent account with order, form and structure'.

Chandrasekhar's discipline was legendary, his mathematical abilities and physical insights of the highest order and his perseverance unmatched. In his autobiographical note he lists seven monographs which cover seven periods of his scientific life, ranging from the 1939 *An Introduction to the Study of Stellar Structure* to the 1983 *The Mathematical Theory of Black Holes*; a truly unbeatable record of scholarly achievement in science. His final book on Newton's *Principia* was completed just before his death. Although the 1983 Nobel prize appeared to recognize his classic work done over fifty years earlier (1931–1936), few scientists have matched his ability to produce scientific work of the highest quality over a period of six decades.

Chandrasekhar stands apart from most of his contemporaries in bringing to discussions of 'truth and beauty' a rigour of approach that is truly his own. His Nora and Edward Ryerson Lecture on *Shakespeare, Newton and Beethoven or Patterns of Creativity* (1975) must be required reading for all those who wonder about human creativity. In this lecture, Chandrasekhar, more than anyone else, before or since, bridges the gap between C. P. Snow's *Two Cultures*. He quotes T. S. Eliot's assessment of Shakespeare: 'The standard set by Shakespeare is that of conti-

nuous development in which the choice both of theme and of dramatic and verse technique in each play seems to be determined increasingly by Shakespeare's state of feeling by the particular stage of his emotional maturity at the time'. Reading this, I could not help but feel that Chandrasekhar too set a standard of 'continuous development' in which each body of work appeared to surpass his earlier accomplishments. Chandrasekhar seemed to be uncomfortable with the view that scientists do their best work when they are young; he was himself a wonderful exception. In his analysis of Shakespeare and Beethoven he marvels at their growing creativity as they age and concludes that there are differences in the patterns of creativity in science and the arts: 'And this to my mind is the center and the core of the difference; the apparent inability of a scientist to continually grow and mature'.

M. S. Subbulakshmi and Subrahmanyan Chandrasekhar were truly great contemporaries. They came from our part of the world, a fact that we must celebrate. Chandrasekhar spent his life in the West, but considered himself a foreigner in the surroundings he called his home. In thinking about these two remarkable Indians (and I deliberately ignore the mundane details of citizenship), I must turn to T. J. S. George's biography of MS. In considering the factors that turned 'Subbulakshmi into an exemplar of "Indianness"' George notes that 'the contrast between Mahatma Gandhi and Jawaharlal Nehru was itself illustrative. Gandhi pulled at the heartstrings of the masses because he symbolized the ethos of the Indian ideology in full measure. Nehru did not; he stood apart as a patrician prince because of his Westernization and agnosticism'. I could not but help wonder at the contrasts between Subbulakshmi and Chandrasekhar; the former loved and celebrated across the length and breadth of India, while the latter a truly patrician figure, remote, austere and undoubtedly one of the scientific greats of the 20th century. At a function in Chicago in April 1984, honouring the 1983 Nobel laureates, Chandrasekhar reflected on judgements: 'On an occasion, now more than fifty years ago (Edward Arthur Milne reminded me that posterity, in time, will give us all our true measure and assign to each of us our due and humble place; and in the end it is the judgement of posterity that really matters. And he further added; he really succeeds who perseveres according to his lights, unaffected by fortune, good or bad. And it is well to remember that there is in general no correlation between the judgement of posterity and the judgement of contemporaries' (Wali, pp. 297–298).

In 1985, at the end of M. S. Subbulakshmi's concert before several hundred scientists, the Academy's president, Sivaraj Ramaseshan thanked her: 'I must call you Dr Subbulakshmi (a reference to her many honorary degrees), but today there are many doctors and there is only one Subbulakshmi'. I believe Ramaseshan would have approved if I concluded this essay by saying that there is also only one Subrahmanyan Chandrasekhar.

P. Balaram

Truth and Beauty: The Two Faces of Science. By Rajgopal Nidamboor © Sep 23, 2017. © Sashkin. Scientists are often steered by their sense of beauty in developing new theories. Science is truth, candor, fidelity, damage and destruction – a loud and clear call of modern civilization – more so, in today’s context, the epoch of wonders and also devastation. It bids fair to a maxim erroneously accredited to Friedrich Nietzsche, that aesthetics, in art or science, is no longer a question of “do my thing, you do yours.” Yet, in a point of fact, integrating artistic verdict with truth, prettiness and forthrightness is, in the times we now live in, more than obligatory than ever before. Truth and Beauty: Aesthet has been added to your Cart. Add to Cart. Buy Now. What is intelligible is also beautiful. We may well ask: how does it happen that beauty in the exact sciences becomes recognizable even before it is understood in detail and before it can be rationally demonstrated? In what does this power of illumination consist? (Pg. 66). He says, “So far, my remarks have been confined to what we may all concede as great ideas conceived by great minds. It does not, however, follow that beauty is experienced only in the context of great ideas and by great minds. This is no more true than that the joys of creativity are restricted to a fortunate few. Science also gives us beauty, when it is pure, elegant, symmetrical and even confounding. Being entranced by a complex mathematical theory, is after all, one path toward truth. Puzzles, capturing the human mind which is itself a complex and confounding miracle of nature, are attractive to our species. Comprehending this, John Keats wrote in An Ode On A Grecian Urn , “Beauty is truth, truth beauty.” The sciences, and our human capacity for engineering and technology take full advantage of this type of beauty. We see nature’s loveliness and we are pulled by nature’s allure, but in our limited humanity, we don’t always face the truth that we belong to nature. It is our continuing quest to understand and work with nature that is exquisite. Music and musical training have also been shown to protect the aging brain and keep it healthy. University of Kansas Medical Center researchers conducted an experiment where they divided 70 healthy adults, ages 60 to 83, into three groups based on their amount of musical experience: no musical training, one to nine years of music lessons and at least 10 years of musical study. The participants, who had similar fitness and education levels and were free of Alzheimer’s disease, were given several cognitive tests Beauty is not yet necessarily art. All living things express beauty. The astrophysical and microphysical laws of the universe, also express beauty. The mere existence of a human child, is beautiful. A horse is also beautiful, and so is the song of the well-trained European nightingale. The relationship between the principle of beauty and the creative principle, which we have just identified, is of the form we call “doubly-connected” in synthetic geometry. For example, in the case of doubly-connected circular action, an “independent degree” of circular action is acting upon circular action constantly. By adding a third, “in dependent degree” of circular action, we generate everything which it is possible to generate by construction within the bounds of visible space.