

Unrecognized Indian women scientists in Science and Technology

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Abstract

Like most professions in India, the field of science is very much male-dominated. Ask anyone to name an Indian scientist and you can probably bet that most names will be male. When asked to name an Indian scientist, most of us can only think of APJ Abdul Kalam or Srinivasa Ramanujan. It's not often that someone names an Indian woman scientist. The inauguration of the recent Women Science Congress held at Manipur University was mostly a man's affair, with just two women scientists on the stage. Women are universally underrepresented in science and technology. India, viewed as a potential powerhouse of innovations, is no exception. True, the subcontinent's institutes of scientific learning are open to all its citizens, but potential female researchers still hesitate at the thresholds of laboratories. Is this because they have seen few role models of their gender in such establishments? "Leelavati's Daughters: The Women Scientists of India," edited by Rohini Godbole and Ram Ramaswamy, is an inspiring anthology published by the Indian Academy of Sciences in a bid to remedy that visibility problem.

Introduction:

Women have made significant contributions to science from the earliest times. Historians with an interest in gender and science have illuminated the scientific endeavors and accomplishments of women, the barriers they have faced, and the strategies implemented to have their work peer-reviewed and accepted in major scientific journals and other publications. The historical, critical and sociological study of these issues has become an academic discipline in its own right.

The involvement of women in the field of medicine occurred in several early civilizations, and the study of natural philosophy in ancient Greece was open to women. Women contributed to the proto-science of alchemy in the first or second centuries AD. During the Middle Ages, convents were an important place of education for women, and some of these communities provided opportunities for women to contribute to scholarly research. While the eleventh century saw the emergence of the first universities, women were, for the most part, excluded from university education.^[1] The attitude

to educating women in medical fields in Italy appears to have been more liberal than in other places. The first known woman to earn a university chair in a scientific field of studies, was eighteenth-century Italian scientist, Laura Bassi.

Although gender roles were largely defined in the eighteenth century, women experienced great advances in science. In the later nineteenth century, the rise of the women's college provided jobs for women scientists and opportunities for education. Marie Curie, the first woman to receive a Nobel Prize in 1903 (physics), went on to become a double Nobel Prize recipient in 1911 (chemistry), both for her work on radiation. Forty women have been awarded the Nobel Prize between 1901 and 2010. 17 women have been awarded the Nobel Prize in physics, chemistry, physiology or medicine.^[2]

IndiaBioScience, a non-profit initiative within the Life Science sector organised a Wikipedia Edit-a-thon in Bangalore last week, to coincide with the Ada Lovelace Day on October 14, 2014. Over 40

entries and edits to pages were made to pages on women scientists from India, to plug the woefully inadequate representation of women's contribution to science in India. Karthik Ramaswamy, visiting scientist at the Indian Institute of Science (IISc) and a participant in the edit-a-thon, quoted to The Hindu that science in India has a 'diversity problem' with Indian women and minorities represented inadequately. "There are very few women scientists among faculty of science institutions because they have no role models. Hopefully, this (presence on Wikipedia) will provide them with role models," he added.

The AASSA report highlights that the proportion of women scientists who have never married is much higher than that of male scientists. Interestingly enough, almost 50% of married women scientists have married individuals within the field of science, which is not so in the reverse case. Recently, two journalists who have been travelling around the country interviewing women scientists about their work and their personal lives began a blog. In one of the interviews, Radhika Nair, a cancer biologist, talks about how for women scientists any time away from the laboratory can be crucial because it means losing out on new technologies.

In a BBC article about women space scientists, Minal Sampath, an engineer working on India's mission to Mars, says, "We were working up to 18-hour days sometimes...What the job takes away from me is that when my son is sick, when he needs me, I am in Bangalore repairing some system there." Women scientists seem to be constantly walking a tightrope – between societal norms and roles on the one hand, and gendered discrimination within science on the other.

The good news is that there is an increasing number of women receiving education in the sciences in India. Working in science has not been easy for women, with its long hours, societal biases, and the need to get married and have children in between. Only 14% of Indian researchers are women; science seen as male

profession. This might make it seem like there aren't many women contributing to the field of science, but that is not the case.

Many women, over the years, have made immense contribution to science, and have also paved a path for others to follow. Let us look at Indian women scientists who have broken stereotypes and are an inspiration to all. Let's look at some of these women, often forgotten heroes, who have made great contributions to science and paved the way for others.

Leelavati:

Leelavati was the daughter of great Mathematician Bhaskaracharya. It is said that Bhaskaracharya wrote a book in her name to console her when her marriage got cancelled. She is also said to be a gifted mathematician and astrologer.

E K Janaki Ammal (1897-1984):

D.Sc. (1931, Michigan), Founder Fellow of the Indian Academy of Sciences, winner of Padmashri Award was a renowned botanist and plant cytologist who made significant contributions to genetics, evolution, phytogeography and ethnobotany. While most girls at the time were studying fine arts and literature, Janaki Ammal decided to pursue Botany, and later scientific research in cytogenetics and phytogeography. She worked briefly in the UK, but returned to India in 1951 to reorganise the Botanical Survey of India (BSI). She served as the Director-General of the Botanical Survey of India (BSI). She also did work on medically important and economically valuable plants.

Kadambini (Basu) Ganguly: (1861 – 1923)

She was not only the first female graduate of the British Empire but she was also the first female physician of South Asia to be trained in western medicine. She studied medicine at the Calcutta Medical College, Calcutta and graduated in 1886.

AnandiGopal Joshi: (1865 –1887)

In the year 1886 another women from India also obtained a degree in Western medicine but she graduated from Women's Medical College in Philadelphia, USA and thus became first Indian to study medicine from abroad.

IravatiKarvePh.D. (1905-1970)

This renowned anthropologist was the Head of the Department of Sociology and Anthropology at Deccan College. She presided over the Anthropology division of the National Science Congress in 1947. She wrote extensively on a wide variety of academic subjects and otherwise. Her writings include the highly acclaimed book 'Yuganta' which won the Sahitya Academy Award.

Kamala Sohoni (1912–1998):

Dr.Sohoni was the first Indian woman to get a Ph.D in a scientific discipline. She applied to the IISc for a research fellowship and met with rejection merely because she was a woman! Prof. CV Raman, then IISc Director was dead against having women students. She then became the first of his female students, and performed so well that Prof. Raman gave her permission to pursue further research. While at Cambridge, she found that every cell of a plant tissue contained the enzyme 'cytochrome C' which was involved in the oxidation of all plant cells. In fact, her 40 page PhD thesis was based on this. The subjects of her research were often on food items consumed by the poorest people. She started her pioneering work on the nutritional value of Neera.

A Chatterjee (1917-2006)

First woman D.Sc. (1944, Calcutta), FASc, FNA, Khaira Professor of Chemistry, Calcutta University. Recipient of the Padma Bhushan. The numerous awards she won include S SBhatnagar award, C V Raman award of the UGC, P C Ray award, Sisir K Mitra Lectureship and Dr G P Chatterjee Lectureship. First lady president of the Indian Science Congress, member of RajyaSabha.

Her area of interest was natural products with special reference to the medicinal chemistry.

Anna Mani: (1918 –2001)

Former Deputy Director General of the Indian Meteorological Department was an Indian physicist and meteorologist. She made significant contributions in the field of meteorological instrumentation. She studied meteorological instruments at Imperial College London and after returning to India in 1948, she joined the Meteorological department in Pune. She conducted research and published numerous papers on solar radiation, ozone and wind energy measurements. She authored two books, *The Handbook for Solar Radiation data for India* in 1980 and *Solar Radiation over India* in 1981. She won the K.R. Ramanathan Medal in 1987

RajeshwariChatterjee(1922-2010):

She was the first woman engineer from Karnataka. In 1946, she was given a scholarship by the (then) Govt of Delhi to study abroad, and studied at the University of Michigan where she obtained her Master's degree from the Department of Electrical Engineering. After obtaining a Ph.D degree, she returned to India and joined the Department of Electrical Communication Engineering at IISc as a faculty member where she along with her husband set up a microwave research laboratory where they did pioneering work on Microwave Engineering.

DarshanRanganathanPh.D(1941-2001). FASc, FNA. Her honors include a Senior Research Scholarship of the Royal Commission for the Exhibition of 1851, A.V. Rama Rao Foundation Award, Jawaharlal Nehru Birth Centenary Visiting Fellowship, Third World Academy of Sciences Award in Chemistry and SukhDev Endowment Lectureship. Was Deputy Director, ICT, Hyderabad. She passed away from metastasis of cancer. She was an organic chemist from India who was known for her work in bio-organic chemistry,

including “pioneering work in protein folding” and “supramolecular assemblies, molecular design, chemical simulation of key biological processes, synthesis of functional hybrid peptides and synthesis of nanotubes.”

RohiniGodbole(Born in 1952):

Rohini is an Indian physicist and a professor at the Centre for High Energy Physics of the Indian Institute of Science in Bengaluru. She has worked for over three decades on Particle Phenomenology, and is particularly interested in exploring the Standard Model of Particle Physics (SM). Rohini is an elected fellow at all the three Indian Science academies and the Science Academy of the Developing World.

KalpanaChawla: (1962–2003)

She was the first Indian-American astronaut and first Indian woman in space. She first flew on Space Shuttle Columbia in 1997 as a mission specialist and primary robotic arm operator. The NASA chief called her a “Terrific astronaut”. On February 1, 2003, the U.S. space shuttle Columbia with a seven-member crew that included Chawla, 41, disintegrated in flames over central Texas shortly before it was scheduled to land at Cape Canaveral in Florida.

CharusitaChakravarty(Born in 1964):

A professor of Chemistry at the Indian Institute of Technology, Delhi since 1999. Born in the USA, she relinquished her U.S. citizenship and now works in India. She has won several awards for her work, most notably, the Shanti SwarupBhatnagar Prize. She is an Associate Member of the Centre for Computational Material Science, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore.

SunetraGupta(Born in 1965):

A novelist and a professor of Theoretical Epidemiology at Oxford University, Sunetra has a passion for studying infectious agents that cause diseases such as influenza and malaria, among others. She has been honoured by the Zoological Society of London with the Scientific Medal, and has also received the Royal Society Rosalind Franklin Award for her contribution to science.

MangalaNarlikar:

An Indian mathematician, Mangala has worked in the field of both Simple Arithmetic and Advanced Mathematics at the University of Pune and the University of Mumbai. One of the few women mathematics researchers in the country, she completed her PhD, 16 years after marriage putting household responsibilities before her career.. Having worked at the Tata Institute of Fundamental Research (TIFR), Mangala published several books on mathematical topics in both English and Marathi. She has been honoured with the VishwanathParvatiGokhale Award 2002 for one of her books in Marathi. One of the few female mathematics researchers in India, MangalaNarlikar describes herself as a part-time scientist.

Aditi Pant:

Aditi is an oceanographer, and the first Indian woman to travel to Antarctica, as a part of the 1983 Indian expedition, to study geology and oceanography. Inspired by Alister Hardy’s book *The Open Sea*, she pursued her MS in Marine Sciences, with a US government scholarship, at the University of Hawaii. Aditi completed her PhD at London’s Westfield College, and returned to India to join the National Institute of Oceanography in Goa. She has conducted coastal studies and has travelled the entire Indian west coast.

NandiniHarinath:

A rocket scientist at the Indian Space Research Organisation (ISRO) Satellite Centre in Bengaluru, Nandini has worked on 14 missions in

her 20 years of work. She was the deputy operations director for the Mangalyaan mission, and says that her first exposure to science was the popular cult television series Star Trek.

Conclusion:

A wide gulf only 25% of women are in scientific faculty of various institutions and universities. Women make up only 14% of 2.8 lakh scientists, engineers and technologists employed in R&D institutions in India. In 2017, of the total applicants to various branches of IITs only 10% were women. Moreover, only 5% of fellowships awarded by Indian National Science Academy, Indian Academy of Sciences and National Academy of Agricultural Sciences has gone to women. Only 8% of ISRO's scientific and technical staff make up of women. Sadly, no woman has headed it since it was founded in 1963. Women scientists say even when women are enrolled in PG and PhD in greater numbers, they fail to convert their degrees into careers due to the biological clock and family pressures.

Only 16 women scientists have won the Shanti SwarupBhatnagar Award since its inception in 1958. Women make up 37 per cent of PhDs in science but the percentage of women holding faculty positions in science research institutions is less than 15 per cent. There could be several reasons for this. Real change requires a small effort – a change in the mindset of the people and policy to push it forward. Young women researchers should know that they always have a choice. The ready availability of enlightened mentors, terribly inadequate in Indian science, would help young women just as much as they would young men.

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