

## Indira Nath (1938–2021)

The world of research in India is left poorer with the passing away of Professor Indira Nath on the night of 24 October 2021. Indira was an iconic scientist, and the scientific community looked up to her as a role model and inspiration. The adjectives of ‘medical scientist’ or ‘woman scientist’ sat lightly on her, and while she was a medical graduate and a woman, her science and ‘scientific temper’ were global in their scope and diversity. She did her M.B.B.S. from All India Institute of Medical Sciences (AIIMS) (1957–61) and M.D. in pathology from the same institution (1969). She was a Nuffield Postdoctoral Fellow (1971), at the Royal College of Surgeons and National Institute for Medical Research, London, UK, before joining AIIMS as a faculty in 1972. In 1983, she was awarded the Membership of the Royal College of Pathologists (MRCPath), UK on basis of publications. This also initiated her long scientific association with late Prof. John Turk at the Royal College of Surgeons and late Dr R. J. W. Rees at the National Institute for Medical Research, London.

When one of us (S.S.) joined AIIMS as an M.B.B.S. student in 1976, Indira was a faculty (then Lecturer, now designated Assistant Professor) in the Department of Biochemistry. By the time I joined the Department of Biochemistry for M.D. in 1981, she was Assistant Professor in the Department of Pathology. When I joined the same department as a faculty in 1988, she was Professor and Head, Department of Biotechnology at AIIMS. We shall not dwell on the implicit recognition of academic breadth and ‘trans-disciplinarity’ of those days, which permitted Indira with an M.B.B.S. and M.D. in pathology to always fulfil these multifaceted roles, across departments, with extraordinary ability. Rather, this perhaps exemplifies the fact that Indira, both as a scientist and a person, defied classification. She was always her own person and by being so left an indelible mark on Indian science. Of course, the boxes we tend to put people into, including scientists, did not matter to her. For her, research was global, both in subject matter and world view. As she mentioned in an interview to *The Hindu*, ‘Unlike most people, I have never had a dilemma about what to do in life. When I was ten, I decided that I wanted to become a doctor. By the second-year medical college, I was sure I wanted to specialize in pathology,

and later I was clear I wanted to do research’<sup>1</sup>. The same article also describes her as a ‘A content grandmother, ardent bonsai lover and a compulsive swimmer’<sup>1</sup>. The interview was on the occasion of L’Oreal–UNESCO award to Indira on International Women’s Day.



Indira was best known for her work in immunology of infectious diseases, especially the immunology of leprosy. When she started work, it was the pre-multidrug therapy era for leprosy, with the only effective therapy being dapsone, which took many years to show an effect. Evidence of the disease was far more widespread than today, with disfigurement and disability due to loss of fingers and toes being an inescapable visual manifestation. Even now, with far better therapy, the disease stubbornly refuses to get completely eradicated. It was clear that the immune response to leprosy had a major role in its protean manifestations. Her contributions included valuable insights into the unresponsiveness of stable lepomatous leprosy patients towards the bacillus, a kind of specific immunological blindness. She was able to demonstrate the role of circulating CD4+ FOXP3+T regulatory cells secreting the immunosuppressive cytokine TGF- $\beta$  in this condition. Another important contribution was the identification of the *LSR2* gene and characterization of the critical residues/motifs of the LSR2 protein recognized by patients in reaction. Leprosy reaction is a condition characterized by a heightened inflammatory reaction which results in tissue damage, especially nerve damage, triggered by chemotherapy and in some cases occurs following completion of treatment. Well past her formal retirement from AIIMS, from the National Institute of Pathology, publishing actively till 2016,

she was able to refine the immunology of leprosy beyond the conventional Th1/Th2 paradigm, to show that the Th17 and Treg populations were imbalanced during reactions.

As a student, our first extensive interactions with her were when she was a faculty in an integrated Immunology course for M.B.B.S. students taken by different departments that included Biochemistry, Pathology, Microbiology, Medicine, Physiology, etc. This was during our second professional stage in 1977, when the medical curriculum was mostly descriptive and strictly discipline-based. Also, in the Department of Biochemistry, headed by the stalwart in modern immunology, Prof. G. P. Talwar, she had her own niche of cellular immunology of infectious diseases, and while she collaborated extensively, her own unique scientific insights shone through. Credit must be given to the AIIMS administration, she flourished as a faculty in the Department of Biochemistry, though she had an M.D. in pathology, something that would be unthinkable today. From biochemistry (1972–80), she moved to pathology (1980–86) consistent in her commitment to immunology, along with a new range of didactic and service functions. It was then that she, along with other faculty at AIIMS, conceived of a Department of Biotechnology offering a teaching programme (Masters in Biotechnology (M.Biotech.)) at AIIMS. As a medical biotechnology programme, it was unique. Though rooted in the Department of Biotechnology, it drew from several departments at AIIMS, like Biochemistry, Biophysics, Biostatistics, Microbiology and Pharmacology, NMR, Endocrinology, Genetics, Transplantation Immunology, and Faculty from School of Life Sciences, JNU; NII, etc. These departments took joint ownership of many of its courses, and also participated in the thesis dissertations of the M.Biotech. students. She was one of the first to realize the storehouse of applied biology in a progressive medical institution and the potential of converting it into an interdisciplinary programme in basic and translational research, at a time when such attributes were unheard of. After formal superannuation in 1998, Indira held the INSA S.N. Bose Research Professor at AIIMS (1998–2003). A brief stint in Sungai Petani, Malaysia as Dean, School of Medicine, Asian Institute of Medical Sciences

and Technology, was followed by her appointment as Director, Lepra Society Blue Peter Research Centre, Hyderabad (2006–2008), followed by Emeritus Professor and Raja Ramanna Fellow, National Institute of Pathology (ICMR), New Delhi from 2009.

Indira's contributions were well recognized both in India and worldwide. The list is long, but includes the Shanti Swarup Bhatnagar award (1983), ICMR-JALMA Trust Oration Award (1981), Shri Om Prakash Bhasin Foundation Award (1990), Basanti Devi Amir Chand Prize (1994; Lifetime Award of ICMR); Rameshwardas Birla Smarak Kosh National Award (1995), R. C. Merhotra Life Time Award of National Science Congress Bhubaneswar (2012). International recognition included the Cochrane Research Award (1999), given by the Cochrane Foundation, and administered by the Royal Society of Tropical Medicine, UK; L'oreal-UNESCO Women in Science 2002 for Asia Pacific (one woman is selected from each of five continents) and the Silver Banner Award (2002), Tuscany, Italy, for work on leprosy as part of the Tuscany Day celebrations, whose theme was 'Women of the World, Women in the World', where six important women of the world were honoured for their role in science, culture and politics. Indira was also awarded an honorary doctorate – Docteur Honoris Causa in 2003, by the University Pierre et Marie Curie, Paris, France.

She was an elected fellow of the Third World Academy (now The World Academy of Sciences), Trieste, Italy; the Royal College of Pathologists, London; the National Academy of Medical Sciences, New Delhi; the Indian National Science Academy (INSA), New Delhi; the National Academy of Sciences, Allahabad; and the Indian Academy of Sciences (IASc), Bengaluru. She held various posts in these academies, including Vice President, IASc and Foreign Secretary, INSA (1995–98). Her civilian awards include *Padma Shri* (1999) and Chevalier le Ordre National du Merite (Knight of the National Order of Merit,

2003) civilian honour decreed by the then President France, Jacques Chirac.

As Member of the Scientific Advisory Committee of the Union Cabinet, Government of India (SAC-C, 2003–2007), she provided major inputs into scientific policy in India. Globally, her work on health, well-being and environment is important. She was Chair, Science Plan on Health and Wellbeing in the changing Environment, International Council of Scientific Unions Regional Office for Asia Pacific, Kuala Lumpur, Malaysia (2010–11) and Chair, International Council for Science (Paris) Committee on Urban Health and Wellbeing in Changing Environment (2011–2014). She was concerned that while the population was overall healthier than ever before in our history, our exploitation of the environment could ultimately negate the gains, and pursued the matter from a scientific policy perspective. She was also Co-Chair, Strengthening Global Research Integrity, Inter Academy Panel, Trieste and Inter Academy Council, Amsterdam (2010–2012).

Just by being herself, Indira was a trail-blazer and a role model for women in science. She saw herself as a scientist, first and foremost. As mentioned in an interview for a write-up in *Nature Medicine*<sup>2</sup>, she did not face any gender-related issues at AIIMS. 'Although women in rural areas are still oppressed, once you reach a certain social level, there's no problem. We don't have a difference in salaries, we don't have any gender-related problems'. However, she was aware of the internal brain drain caused by gender differences, and was active in initiating measures to bring women back to their careers in science and medicine after childbirth.

Indira married R. N. Gupta (her M.B.B.S. batchmate) in July 1965. Their daughter Deepa works as a Research Facilitator at the University of Oxford, UK. She is married to Dr Ben Berks (Professor, Department of Biochemistry, University of Oxford, and fellow of the Royal Society) and has two daughters, Madhavi Berks (currently pursuing Medicine at Cam-

bridge University) and Priya Berks (in school).

Indira Nath lived life by her terms. She was fortunate that her father allowed her to take up medicine. Financial independence encouraged her to pursue a career of her choice. After marriage, both Nath and Gupta decided to go to England. However, they agreed to limit their stay to three years. Gupta completed his MRCP and went on to be a paediatrician par excellence. His expertise generously extended to take care of all children of students and staff of the Leprosy Immunology Laboratory at AIIMS. Indira had selected a new subject (Immunology) at that time and chose to work on leprosy. India was the best country to study leprosy owing to a large number of patients. Keen on not wanting to add to the brain drain, she and her husband decided to return to India – failures and difficulties were there, but they had the confidence to confront the frustrations and impediments. When people look back at the research done on leprosy, they will find her name. Besides the same confidence and motivation that helped her persist with her work would hopefully resonate with others and persuade them to deal with the pressing medical problems of the day.

1. *The Hindu*, 17 March 2002.
2. *Nature Med.*, 2002, **8**(6), 545.

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