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GUEST EDITORIAL

The need to become science-friendly

28th February is celebrated in India as the National Science Day (NSD) as a tribute to science. The date itself pays tribute to the discovery of Raman Effect which brought a Nobel Prize to C. V. Raman. Apart from speeches and films highlighting the role of science and its importance to the common citizen, the various programmes on the NSD also highlight the scientific temper. The scientific temper owes its origin to the way science proceeds to expand its role in understanding nature. But it has a wider role to play, which takes it well beyond the highways and byways of science. It is an attitude of mind which we should all cultivate that aims at being rational in our action and overall behaviour. Science progressed over the years by admitting new facts and ideas to its fold by demanding their critical appraisal. Do not accept a statement as factual until you have evidence to support it...even if it comes from a distinguished or important personage. So says the scientific temper.

Jawaharlal Nehru had warmly supported the scientific temper and had written about its importance for India which he saw as bound up in many superstitions. Jawaharlal Nehru stated: '[What is needed] is the scientific approach, the adventurous and yet critical temper of science, the search for truth and new knowledge, the refusal to accept anything without testing and trial, the capacity to change previous conclusions in the face of new evidence, the reliance on observed fact and not on pre-conceived theory, the hard discipline of the mind – all this is necessary, not merely for the application of science but for life itself and the solution of its many problems.' – Jawaharlal Nehru, *The Discovery of India*, 1946, p. 512 Writing in his *Discovery of India* he had further expressed the hope that after the country gains independence its citizens would learn to adopt the scientific temper. Of the many age old beliefs they would learn to discard those which have ceased to be relevant and retain only those which have stood the test of time. Unfortunately this has not happened. The majority of our countrymen still continue to harbour many superstitions.

The NSD therefore has a role to play. On this day there are talks and presentations debunking superstitions of various kind, as well as programmes presenting highlights of science so as to make people appreciate science

and be science-friendly. In particular, children are an ideal target group for the NSD. Arvind Gupta, a science popularizer has created a niche for himself through his science toys. Made mostly out of discarded material with minimal additions of equipment bought outside, these toys are very cheap to make but are remarkable in what they do. To a superficial observer they look magical until their secrets are explained. The secret of each toy is based on some law of science, the same law that appeared in the school textbook. Whereas the textbook version was presented in the class in a dry and uninteresting form, the toy version is of great interest to the student as it is manifest through the law in action. Indeed, Gupta's creations show that practical demonstration is the best way of learning science.

Of course, there are many ways of demonstrating to the uninitiated, how science works. The important thing is that the demonstration is in some action oriented mode. The famous scientist Michael Faraday had realized this and stressed the importance of practicals in teaching science. He had set up the Royal Institution of Great Britain back in the nineteenth century. Even today, this venerable organization has been following Faraday's practice of presenting basic science to the layperson through lecture demonstrations. And the response of the general public has been overwhelming. It is said that the crowds caused such traffic jams of hansom cabs that the Albemarle Street where the Institute is located had to be declared a one-way street. It is in fact the first one-way street in the world!

An example from India will testify to the popularity of science amongst general public in India. In 1999 a public lecture by Roger Penrose was arranged in Pune as part of a major international conference on general relativity and gravitation. The organizer was the Inter University Centre for Astronomy and Astrophysics (IUCAA). It was felt that the five hundred seater IUCAA auditorium would be inadequate to accommodate the audience and so the lecture was shifted to one three times as large. As the organizers brought the speaker to the entrance, they were met by a large collection of people who were denied admission as the auditorium was full and overflowing. The problem was how to get the speaker in. At that time help

came from an unexpected quarter. The famous Marathi drama actor Shiram Lagu showed a back entrance through which Penrose could be taken in. While this was happening Lagu stationed himself at the main door from where he made impromptu but dramatic speech urging the 'outsiders' to disperse peacefully. The crowd finally dispersed when the organizers promised to have a show of video recording of the lecture. The scene of Lagu blocking the entrance with all his might to enable Penrose reach safely the stage was strangely reminiscent of the historic fight put up by Baji Prabhu Deshpande which enabled Shivaji to escape safely.

My own experience of science popularization supports the above view. About forty years ago I was invited to deliver three public lectures in Nanded in the Marathwada area of Maharashtra. I proposed three topics from astronomy and informed the organizers to keep a projector ready. The organizers agreed to the arrangement but I could sense that they were not quite happy about it. They were afraid that the audience will not come in good numbers as people are generally afraid of science. Nevertheless they made all the arrangements. On the first day the auditorium was filled to capacity and those who were denied admission asked the organizers to shift the venue to open air for the remaining lectures. Again the organizers did nothing thinking that the crowd for later lectures would be much reduced. The contrary happened with the audience not admitted threatening angry action. Finally the last lecture was held in open with an audience of around ten thousand!

These examples suggest that there is considerable scope for popular science lectures and the proverbial ball is in our court! How many of us, professional scientists bother to play the game? Apart from lectures or lecture demonstrations on scientific topics, there is need to provide guidance on rational thinking. I should perhaps also mention here the peer review system which tells us what scientific research is worth publishing and which is not. I have encountered personally referee's negative comments on works not in the accepted mainstream models of cos-

mology. Often these are rejected out of hand or they are subjected to requirements that are manifestly impossible to satisfy. I sometimes wonder whether the modern review processes are no different from those which operated in the times of Copernicus and Galileo.

Indeed, not only public outlook, but research level science also sometimes needs scientific temper. For example, in cosmological studies a question arises about how the data on spectral shifts are interpreted. According to the Hubble law, there is a unique relation between velocity and distance of a galaxy. This forms part of the main basis of the expanding universe idea. The whole structure of the present cosmology is based on Hubble's law. However, for the last fifty years, there have been several examples in which there is a suspicion that the Hubble law does not work in some cases. One of the main pioneers in discovering this effect was Halton (Chip) Arp. Arp had been an assistant of Hubble and later went on to become a very mature observer in optical astronomy. He began to find discrepancies between Hubble's law and some of the galaxies he had encountered. At present this list is fairly large. However, when Arp tried to publish his results, he was always made to work hard to support what he was saying. As a result, the concept of non-cosmological redshifts which is suspected to be present in the cosmos, is being ignored. This is an example of how the above referee process operates in this subject. The philosophy of the establishment seems to be to argue that if we ignored such non-fitting data, it will eventually go away. This is hardly a scientific outlook. The scientific outlook would have been to consider such discrepant data and devise more sophisticated means of testing it.

Jayant Narlikar

Inter University Centre for Astronomy and Astrophysics,
Ganeshkhind,
Pune 411 007, India
e-mail: jvn@iucaa.in