

## Ashesh Prosad Mitra (1927–2007)

Ashesh Prosad Mitra, Padma Bhushan, former Director General of CSIR, and ex-director of the National Physical Laboratory (NPL), New Delhi, passed away in the early hours of 3 September 2007, after a month's illness. Only a few months earlier, his eightieth birthday had been celebrated at NPL, the institution with which his name had been inseparably associated for the last half a century. He is survived by his wife, two daughters and their respective families.

A. P. Mitra was born on 21 February 1927 in Calcutta (now Kolkata), where he received his early education. Son of a schoolteacher, he had inculcated the high standards of academics and discipline from his father, which he nurtured and actively practised till the very end. A brilliant student all through his educational career, Mitra stood first in all his examinations. His biggest decision after passing M Sc in Physics from Calcutta University was perhaps in joining the laboratory of S. K. Mitra, the pioneer of ionospheric research in India. His D Phil degree from Calcutta University on this subject at a time that was considered the golden era of Indian ionospheric science, thanks to the leadership of S. K. Mitra, marked the first step of a brilliant scientific career.

The next landmark in his scientific career occurred in 1954, when Mitra joined the NPL and soon afterwards set up the

Radio Science Division there, marking the beginning of an association that was to last till the very end. A short digression on the subject of ionospheric research may be relevant here. Since interactions of



the components of these upper atmospheric layers with particles or radiation, primarily from the sun or from other sources like meteorites largely determine their composition, this is an extremely rich science with regard to applications. On the other hand, before the birth of rocket technology, such information could only be accessed indirectly by limited means, such as spectroscopy, with mostly earth-based instruments. So, by its very nature, this type of research is bound to be strongly dependent on the state-of-the-art techno-

logy of the country of origin, unlike a common global standard that characterizes theoretical research. In India, the field of ionospheric research was pioneered by S. K. Mitra, with a huge global impact. It fell on his long-term associate and successor A. P. Mitra, to carry the programme forward at NPL in the company with several other Indian groups operating from other laboratories.

A. P. Mitra's researches involved the earth's near-space environment, first with ground-based and later with space techniques. As Secretary of the Indian Committee of the International Geophysical Year (IGY), he steered the Indian programme for IGY as well as the International Quiet Solar Year during 1957–58, which pushed Indian efforts into international limelight and ushered its scientists to a new era of ionospheric chemistry. His pioneering research in cosmic radio noise for studying the upper atmosphere led to a series of discoveries in the ionosphere and solar physics.

The sixties saw the beginning of high-level atmospheric probing with rocket-borne payloads. The seventies saw the introduction of the ADGES programme signifying scientific capability in radar and troposcatter systems. The SITE experiment (with radio beacons) led to an India-wide effort on the studies of the upper ionosphere. The Indian Middle Atmosphere Programme of the eighties saw extensive

### A requiem to an environmental scientist

In December 2005 when I met A. P. Mitra, he shared his insights on a number of issues.

*Ozone:* Mitra was of the opinion that the problem of stratospheric ozone depletion has been taken care of by the Montreal Protocol. The real problem now is the ground-level ozone which has direct impact on agriculture (10% drop in output) and health.

*Atmospheric Brown Cloud:* As I had read the debates in various issues of *Current Science* on the then Asian Brown Cloud now called Atmospheric Brown Cloud (ABC), I did mention that I was aware of the differences in opinion of his joint article<sup>1</sup> with that of other authors<sup>2</sup>. As I was uncomfortable to rake up an issue that was unresolved, I did not ask him to give his views. Not being an atmospheric scientist by training, I still await the final scientific truth. Some insights have been well understood through the editorials, correspondence and meeting reports in *Current Science*<sup>3</sup>. Now in 2007, the debate is still unresolved. Each year the print media does show on the front page, a photograph (mostly from NASA, USA) indicating the ABC and its greater contribution to the perils of global warming and its negative impact on even the retreat of Himalayan glaciers.

*Generation of our own database:* Mitra's contribution on climate change research in challenging the Western projections of methane emission from India is regarded as a watershed event. In the 1990s, Mitra proved that calculations as done by the West on methane emission from rice fields was much lower than what was being projected (the data was then revised by the United Nations body as it related to India). Mitra mentioned that 'methane from paddy field is now no more an issue. Enteric fermentation from cattle is also not a serious issue as it

can be controlled by change of fodder. But I am worried about two other pollutants – emissions from coal and by many diesel-based generators in houses and shops and also in the agricultural sector’.

Climate science eco-politics needs to be countered by good home-grown science. It is in this context that Mitra told me that ‘there is a need to have our own independent database on climate science. The foreign-funded research agencies in the region always carried an agenda suited to their own national interests’. He was keen that a South Asian Association for Regional Cooperation (SAARC) network be established with India assuming the leadership role. He elaborated on the new high-altitude lab set up at Hanle, Ladakh with a great potential for studying atmospheric data. ‘In the east’, he said ‘there is only one station at Darjeeling located in the house of our great scientist J. C. Bose. The Jadavpur University at Kolkata also had set up a station in the Sunderbans, besides there is one station at Port Blair’. He was keen that the army gets involved in this business of atmospheric chemistry and radio propagation, especially in the rugged, remote and high altitude region of Eastern Himalayas, which according to him did not have adequate number of stations to measure data.

*Transboundary pollution:* Mitra then mentioned that future wars for water is a well-known concept. He mentioned that ‘the problem of acid rain has to be addressed and transboundary pollution may seldom lead to war, but it may assume serious proportions in a tense international environment’. Examples of transboundary pollution concerns were – (i) Chinese dust storms over Japan; (ii) ABC over Asia reducing sunlight and food production; (iii) Ground-level/tropospheric ozone problem; (iv) African dust reaching the continent of USA, and (v) Forest fires in South East Asia.

Mitra touched that 2°C was the limit or threshold which needs to be our target in global warming. On water security he was concerned as to why a study of ‘virtual water’ was not being implemented in water-deficient regions and water-guzzling crops were being grown. He was also concerned that the our national production of 200 metric tonnes of foodgrain per annum has dropped below that mark. He concluded that a number of reasons have led to this emerging challenge of food security changed rainfall pattern being one. He also shared an important truth when he said, ‘the complexity of global change is much more than global warming’. Finally he wished that the generation, in the age group of 30–40 years working in the industrialized countries, reverts to serve India.

1. Ramanathan, V., Crutzen, P. J., Mitra, A. P. and Sikka, D., *Curr. Sci.*, 2002, **83**, 947–955.
2. Srinivasan, J. and Gadgil, S., *Curr. Sci.*, 2002, **83**, 586–592; Srinivasan, J. and Gadgil, S., *Curr. Sci.*, 2002, **83**, 1307–1309.
3. Balaram, P., *Curr. Sci.*, 2002, **83**, 350–351; Kamra, A., *Curr. Sci.*, 2002, **83**, 1300–1301; and Meeting Report, *Curr. Sci.*, 2005, **88**, 1366–1368.

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use of balloons and rockets to carry equipment up to ionospheric levels. The nineties saw two new world-class efforts: MST radar and the SROSS satellite, with specialized capacities to access substantial parts of the atmospheric environment from near the surface to around 1000 km (with a few gaps), for physical properties like electron and ion temperatures as well as densities at different levels. In these successive developments, the firm guiding hands of Mitra were strongly evident.

During the last decade, Mitra had concentrated on global environmental changes from human activities and their consequent impact on the biosphere. His contribution to the chemistry of the atmosphere and measurement of greenhouse gases of India, and to global environmental chemistry, including measurement of methane

emission from paddy fields, has been significant. As a leading figure in international programmes like the Indian Ocean Experiment, he played a crucial role in the now fashionable field of global change research.

Mitra was the recipient of many coveted honours and awards. He was a Fellow of not only all the three Indian national academies, but also of some of the most prestigious academies of the world, especially the Royal Society, the Russian Academy of Science and TWAS. His awards spanned a wide range, from the Bhatnagar Award to more specialized ones like the C. V. Raman (1980), FICCI (1982), G. M. Modi (1991) and Meghnad Saha (1992) awards, to name only a few. His Presidentship of the Indian Science Congress, and of the International Union

of Radio Science testified to his high stature. His professional standing notwithstanding, his human qualities were no less evident. One of his last works was an authoritative account of the progress of ionospheric research in India, starting from the pioneering efforts of his teacher, S. K. Mitra, which were duly carried forward by NPL under his dynamic leadership, as a chapter in a book entitled *India in the World of Physics: Then and Now* (ed. Mitra, A. N., Pearson Education Delhi, 2007, to appear).

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