प्रमा

Pramā

True Cognition

Special edition on the occasion of

INDIA INTERNATIONAL SCIENCE FESTIVAL 2020

शिव शक्त्या युक्तः शक्ति

A National Movement for Women

INDIAN WOMEN SCIENTISTS


Shakuntala Devi Human Computer


Mangala Narlikar


Bibha Chaudhary


Archana Bhattacharyya


Anna Mani


Darshan Ranganathan


Janaki Ammal


Sunita Narain


Asima Chatterjee


Neena Gupta


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● MATHMATIC ● PHYSICS ● CHEMISTRY ● BIOLOGY ● ENVIRONMENT ● BHATANAGAR AWARDEE

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From The Desk of Editorial Team .....

It is our great pleasure to welcome you to this special issue of Prama: the true cognition. The Covid-19 pandemic continues to spread and affect the lives of everyone, and the negative impact of this crisis on women scientists is hard to ignore. Even then all the scientists, members and scholars worked hard to publish the soft copy of this issue in this mega India International Science Fair 2020.

We are really happy to know that honourable Minister Madam Smriti ji Irani is going to launch this book. Thanks a lot to Madam Smriti Zubin Irani ji, Cabinet Minister of Women & Child Development and Minister of Textile.

Basically Indian women are the invisible player behind the visible growth in India. Now the time has come. The invisible contribution of women of India that makes the growth of the country visible has to be recognised. Since time immemorial, India is famed for its rich contribution to the field of Science, Technology, Engineering and Mathematics (STEM). In this issue we tried to focus some of our eminent women scientists from ancient to modern days in Mathematics, Physics, Chemistry, Biology, Environmental Science along with Bhatnagar Awardees and Shakti Members in the field of Science.

We have taken scientists life sketches randomly, tried the contents be in similar formats but many places we failed, there is no order in the scientists' biography, wither it should past followed by the present, the style of writing is different for different scientists. We also know that the texts need more editing and should be arranged by dates, but due to time constraint we failed to do so. We apologise for that. In the next edition we will rectify all the limitations.

We take the opportunity to thank all the contributors, helpers and advisors for their kind help in various ways. We thank our computer operator Krishna Verma ji and Murlidhar ji. Our special thanks goes to team Women Scientists' and Entrepreneurs'' Conclave in IISF2020.

Kindly distribute it in your students and your scientific network.

Let us hope this pandemic shall end soon. This is an opportunity to learn how science, technology, environment and human beings are interrelated to the development of the nation. Better days will come for all women in science around the world.

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MESSAGE FROM THE NATIONAL PRESIDENT, SHAKTI

Indian women are born innovators, managers and multitaskers.They are the perfect triangle of ethical,sentimental and professional acumen.The attitude and aptitude of Indian women can lead the women of the world for a better home, society and nation.

Although the numbers for participation of Women in Science at the global and Indian scenario is not satisfactory and need a boost, the contribution of Women scientists through ages is very impressive and should be brought in the limelight for younger generation to take inspiration.

The recent edition of Prama has is inclusive of the information about the women scientists through ages and is worth possession.I extend my best wishes for the team.

This book may get old but still it will be read by all the coming generations. Same way however old you get, you will always be remembered. Sending my good wishes to the readers espaciall to all budding women sciebntists in this IISF 2020.

With regards,
Dr. Sudha Tiwari
President
National Shakti

MESSAGE FROM THE GENERAL SECRETARY, SHAKTI

My heartiest greetings to all the participants, Experts, Guests and Attendees of Women Scientists & Entrepreneurs Conclave under IISF 2020.

The theme of IISF 2020 is Science for Self-Relient India and Global Welfare.

SHAKTI is privileged and honoured to share e-version of compendium on " Indian Women Scientists" that is been published as issue of PRAMA at IISF 2020.

Despite the present pandemic situation, we have left no stone unturned to gather the best write ups, capturing the success stories of each women scientist.

Our objective is to share the success stories of Indian Women Scientists with the present millennial generation, so that they can acknowledge the achievements of women scientists.

Our objective is to motivate the young girls to pursue science as their career, and fulfil their dreams of being one such eminent scientist.

I convey my thanks and gratitude to the entire editorial team, totally devoted to the cause and who worked tirelessly to make this issue a dream come true.

We will also appreciate your analytical reading and your valuable feedback on this compilation.

With regards,
Prof Ankita Bohare
General Secretary,
Shakti & One of the
Coordinators of
WSEC 2020

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MATHEMATICS

Journey of Mathematics

Journey of Mathematics with special reference to Indian Mathematicians and their contribution

● **Dr. Manisha Khaladkar**
Associate Professor, College of Engineering Pune

From very early historic and pre historic times, Indian mathematicians have developed the subject independently of Chinese (and probably also of Babylonian mathematics) and Egyptians. Numbers , metric system was passed forwards in the form of mantras from the early Vedic period (before 1000 BCE) invoke powers of ten from a hundred all the way up to a trillion. Evidence of the use of arithmetic operations such as addition, subtraction, multiplication, fractions, squares, cubes and roots is available since 4 century BC. A 4th Century CE Sanskrit text reports Buddha enumerating numbers up to 1053, as well as describing six more numbering systems over and above these, leading to a number equivalent to 10421. Given that there are an estimated 1080 atoms in the whole universe, this is as close to infinity as any in the ancient world came. It also describes a series of iterations in decreasing size, in order to demonstrate the size of an atom, which comes remarkably close to the actual size of a carbon atom (about 70 trillionths of a meter.

As early as the 8th Century BCE, long before Pythagoras, a text known as the "Sulba Sutras" (or "Sulva Sutras") listed several simple Pythagorean triples, as well as a statement of the simplified Pythagorean theorem for the sides of a square and for a rectangle (indeed, it seems quite likely that Pythagoras learned his basic geometry from the "Sulba Sutras").

These Sutras also contain geometric solutions of linear and quadratic equations in a single unknown, and give a remarkably accurate figure for the square root of 2, obtained which yields a value of 1.4142156, correct to 5 decimal places.

Jain mathematicians recognized five different types of infinities: infinite in one direction, in two directions, in area, infinite everywhere and perpetually infinite as early as in 2 and 3 rd century BC. Ancient Buddhist literature also demonstrates awareness of indeterminate and infinite numbers. Indian mathematicians classified numbers to be of three types: countable, uncountable and infinite.

Indian mathematicians were also responsible for another hugely important development in mathematics. The earliest recorded usage of a circle character for the number zero is usually attributed to a 9th Century engraving in a temple in Gwalior in central India. But the brilliant conceptual leap to include zero as a number in its own right is usually credited to the 7th Century Indian mathematicians Brahmagupta - or possibly another Indian, Bhaskara I - even though it may well have been in practical use for centuries before that. Bramaguptaestablished the basic mathematical rules for dealing with zero: 1 + 0 = 1; 1 - 0 = 1; and 1 x 0 = 0 (the

breakthrough which would make sense of the apparently non-sensical operation 1 ÷ 0 would also fall to an Indian, the 12th Century mathematician Bhaskara II). Brahmagupta also established rules for dealing with negative numbers, and pointed out that quadratic equations could in theory have two possible solutions, one of which could be negative. He even attempted to write down these rather abstract concepts, using the initials of the names of colours to represent unknowns in his equations, one of the earliest intimations of what we now know as algebra.

Golden Age of Indian mathematics can be said to extend from the 5th to 12th Centuries, and many of its mathematical discoveries predated similar discoveries in the West by several centuries.Golden Age Indian mathematicians made fundamental advances in the theory of trigonometry, a method of linking geometry and numbers first developed by the Greeks. They used ideas like the sine, cosine and tangent functions (which relate the angles of a triangle to the relative lengths of its sides) to survey the land around them, navigate the seas and even chart the heavens.

The Kerala School of Astronomy and Mathematics was founded in the late 14th Century by Madhava of Sangamagrama, sometimes called the greatest mathematician-astronomer of medieval India. He developed infinite series approximations for a range of trigonometric functions, including ?, sine, etc. Some of his contributions to geometry and algebra and his early forms of differentiation and integration for simple functions may have been transmitted to Europe via Jesuit missionaries, and it is possible that the later European development of calculus was influenced by his work to some extent.

Indian mathematician Leelavati was daughter of Bhaskara II, she was a bright lady who exceled in Astronomy, Arithmetics, Bhaskara II wrote a book named Leelavati which contained thirteen chapters, mainly definitions, arithmetical terms, interest computation, arithmetical and geometrical progressions, plane geometry, solid geometry, the shadow of the gnomon, the Ku??aka - a method to solve indeterminate equations, and combinations. Bhaskara II gi,ves the value of pi as 22/7 in the book but suggest a more accurate ratio of 3927/1250 for use in astronomical calculations. Also according to the book, the largest number is the parardha equal to one hundred thousand billion.

Hypatia of Alexandria (AD 350 or 370-AD 417), Émilie du Châtelet (1706-1749),Maria Agnesi (1718-1799), SophieGermain's (1776-1831), . Ada Lovelace (1815-1852), India's Shakuntala Devi are renowned all time important Lady mathematicians of the World.

Srinivasa Ramanujan (22 December 1887 - 26 April 1920)an Indian mathematician of modern times didn't have any formal training in Mathematics but contributed substantially to mathematical analysis, number theory, infinite series, and continued fractions, including solutions to mathematical problems then considered unsolvable.

Arithmetic, Algebra, Geometry, complex numbers, abstract algebra, graph theory are indispensable in the developments of Astronomy, Physics, Engineering, computers, even gambling. No wonder Mathematics is called as language of Engineering and Technology.

A BRIEF OUTLINEON SOME RENOWNEDINDIAN WOMEN-MATHEMATICIANS

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Introduction: The women's liberation movement which is nearly at the height of its existence had its beginnings many years ago. As for back as the time of the Greeks, women have been trying to assert their knowledge and prove their talents, in the hope of being recognized. It has been a continuous struggle, but many determined women have achieved their purpose and now distinguished among the great people of yesterday. Many great women have accomplished what they set out to do, regardless of the constant discouragement they encountered along the way.

When it comes to discuss about women mathematicians, some eminent names come up likeHypatia, Sophie Germain, SofyaKovalevskaya, Emmy Noether, Julia Robison, Katherian Johnson, Maryam Mizakhani, Sijue Wu, Fan Chung Lai-Sang Young, Alexandra Bellow, Sun-Yung Alice Chang etc. In India there are many renowned women mathematicians who have contributed a lot namely Shakuntala Devi, Neena Gupata, Sujata Ramdorai, Raman Parimala etc.

Shakuntala Devi (1929-2013): Shakuntala Devi was an Indian writer and mental calculator, popularly known as the "human computer".

Shakuntala Devi was born on November 4, 1929 in Bangalore, Karnataka to an orthodox Kannada Brahmin family. Her father discovered his daughter's ability to memorize numbers while teaching her card trick when she was about three years old. Her father took her on road shows that displayed her ability at calculation without any formal education. At the age of six, she demonstrated her arithmetic abilities at the University of Mysore.

In 1944, Shakuntala Devi moved to London with her father. She travelled the world demonstrating her arithmetic talents, including a tour of Europe in 1950 and a performance in New York City in 1976.

In 1988, she travelled to US to have her abilities studied by Arthur Jensen, a Professor of psychology at the University of California, Berkeley. Jensen tested her performance of several tasks, including the calculation of large number. Jensen reported that Shakuntala Devi provided solution of some calculation link cube root and seventh root of some large numbers before Jensen could copy them down

in his note book. Jensen published his finding in the academic journal Intelligence in 1990.

In 1977, at Southern Methodist University, she gave the 23rd root of a 201-digit number in 50 seconds.

On June 18, 1980 she demonstrated the multiplication of two 13-digit numbers 7,686, 369, 774, 870×2, 465, 099, 745, 779-picked at random by the Computer Department of Imperial College London. She correctly answered 18, 947, 668, 177, 995, 426, 773, 730 in 28 seconds. This event was recorded in the 1982 Guinness Book of Records.

Shakuntala Devi explained many of the methods she used to do mental calculations in her book Figuring: The Joy of Numbers, which is still in print.

She wrote many books, most ratably among them are 'The World of Homosexuals' (1977), Book of Numbers (1977), In the Wonderland of Numbers (2006), Astrology for You (2005), Super Memory: It Can Be Yours (2011), etc.

She died on 21 April, 2013. On 4 November 2013, Shakuntala Devi was honored with a Google Doodle on what would have been her 84th birthday.

Raman Parimala: Raman Parimala was born on November 21, 1948 and raised in Tamilnadu, India. She studied at the SaradhaVidyalaya Girls' High School and Stella Maris College at Chennai. She received her M.Sc. from Madras University (1970) and her Ph.D. from Bombay University(1976). Parimala works in algebra. Her research uses tools from number theory, algebraic geometry and topology. Raman Parimala has described as a "Supreme and powerful algebraist". She published the first example of a non-trivial quadratic space over an affine plane. Her study of quadratic forms also led her to investigate real algebraic geometry as well as complex algebraic geometry and the cohomology theories that are linked to it.

For many years, she was a Professor at the Tata Institute of Fundamental Research in Mumbai(Bombay), and she has held visiting position at the Swiss Federal Institute of Technology (ETH) in Zu ?rich, the University of Lausanne, University of California-Berkeley, University of Chicago, Ohio State, and University of Paris at Orsay. In 2005 Parimala was appointed the Asa Griggs Candler Professor of Mathematics at Emory University in Atlanta, Georgia. She is Fellow of all three Indian academics of science. She was an invited speaker at the International Congress of Mathematics in Zu ?rich in 1994 and plenary speaker at the 2010 ICM in Hyderabad.

Her research has been recognized with the Shanti SwarupBhatnagar Prize in 1987, an honorary doctorate from the University of Lausanne in 1999 and the SrinivasaRamanujan Birth Centenary Award in 2003. She also received TWAS Prize by The World Academy of Sciences in 2005.

Sujatha Ramdorai: Sujatha Ramdorai (born in 1962) is an algebraic number theorist known for her work on Iwasawa Theory. She completed her B.Sc. in 1982 at St. Joseph's college, Bangalore and then got her M.Sc. through correspondence from Annamalai University in 1985. After that she went

for Ph.D. at Tata Institute of Fundamental Research and was awarded her Ph.D. under supervision of Raman Parimala in 1992. Her dissertation was "Witt Groups of Real Surfaces and Real Geometry".

Together with Coates, Fukaya, Kato and Venjakob she formulated a non-commutative version of the main conjecture of Iwasawa theory.

She holds an adjunct Professorship position at Indian Institute of Science Education and Research, Pune. She is a member of the Scientific Committee of several international research agencies such as the Indo-French Centre for Promotion of Advanced Research, Banff International Research Station, International Centre for Pune and Applied Mathematics. She was a member of the National Knowledge Commission from 2007 to 2009. She is at present a member of the Prime Minister's Scientific Advisory Council from 2009 onwards and also a member of the National Innovation Council.

Ramdorai became the first Indian to win the prestigious ICTP Ramanujan Prize in 2006. She was also awarded the Shanti SwarupBhatnagar Award, the highest honour in scientific fields by the Indian Government in 2004. She is also the recipient of the 2020 Krieger-Nelson Prize for her exceptional contributions to mathematics research.

Neena Gupta: Neena Gupta was born on November 24, 1984.Neena did her schooling from Khalsa Model Senior Secondary School and graduated with honours in Mathematics from Bethun College in 2006. She did her post graduation in Mathematics from Indian Statistical Institute in 2008 and subsequently, her Ph.D. degree in 2011 with algebraic geometry under the supervision of Professor Amartya Kumar Datta. Her Ph.D. dissertation was "Some Results on Laurent Polynomial Fibrations and Quasi A^* Algebras".

Neena Gupta is an Associate Professor at the Statistics and Mathematics unit at ISI, Kolkata. She received the Indian National Science Academy Young Scientist award in 2014 for the solution she proposed to the ZariskiConcellation Problem in positive characteristic.

She has also earned Saraswathi Cowsik Medal in 2013, awarded by TIFR Alumni Association. She was previously a visiting scientist at the ISI and a visiting fellow at the TIFR, Mumbai. In 2019 Neena Gupta has become the youngest person to ever receive the prestigious Shanti Swarup Bhatnagar award at the age of 35. She was awarded the prize for having solved a 70-year old mathematics puzzle called the Zariski Cancellation Problem. Neena Gupta is not just the youngest, but also only the third woman to win the honour till date.

She has been honoured by many awards which are six awards from Bethun College in 2006 (PC Chandra Award for overall excellence, SushmaBasu Memorial Medal for highest marks amongst all science graduates, Shantilata Basu Medal for standing first amongst mathematics graduates, the GC and Pralima Das Medal for standing first in B.Sc. (Hons) and the Nalini Das Medal for most Promising student). PC Panesar Gold Medal for Outstanding Performance

in the Masters program in Mathematics, ISI (2008).

The Ramanujan Prize from the University of Madras (2014), The INSA Young Scientist Award (2014), The inaugural Professor A. K. Agarwal Award for best research publication by the Indian Mathematical Society), The Swarna Jayanti Fellowship Award by Department of Science and Technology (India) (2015), B. M. Birla Science Prize in Mathematics (2017).

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T. A. Sarasvati Amma

T. A. Sarasvati Amma (Tekkath Amayan kottukurussi Kalathil Sarasvati, also spelled as T.A. Saraswathi Amma) was a scholar born in Cherpulassery, Palakkad District, Kerala, India. She has con- tributed to the fields of history of Mathematics and Sanskrit, through her work on Geometry of ancient and medieval India.

Education

She took her basic degree inmathe- Her book Geometry in Ancient and Medieval India is a survey of the Sanskrit and Prakrt scientific and quasi-scientific literature of India, beginning with the Vedic literature and ending with the early part of the 17th century.

It deals in detail with the Sulbasutras in the Vedic literature, with the mathematical parts of Jaina Canonical works and of the Hindu Siddhantas and with the contributions to geometry made by the astronomer mathematicians Aryabhata I & II, Sripati, Bhaskara I & II, Sangamagrama Madhava, Paramesvara, Nilakantha, his disciples and a host of matics and physics from Madras University and obtained an M.A. degree in Sanskrit from Benares Hindu University.

She did her research under the guidance of Dr.V. Raghavan, a Sanskrit scholar. Sarasvati Amma taught at Sree Kerala Varma College, Thrissur, Maharaja's College, Ernakulam and also at Women's College, Ranchi. She served Shree Shree Lakshmi Narain Trust Mahila Mahavidyalaya, Dhanbad, Jharkhand as its principal from 1973 to 1980. After retirement she spent her last years in her home town Ottappalam.

Contribution

In the words of Michio Yano, who reviewed Sarasvati Amma's book GeometryinAncientandMedievalIndia, the book "established a firm foundation for the study of Indiangeometry".

others. The works of the mathematicians Mahavira, Sridhara and Narayana Pandita and the Bakshali Manuscript have also been studied.

The work seeks to explode the theo- ry that the Indian mathematical genius was predominantly algebraic andcomputational and that it eschewed proofs and rationales. There was a school in India which delighted to demonstrate even algebraic resultsgeometrically.

Dealing with sanskrit and prakrit scientific and quasi-scientific literature, the book breaks the myth around indian mathematics: that it is purely algebraic and computational and has no basis in rationale and proofs.

Social impact

The cyclic quadrilateral is a figure of pride in Indian geometry, and hasan eventful history. Brahmagupta' sformulas for its area and diagonals are considered to be among the most beautiful results of 7th century mathematics. Sarasvati's paper "Cyclic Quadrilateral in Indian

Mathematics"7 is quite comprehensive and shows her remarkable competencein dealing with Sanskrit and Malayalam mathematicaltexts. Her work also throws light on the interaction between greek and hindu mathematics in the development of trigonometry however minimal and motivated by the needs of astronomy.

Achievements

In her honour, the Kerala Mathematical Association organizes, in its annual conference, a Prof. T.A. Sarasvati Amma Memorial Lecture.

Vanaja Iyengar

Vanaja Iyengar (died 2001) was an Indian mathematician, educationist and the founder vice-chancellor of Sri Padmavati Mahila Visvavidyalayam, Tirupati, in thesouth remembered by her students. Many people who were closely associated with her recall the many times she went the extra mile to help people. When Sri Padmavati Mahila Visvavidyalayam, an all women university, was established in 1983, she was appointed as its vice-chancellor and continued at the post till 1986. Indian state of Andhra Pradesh.

Education

Born in the undivided Andhra Pradesh, she completed her early education at Hyderabad and obtained higher educa- tion in Mathematics from Cambridge University in 1950, after which she visited Yugoslavia, Czechoslovakia and Hungary as a part of student forums. Her career started as a member of faculty at Osmania University and worked in two of the colleges affiliated to the university, University College for Women, Koti (Osmania Women's College) and Nizam College. During her tenure at Osmania, Iyengar secured a doctoral degree in Mathematics from the University of Delhi in 1958. She served Osmania University as a reader, professor, head of the department of Mathematics depart- ment and the principal of the University College for Women, Koti and held the post of the vice-chancellor for a while.

Contribution

She was the first assistant of the school and her classes in social studies are well

Social impact

Shewasalsooneofthefoundermembers of the Osmania University Teachers Association. She was a life trustee of Andhra Mahila Sabha and she served organisation as its vice- president and the president, a post she held since 1994 till her death. She is also credited with articles on the topic ofeducation.

Awards and achievements

In 1987, the Government of India award- ed Iyengar the civilian honour of Padma Shri. She received the Best Teacher award from the Government of Andhra Pradesh and was a fellow of the Rajiv Gandhi Foundation.

Shakuntala Devi

Shakuntala Devi (4 November 1929-21 April 2013)was an Indian writer and mental calculator, popularly known as the "Human Computer".

Education

Shakuntala Devi travelled the world demonstrating her arithmetic talents, including a tour of Europe in 1950 and a performance in New York City in 1976. Shakuntala Devi was born in Bangalore, Karnataka to an orthodox Kannada Brahmin family. Her father discovered her ability to memorise numbers while teaching her a card trick when she was about three years old. Her father left thecircus and took her on road shows that displayed her ability at calculation. She did this without any formal education.At the age of six, she demonstrated her arithmetic abilities at the University of Mysore. In 1944, Shakuntala Devi moved to London with her father.

Her talent earned her a place in the 1982 edition of The Guinness Book of World Records.

Contribution

In 1988, she travelled to US to have her abilities studied by Arthur Jensen, a professor of psychology at the University of California, Berkeley. Jensen tested her performance of several tasks, including the calculation of large numbers. Examples of the problems presented to Devi included calculating the cube root of 61,629,875 and the seventh root of 170,859,375. Jensen reported that Shakuntala Devi provided the solution to the above mentioned problems (395 and 15, respectively) before Jensen could copy them down in his notebook. Jensen published his findings in the academic journal Intelligence in 1990. In 1977, at Southern Methodist University, she gave the 23rd root of a 201-digit number in 50 seconds. Her answer-546,372,891-was confirmed by calculations done at theUS Bureau of Standards by the UNIVAC 1101 computer, for which a special pro- gram had to be written to perform such a large calculation.

On 18 June 1980, she demonstrated the multiplication of two 13-digit numbers-7,686, 369, 774, 870×2, 465, 099, 745, 779-picked at random by the Computer Department of Impe- rial College London. She correctly answered 18,947,668,177,995,426,462,773,730in 28 seconds. This event was recorded in the 1982 Guinness Book of Records. Writer Steven Smith said, "the result is so far superior to anything previously reported that it can only be described as unbelievable.

Social impact

"Shakuntala Devi explained many of the methods she used to do mental calcula- tions in her book Figuring: The Joy of Numbers. Shakuntala Devi wrote a number of books in her later years, including novels as well as texts about mathematics,

puzzles, and astrology. In 1977 she wrote the book “The World of Homosexuals”, which is considered the first study of homosexuality in India. The book, considered "pioneering", features interviews with two young Indian homosexual men, a male couple in Canada seeking legal marriage, a temple priest who explains his view sonhomosexuality,and are view of the existing literature on homosexuality.It ends with a call for decriminalisation of homosexuality, and "full and complete acceptance-not tolerance and sympathy".She treated homosexuality in a positive light and is considered a pioneer in the field.

Achievements

Devi was an astrologer and an author of several books, including cookbooks and novels. Shakuntala Devi was honoured with a Google Doodle on what would have been her 84th birthday.

Renu C. Laskar

Renu Chakravarti Laskar is an Indian-born American mathematician, with specialisation in graph theory. She is Professor Emerita of Mathematical sciences at Clemson University.

Education

Renu C. Laskar was born in Bihar, India. With the help of her family support,

She finished her school in gand college, which wasn't much accessible to the women that time due to the cultural norm-spreva- lent in India. It was during that time, when she discovered her talent for mathematics. She finished her Master'sdegree in Mathematics from B. R. Ambedkar Bihar University in the year 1955. Upon finishing college, Laskar, with strong encouragement from her elder brother, decided to come to the United States to pursue her Ph.D. in the year 1958. She worked for her Ph.D. degree at the University of Illinois at Urbana-Champaign under her advisor HenryRoy Brahana and received her degree in the year1962.

She is the first female Indian to receive a Ph.D. in Mathematics from UIUC. She returned to India after that and joined the Indian Institute of Technology Kharagpur as the first woman faculty at theinstitute. After three years, Laskar thenmoved back to the US at University of North Carolina at Chapel Hill and then finally joined Clemson University in the year 1968.

Contribution

Laskar took full advantage of the opportunities she had and set new standards for women in mathematics. She ranks among the top women in discrete mathematics in the number of articles published.

According to MathSciNet, she has over 100 publications. Part of the reason for her success in this area is her collaboration network, which included Raj Chandra Bose and Paul Erdos. She has extended her influence by supervising Ph.D. students. In 1986, Laskar and Steve Hedetniemi organized the Clemson University Discrete Math Miniconference, an event that has drawn an international audience each year since.

Bhama Srinivasan

Bhama Srinivasan is a mathematician known for her work in the representation theory of finite groups. Her contributions were honored with the 1990 Noether Lecture. She served as President of the Association for Women in Mathematics from 1981 to 1983. She currently is a professor at the University of Illinois at Chicago. Shehas had five doctoral students. She has co-authored a number of papers with Paul Fong in modular representation theory and Deligne-Lusztig theory.

Education

Srinivasan was born in Madras, India. She attended the University of Madras, where she earned her Bachelor of Arts degree in 1954 and her Master of Science degree in 1955. She travelled to England for her doctoral study. She earned her Ph.D. in physics in 1959 with her dissertation Problems on Modular Representations of Finite Group sunder.

A. Green at the University of Manchester.

She remained in England to commence her professional academic career as alec-turer in mathematics at the University of Keele from 1960 through 1964. She then pursued a postdoctoral fellowship at the University of British Columbia through the National research Council of Canada From 1965 through 1966. She returned home to India to teach at the Ramanujan Institute of Mathematics of her Alma mater, the University of Madras, from 1966 through 1970.

Contribution

Srinivasan then immigrated to the United States, where she taught for the next decade at Clark University in Worcester, Massachusetts, as an associate professor. In 1977, she became a naturalized citizen of the United States. That year, she wasa member of the Institute for Advanced Studies at Princeton. In 1980, she commenced her longstanding tenure at the University of Illinois as a professor of mathematics at the Chicago Circle campus.

Srinivasan has distinguished herself in her field throughout her career. In January, 1979, she delivered the Invited Address to the American Mathematical Society(AMS) at the Joint Mathematics Meetings in Biloxi, Mississippi.

Social impact

Srinivasan collaborated with Paul Fong on finite groups of the Lie type, and this work has been linked to Lusztig's research on quantum groups, thus crossing over between mathematics and physics. Although Srinivasan generally advocates pure mathematical research, resisting the temptation to find apractical application for all mathematics, she nevertheless got excited by the application of her research to physics.

Awards and achievements

In 2012 she became a fellow of the American Mathematical Society. In 2017, she was selected as a fellow of the Association for Women in Mathematics in the inaugural class.

She has also been invited to fill visiting professorships internationally at the Ecole Normale Superieure in Paris, the University of Essen in Germany, Sydney University, and the Science University of Tokyo in Japan. She has served as anedi-tor for several journals in her field: Proceedings of the AMS (from 1983 through 1987); Communications in Algebra (from 1978 through 1984); Mathematical Surveys and Monographs (from 1991 through 1993). From 1991 through 1994, she served on theEditorial Boards Committee of the AMS.

Kanta Gupta

Chander Kanta Gupta FRSC was a Canadian distinguished professor of mathematics at the University of Manitoba, known for herresearch in abstract algebra and group theory. Much of her research concerns the auto- morphisms in different varieties of groups.

Education

Gupta earned a bachelor's degree from the University of Jammu and Kashmir, a master's degree from the Aligarh Muslim University, another master's degree from the Australian National University, and a Ph.D. in 1967 from ANU under the supervision of Michael Frederick Newman.

Awards and achievements

Krieger-Nelson Prize, She was elected to the Royal Society of Canadain1991,and awarded the Krieger-Nelson Prize of the Canadian Mathematical Society in 2000

Vasanti Bhat

Vasanti N. Bhat-Nayak was a mathematician whose research concerned balanced incomplete block designs, bivariegated graphs, graceful graphs, graph equations and frequency partitions.

Education

She earned a Ph.D. from the University of Mumbai in 1970 with the dissertation Some New Results in PBIBD Designs and Combinatorics. S. S. Shrikhandewas her advisor. After completing her doctorate, she remained on the faculty at the university, and eventually served as department head.

Contribution

Vasanti N. BhatNayak was a mathematician whose research concerned balanced incomplete block designs, bivariegated graphs, graceful graphs, graph equations and frequency partitions.

Renuka Ravindran

Renuka Ravindran (née Rajagopalan) was the first women to be the Dean of the Indian Institute of Science. She joined the Indian Institute of Science in 1967 as a professor and the Chairman of the Department of Mathematics, and then became the Dean of Indian Institute of Science. She has also been visiting professor at various universities, including the University of Kaiserslautern, Germany.

Education

She was a student at the Presentation Convent in Vepery in Chennai and later at the Women's Christian Collegein Chennai. She earned her PHD from Indian Institute of Science in Applied Mathematics and later Doktoringenieur from the Technische Hochschule Aachen in Aerodynamics in Germany. Her fields of specialization are nonlinear waves and non-Newtonian fluids Contribution She is author of numerous research papers on wave propagation and non- Newtonian fluids. She has given many popular lectures on mathematics, takes a deep interest in mathematics education at all levels and has significantly con- tributed to the preparation of text books of school level.

Social impact

Ravindran has been teaching at various levels at the IIS, both for graduate students in engineering as well as research students in the mathematics department. She has also been teaching at the University of Kaiserslautern, Germany, under the International Mathematics Programme. Laying stress on the development of science education at the school level, she says, "Some of our best brains come from the villages of the country. Infact,setting up science clubs will be a good way of nurturing young talents." She also suggests setting up of summer schools in different parts of Assam. "The service of the IIT professors can be asked for. Children should be exposed tothelatest developments in the realm of science and technology," she says. She wouldn't mind pitching in either. "I enjoy visiting this place. But it is the hospitality of the people which makes us feel like coming here again and again," she says. But it's taking science to the young minds that Ravindran is passionate about. "Instead of television, children should be encouraged to watch stars," the passionate mathematician signs off.

Awards andAchievements

She had also won several awards like the Borchers plaque for completing a degree course with "outstanding" grades, Sofia Kowalewskaja guest professorship,

University of Kaiserslautern, 1996, among others. She is also the recipient of theAlexandervonHumboldtFellowship, 1977, 1992 and GermanAcademic

Exchange Fellowship, 1971-73.

University of Kaiserslautern, 1996, among others. She is also the recipient of theAlexandervonHumboldtFellowship, 1977, 1992 and GermanAcademic

Exchange Fellowship, 1971-73.

Ajit Iqbal Singh

Ajit Iqbal Singh is an Indian mathematician, specialising in functional analysis and harmonic analysis. Singh is a Fellow of the Indian National Science Academy (INSA), India's apex body of scientists and technologists. She is also a fellow of the National Academy of Sciences (India), based in Allahabad.

Education

Singh completed her under graduation in Mathematics from Indraprastha College and graduated in the same subject from Delhi University in 1963 and 1965, respectively. She earned a PhD in mathematics from the University of Cambridge in 1969. Her dissertation titled 'Contributions to the Theory of Linear Operators in Locally Convex Spaces', was supervised by Frank Smithies. Singh attended Cambridge as a Commonwealth Scholar at Newnham College from 1966 to 1969.

Career Singh began teaching immediately after completing her master's degree, as faculty at Indraprastha College, Delhi University. On completing her PhD from Cambridge, she returned to Delhi and joined Hindu College. She taught alongside her research in functional analysis and harmonic analysis. In 1974, Singh was appointed Reader in Mathematics at Delhi University South Campus and continued on as Professor from 1984 to 2008. From 2008, she has been a Visiting Professor at the Indian Statistical Institute, Delhi Centre.

Contribution

Singh has worked on linear operators in locally convex spaces, topological algebra, spectral synthesis in hypergroups, multipliers and module homomorphisms, semigroup algebras, applications of harmonic analysis to differential equations and orthogonal polynomials, geometryof the range of a vector measure, and quotient rings of algebras of functions and operators.

Social impact

Ajit Iqbal Singh has been an active member of many academic andadministrative committees set up by the University of Delhi, DST, NCERT, UGC, CSIR, INSA, etc. She organized many academic activ- ities and conferences. She has served the INSA Council. She was Associate Editor of Indian Journal of Pure and Applied Mathematics (2004-2011).

Awards and recognition

Singh was awarded the Rai Bahadur Brij Mohan Lal Saheb Memorial Gold Medal and the Ravi Kanta Devi Prize from Delhi University.

Indulata Shukla

Indulata L. Shukla is a former Professor of Mathematics, who served for more than three decades at Sambalpur University, Sambalpur, Odisha, India. Education She did her schooling from Maharani PremKumari Girls' School and B.Sc. with Mathematics Honours from M.P.C. College, Baripada. She completed her M.Sc. in Mathematics from Ravenshaw College, Cuttack in 1966, and had a brief stint as a lecturer in M.P.C.College,[cita- China to present papers in conferences such as the prestigious International Congress of Mathematicians (ICM). Her first foreign visit in 1987 to the historic laval University, the oldest centre of education in Canada, is a memorable event for her. A popular and revered teacher among her students, she has also super- vised many doctoral fellows during her illustrious academic career.

Social impact

Dr Sukla's textbook Number Theory and Its Applications to Cryptographyiswide- ly followed by post-graduate students of Odisha universities. Her numeroustion needed before moving to the University of Jabalpur with a CSIR Fellowship to pursue Ph.D under the supervision of TribikramPati. While pursuing her researches, she joined Sambalpur University in November1970 as a lecturer in the School of Mathematical Sciences, and continued there till her retirement inMarch2004.

Contribution

She is the author of the text book Number Theory and Its Applications to Cryptography. In her research, she worked with English mathematician Brian Kuttner on Fourier series. She is a Life Member of the American Mathematical Society (AMS) and the Indian Mathematical Society(IMS).

She has been invited to countries like Canada, the US, Switzerland, Japan and research papers have been published in many international journals.

Awards and achievements

The Orissa Mathematical Society (OMS) gave her the Lifetime Achievement Award for her work in Number Theory, Cryptography andAnalysis. She received the award from Professor Ramachandran Balasubramanian, Director of the Institute of Mathematical Sciences, Chennai at the 42nd Annual Conference of OMS held at Vyasanagar Autonomous College, Jajpur Road, Orissa onFebruary 7,2015.

Mangala Narlikar

Mangala Narlikar is Indianmathematician who has worked and taught in both advanced mathematics and simple arithmetic. After her degrees in mathematics, she initially worked at the Tata Institute of Fundamental Research (TIFR) in Mumbai and later worked as a lecturer in the niversity of Bombay and Pune. She has published a number of books and articles both in English and Marathi language on mathematics related subjects. She is the recipient of the Vishwanath Parvati Gokhale Award 2002 for her Marathi book Gargi Ajun Jeevant Aahe.

Education

Narlikar studied from the University of Bombay and received degrees of B. A. (Maths) in 1962 and M.A. (Maths) in 1964 with first rank and also won the Chancellor's gold medal.

From 1964 to 1966 Narlikar worked as a Research Student and Research Associate in the School of Mathematics of the Tata Institute of Fundamental Research, Mumbai. From 1967 to 1969 she taught the undergraduate school at the University of Cambridge. From 1974 to 1980 she again worked in the School her Ph.D. degree in mathematics from the University of Bombay, 16 years after her marriage, in 1981 on the subject of Analytic Number theory. After obtaining her doctoral degree, she continued to work with TIFR from 1982-1985 as a Pool Officer in the School of Mathematics. Her teaching assignments from 1982 to 1985 was for MPhil class of Mathematics of TIFR. She obtainedin the Department of Mathematics in the University of Bombay. She also taught at intervals in the department of Mathematics of the University of Pune from 1989 to 2002 and taught M Sc stu- dents at the centre in BhaskaracharyaPratishthan from 2006 to 2010.

Contribution

Narlikar's core fields of interest are Real and Complex Analysis, Analytic Geometry, Number Theory, Algebra and Topology. She has published a number of booksand articles both in English and Marathi lan- guage on mathematics relatedsubjects.

Social impact

On writing books on mathematics, Narlikarwrote:"I enjoyed writing a book on how to make Mathematics interesting and accessible". On her combining herprofession with looking after the house- hold functions she wrote: "My story is perhaps a representation of the lives of many women of my generation who are well educated but always put household responsibilities before their personal careers"

Awards

She is the recipient of the Vishwanath Parvati Gokhale Award 2002 for her Marathibook Gargi Ajun Jeevant Aahe.

Ushadevi Bhosle

Ushadevi Bhosle is the member of FASc, FNASc, and VBAC international committees. She also was the senior associate of International Centre of Theoretical Physics, Italy. She was a fellow member of the Indian National Science Academy, Bangalore and National Academy of Sciences, Allahabad.

Education

She got a B.Sc. degree in 1969 and an M.Sc. degree in 1971 from University of Pune, Shivaji University, respectively. She commenced her post-graduate studies in 1971 from Tata Institute of Fundamental Research and got her doctorate degree of philosophy under the guidance of her mentor S.Ramanan in 1980.

She started her career with being a Research Assistant at the Tata Institute of Fundamental Research from 1971 to 1974. Then she became the Research Associate II in the same institute Tata Institute of Fundamental Research, from 1974 to 1977. Later on, she became a Research Fellow from 1977-1982 and the Fellow from 1982-1990 at Tata Institute of Fundamental Research. In 1990, she became a Reader in West Virginia, United States. In 1995, she was the Associate Professor till 1998 and later, she was Professor till 2001. Since 2001, she is the Professor.

Contribution

Her research areas are Parabolic vector bundles on curves, Picard groups of the moduli spaces of vector bundles, Generalized parabolic bundles and applications- II, Parabolic sheaves on higher dimensional varieties,

Nets of quadrics and vector bundles on a double plane, Generalised parabolic bundles and applications to torsion-free sheaves on nodal curves, Moduli of parabolicG-bundles on curves.

Awards and Achievements

She was awarded by Stree Shakti Science Samman in 2010 and RamaswamyAiyer Memorial Award in 2000.

V. Lakshmibai

Venkatraman Lakshmi bai is an Indian mathematician a pro- fessor of mathematics at Northeastern University in Boston.

Education

Lakshmibai earned her PhD in 1976 from the Tata Institute of Fundamental Research.

Contribution

Her research concerns algebraic geometry, the theory of algebraic groups, and representation theory, including in particular the theory of flag varieties and Schubert varieties.

Achievements

With Sara Billey she is the co-author of the monograph Singular Loci of Schubert Varieties (Progress in Mathematics 182, Birkhäuser, 2000). She has also co-authored two mono- graphs with Justin Brown: Flag Varieties: An Interplay of Geometry, Combinatorics, and Representation of Mathematical Society.

Aparna Higgins

Aparna W. Higgins is a mathematician known for her encouragement of undergraduate mathematicians to participate in mathematical University, and the two regularly take their sabbaticals together in California. Awards and achievements Higgins won a Distinguished Teaching Award from the Mathematical Association of America in 1995, for her contributions to undergraduate research. In 2005 she was one of three winners of the Deborah and Franklin Haimo Award Higgins is originally from Mumbai, India, and did her undergraduate studies at the University of Mumbai, graduating in 1978. She completed her Ph.D. in 1983 at the University of Notre Dame; her dissertation was on , Heterogeneous Algebras Associated with Non-Indexed Algebras, a Representation Theorem on Weak Automorphisms of Universal Algebras, was supervised by Abraham Goetz.

Contribution

Higgins originally specialized in universal algebra, but her more recent research concerns graph theory, including graph pebbling and line graphs. She is a professor of mathematics at the University of Dayton.

In 2009 she became Director of Project NExT, after the previous director, T. Christine Stevens, stepped down; this project is an initiative of the Mathematical Association of America to provide career guidance to new doctor- ates in mathematics. Higgins is married to Bill Higgins, a mathematics professor atWittenberg for Distinguished College or University Teaching of Mathematics of the Mathematical Association of America.

Vyjayanthi Chari

Vyjayanthi Chari is an Indian-American professor of mathematics at the University of California, Riverside, known for her research in representation theory and quantum algebra.

Education

Chari has a bachelor's, master's, and doctoral degree from the University of Mumbai.

Chari received her Ph.D. from the University of Mumbai under the supervision of RajagopalanParthasarathy. She was then a fellow at the Tata Institute of Fundamental Research, Mumbai Contribution invited research fellow at Brown University, RI; and an invited senior participant at Hausdorff Research Institute for Mathematics, Bonn, Germany; and visiting professor at the University of Rome Tor Vergata, Italy.

She was also the editor of the Pacific JournalofMathematicsandAlgebrasand RepresentationTheory.

Awards

Professor Chari was conferred with the Doctoral Dissertation Advisor/Mentor Award from the UCR Academic Senate. American Mathematical Society 2016 Class of Fellows.

Hema Srinivasa

Hema Srinivasan is a mathematician specializing in commutative algebra and algebraic geometry. Originally from India, she is a professor of mathematics at the University of Missouri.

Education

Srinivasan was a National Science Talent Scholar in India beginning in 1975. She studied at Bombay University, where she won the Ghia Prize for mathematics in 1978, but graduated from Indiana University Bloomington in 1982. She completed her Ph.D. at Brandeis the American Mathematical Society, elected "for contributions to algebra and algebraic geometry, mentoring, and service to the mathematical community".

Awards

She has following awards in her credit Ghia Prize for Mathematics, Bombay University, Sept 1978. National Science Talent Scholar, (India) Aug 1975 - July 1980. IBM Fellowship, Aug 1984 - July 1986 (Held at Brandeis University). General Member, MSRI, Special Year Commutative Algebra, Fall 2002. General Member, MSRI, Special Year Commutative Algebra, Dec 2012 - May 2013. Fellow, American Mathematical Society, since2018.

University in 1986. Her dissertation, supervised by David Buchsbaum, was Multiplicative Structures on Some Canonical Resolutions. After working as a Visiting Instructor at Michigan State University from 1986 to 1988 and as a Research Assistant Professor Purdue University from 1988 to 1989, she joined the University of Missouri faculty as an assistant professor in 1989. At Missouri, she has supervised 6 doctoral students and is currently the faculty advisor for the Association for Women in Mathematics Student Chapter.

Contribution

She is part of the 2018 class of Fellows of

Kavita Ramanan

Kavita Ramanan is a probability theorist who works as a professor of applied mathematics at Brown University.

Education

Ramanan is the daughter of Indian alge braicgeometer S. Ramanan. Sheearneda bachelor's degree in chemical engineering at the Indian Institute of Technology Bombay in 1992. She completed her Ph.D. in applied mathematics at Brown University in 1996. Her dissertation was supervised by Paul Dupuis,on mathematical techniques for the analysis of stochastic networks and interacting particle systems, which model phenome- na in a variety of fields including engineering, statistical physics and neuroscience. She has also made fundamental contributions to the study of large deviations or rare events, with applications to asymptotic convex geometry and high- dimensional statistics.

Social impact

She is also passionate about math outreach. She founded the Math CoOp, served as consultant and narrator for the film "Srinivasa Ramanujan: The Construction and Large Deviation Analysis of Constrained Processes, with Applications to Communication Networks.

After postdoctoral studies at the Technion, she worked at Bell Labs from 1997 to 2002, and as a faculty memberin mathematical sciences at Carnegie Mellon University from 2002 to 2009. She returned to Brown as a faculty mem- ber in2010.

Contributions

She is an interdisciplinary researcher, whose work transcends boundaries and combines tools from a broad array of fields, including discrete probability, stochastic analysis and partial differential equations. She has introduced novel perspectives and developed innovative Mathematician and his Legacy", and acts as corresponding editor for the Mathematics Magazine Bh?v?na. Photo Credit: T.J. Ravishankar

Awards

Ramanan won the Erlang Prize of the Applied Probability Society of INFORMS in 2006. She was elected as a fellow of the Institute of Mathematical Statistic sin 2013, andelectedtothe 2018 class of fellows of the American Mathematical Society and the Institute for Operations Research and the Management Sciences. She gave the 2015 Medallion lecture for the Institute of Mathematical Statis- tics, on "Infinite- dimensional scaling limits of stochastic networks.

Nilanjana Datta

Nilanjana Datta is an Indian-born British mathematician working in quantum information theory. She is a Reader in Quantum Information Department of Applied topics such as quantum state transfer, memory effects in quantum information theory and one-shot quantum informa- tion theory. Her collaborators include Artur Ekert, JürgFröhlich, Alexander Holevo, Richard Jozsa, Mary Beth Ruskai, and Andreas Winter.

Mathematics and Theoretical Physics at the University of Cambridge, and a Fellow of Pembroke College.

Education

Datta graduated from Jadavpur University with a Master of Science and did a Post-MSc at the Saha Institute of Nuclear Physics. In 1995 she obtained a PhD from ETH Zürich under thesupervision of JürgFröhlich and Rudolf Morf, working on quantum statistical mechanics and the Quantum Hall effect. She then held postdoctoral positions at the CNRS Marseille, the Dublin Institute for Advanced Studies the University of Strathclyde, and the École Polytechnique Fédérale de Lausanne. In 2001 she became an affili- ated lecturer of the Faculty of Mathematics, University of Cambridge and a Fellow of Pembroke College.

Contribution

After moving to Cambridge, Datta focused her research on the field of quantum information theory, contributingto

Social impact

Her research has primarily been in the field of Quantum Information Theory. She has been working on various aspects of this field: perfect transfer of quantum states and entanglement over spin networks, additivity conjectures of the Holevocapacityandtheevaluationofthe optimal rates of various quantum information protocols using the Quantum Information Spectrummethod.

Award

Awarded by External media: Women of Mathematics: an exhibition of portraits (University of Cambridge)

Radha Kessar

Radha Kessar is an Indian mathematician known for her research in the representation theory of finite groups. She is a professor of mathematics at City, University of London,and in 2009 won the Berwick Prize of the London Mathematical Society.

Education

Kessar graduated from Panjab University in 1991. She completed her Ph. D. in 1995 from Ohio State University; her dissertation titled Blocks And Source Algebras For The Double Covers Of The Symmetric Groups, was supervised by Ronald Solomon.

After taking visiting assistant professor positions at YaleUniversity and the University of Minnesota, and working as a Weir Junior Research Fellow at University College, Oxford, she returned to Ohio State as an assistant professor in 2002. She moved to the University of Aberdeen in 2005, and again to City in 2012.

Contribution

She is an author of the book Fusion Systems in Algebra and Topology With Michael Aschbacher and Bob Oliver (Cambridge University Press, 2011).

Awards

Her 2009 Berwick award was joint with her future City colleague Joseph Chuang, for the research reported in their paper "Symmetric Groups, Wreath Products, Morita Equivalences and Broué's Abelian Defect Conjecture"

Seema Nanda

Seema Nanda is an Indian mathematician. In her research she applies mathematics to study problems in biology, engineering and finance. Her research interests are primarily in solving real world problems using mathematics and computations.

Education

Her education in mathematics was at the Courant Institute of Mathematical Sciences of New York University, where she obtained her Ph.D in 1998. Her PhD thesis was in the area of probability theory and was supervised by Charles M. Newman.

Contribution

Prior to her current position as a faculty at the Tata Institute of Fundamental Research in Bangalore, she held cross-disciplinary academic positions at the University of Tennessee and at Harvey Mudd College. She switched careers from working in the corporate world to academic research in 2004.

Before returning to academia she-worked as a quantitative analyst for an investment bank in New YorkCity.

Social impact

She is interested in encouraging the youth of India to understand science and mathematics. In 2012 she founded an NGO called Leora Trust which aims to empower girls through education.

Awards

She was a recipient of the Bella Manel prize (given to a promising female student of mathematics at NYU) in 1996.

PHYSICS

Unveiling The Hidden Jewels

Sampa Das, Senior Scientist, Bose Institute, Kolkata

When we think about the Women Nobel Laureate in Science, the first name that comes to our mind is Madam Marie Curie not only because she was the first woman ever to win the Nobel Prize for her outstanding discovery of Polonium and Radium in the area of physics in 1903 (along with her husband, Dr. Pierre Curie, another reverent scientist) but for receiving the second Nobel prize in Chemistry in the year 1911 with sole credit of her own in recognition of her research on discovering properties of radioactivity. This remarkable properties become valuable in both scientific experimentation as well as in the field of medicine. Marie Curie was not only a prodigal scientist but also a great human being who was never interested in winning awards or prizes. Once she refused the order of prestigious "Legion of honour"award. However, innumerable awards andhonour had been offered later from various academies allover the world. This journey towards her success was not very smooth. Her struggle for research, running the family (after Dr.Pierre Courie's untimely death) and raising two daughters to a distinct height are exemplary to any woman ever across the country. Her honesty, simplicity, patience, high level of confidence were her strengths. Later her elder daughter Irene Curie also won Nobel prize in chemistry along with her brilliant husband, Fred Jolliot Curie. Madam later founded a Radium Research Institute in her native town Warsaw in Poland. Irene subsequently took care of that Institute.Ever since the first Nobel recognition of Madam Curie in 1903 till today only 20 women received this honour.

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.

There may be many different reasons behind such less representation of women scientists in world class platform which are more of social than scientific like marriage and accommodating with parents, husband, children. It also cannot be ignored that for achieving due recognition one scientist should have adequate research facility and required fund to conduct top grade experiments which necessitates the securing of permanent position and probably at a senior level. Still it is not easily achievable for women with exception. Even in this 21st century most of the women could not come out of their cocoon with a preconceived mind set that they are women and they have certain different commitments than their male counterpart. The Famous IISC Bangalore based Padma Shri awardee Physicist Dr.RohiniGodbole made a very inspiring comment -

" Women have to be really lucky to be a good scientist,a mother,and look after the family."

Coming to the story of yet a forgotten Indian angel physicist Dr. Bibha Chowdhury (1913-1991) whose research contribution remained hidden for years. We only came to know about her work from the joint publications of herwith Dr. D.M Bose, the former Director of Bose Institute as his co-worker. The research contribution of deprived physicist Chowdhuri was unveiled by Prof. Suprakas Roy, a former Professor of Bose Institute along with his Co-author Dr. Rajinder Singh, University of Oldenburg, Germany in their recent book " A JEWEL UNEARTHED : BIBHA CHOWDHURI (2018). Bibha was the first generation Indian woman scientist of pre-independent era.

After post graduation she approached Dr.D.M Bose to join his laboratory. Initially Bose refused her to take in, which was not very uncommon phenomenon of that age. Similar allegation was raised against Dr.C. V. Raman when he was reluctant to engage another woman scientist in his team at IISC Bangalore. Dr.Bose was compelled to recruit Bibha as her performance in the interview was outstanding. Bose and Chowdhuri started working in the area of particle physics

to experimentally detect the hypothetical Mesons. They started doing their experiments between 1939-1942 in high altitude of Darjeeling, Sandakphu using photographic emulsion technique. They were successful to detect two Mesons 200 and 300 times higher masses of electron. Over these years their findings were published in several issues of the prestigious Journal Nature. Unfortunately, due to their inability to import good quality photographic plates during World War they could not produce unambiguous evidence of Meson. After the war stopped Dr.C.F. Powell in Bristol,UK with full tone photographic plate was able to detect two mesons of masses 290 and 214 times higher than the mass of electron. Powel got Nobel Prize in 1950 for this remarkable achievement. He very generously acknowledged in his book on elementary particles-Chowdhuri and Bose were the first to detect tracks of particles with masses close to Meson. It was sheer ill luck of Chowdhuri and Bose that they could not produce accurate masses of Mesons without having full tone photographic plate. Otherwise history of Nobel prize would have been written ina differentcolour. In 1945 Bibha moved to Nobel laureate, Dr. Blackett's laboratory at Manchester for pursuing Ph.D.degree. After completing her Ph.D. on "Extensive Air Shower" in the area of cosmic ray she intended to return to India to continue her research. In 1952 she was offered a job at TIFR, Bombay and with new energy she started a project on Kolar Gold mine experiment with her air shower technique. She continued there till 1957. After that she went to USA for a year and on returning worked in Physical research laboratory, Ahmedabad for a couple of years till she returned to Kolkata..

After the completion of the Kolar Gold Mine experiment, she had a plan to set up a new experiment with Prof. Vikram A. Sarabhai at Mount Abu on radio frequency emissions associated with

Extensive Air Showers. However, this project did not come to life due to the untimely demise of Sarabhai. She took a voluntary retirement and continued to work on High Energy Physics in Kolkata in collaboration with scientists of Saha Institute of Nuclear Physics, University of Calcutta and Indian Association for the Cultivation of Science. In 1983 she participated in a national conference in Amritsar, Punjab where prominent cosmic ray researchers were invited. Till her last days in Kolkata she was involved in several scientific activities in Saha Institute of Nuclear Physics and Indian Association of Cultivation of Science. She died in her Broad Street residence on 2nd June, 1991.We lost the priceless Jewel quite silently.

It is a matter of pride for us that finally International Astronomical Union on 17th December, 2019 announced that " A white yellow star in Sextan constellation will now be named as 'BIBHA'" .

In Bengali Bibha means "bright beam of light". Literally with her bright beam of light she will remain immortal in the history of science.

Evolution of Physics

● **Dr Anjali Oudhia**
Prof. Physis, govt Nagarjuna PG col- lege of science.

1. GreekContributions

A number of contributions were made during the period of Greek civilization, dating from Thales and the early lonian natural philosophers in the Greek colonies of Asia Minor (6th and 5th cent. BC). Democritus (c.460-370 BC) proposed an atomic theory of matter and extended it to other phenomena as well, but the dominant theories of matter held that it was formed of a few basic elements, usually earth, air, fire, and water. The most important philosophy of the Greek period was produced by two men at Athens, Plato (427-347 BC) and his student Aristotle (384-322 BC), Aristotle in particular had a critical influence on the development of science in general and physics in particular. The Greek approach to physics was largely geomet- rical and reached its peak with Archimedes (287-212BC).

Another important scientist of the early Hellenistic period, centered in Alexandria, Egypt, was the astronomer Aristarchus (c.310-220 BC), who proposed a heliocentric, or sun-centered, system of the universe. However, just as the earlier atomic theory had not become generally accepted, so too the astronomi- cal system that eventually prevailed was the geocentric system proposed by Hipparchus (190-120 BC) and devel- oped in detail by Ptolemy (AD 85-AD 165).

Modern mechanics dates from the work of Galileo and Simon Stevin in the late 16th and early 17th cent. The great breakthrough in astronomy was made by Nicolaus Copernicus, who proposed (1543) the heliocentric model of thesolar system that was later modified by Johannes Kepler (using observations by TychoBrahe) into the description of planetary motions that is still accepted today. Galileo gave his support to this new system and applied his discoveries in mechanics to it sex planation.

2. Newtonian concepts of modern mechanics andoptics

The full explanation of both celestial and terrestrial motions was not given until 1687,when

Isaac Newton published his Principia [Mathematical Principles of Natural Philosophy). This work, the most important document of the Scientific Revolution of the 16th and 17th cent., contained Newton's famous three laws of motion and showed how the principle of universal gravitation could be used to explain the behavior not only of falling bodies on the earth but also planets and other celestial bodies in the heavens. William Gilbert, court physician to Queen Elizabeth I, published (1600) an important work on magnetism, describ- ing how the earth itself behaves like a giant magnet.

Newton himself discovered the separa- tion of white light into a spectrum of col- ors and published an important work on optics, in which he proposed the theory that light is composed of tiny particles,or corpuscles. A rival theory of light, explaining its behavior in terms of Waves, was presented in 1690 by Christian Huygens, but the belief in the mechanistic philosophy together with the great weight of Newton's reputation was such that the wave theory gained relatively little support until the 19th cent.

Duringthe18thcent.the mechanics founded by Newton was developed by several scientists and received brilliant exposition in the Analytical Mechanics (1788) of J. L. Lagrange and the Celestial Mechanics 17991825 of P.

S. Laplace. Daniel Bernoulli made important mathematical studies (1738) of the behavior of gases, anticipating the kinetic theory of gases developed more than a century later, and has been referred to as the first mathematical physicist.

3. Formulations of thermodynamics

In the 19th cent. this connection was established quantitatively by J.R. Mayer and J. P. Joule, who measured the mechanical equivalent of heat in the 1840s. This experimental work and the theoretical work of Sadi Carnot, published in 1824 but not widely known until later, together provided a basis for the formulation of the first two laws of thermodynamics in the 1850s by William Thomson (later Lord Kelvin) and R. J. E. Clausius.

The first law is a form of the law of conservation of energy, stated earlier by J. R. von Mayer and Hermann Helmholtz on the basis of biological considerations: the second law describes the tendency of energy to be converted from more useful to less useful forms. The atomic theory of matter had been pro-posed again in the early 19th cent. by the chemist John Dalton and became one of the hypotheses of the kinetic-molecular theory of gases developed by Clausius and James Clerk Maxwell to explain the laws ofther modynamics.

The kinetic theory in turn led to the sta- tistical mechanics of Ludwig Boltzmann and J. W. Gibbs The study of electricity and magnetism also came into its own during the 18th and 19th cents. C. A. Coulomb had discovered the inverse-square laws of electrostatics and magnetostatics in the late 18th cent, and Alessandro Volta had invented the electric battery, so that electric currents could also be studied. In 1820, H. C. Oersted found that a current-carrying conductor gives rise to a magnetic force surrounding it, and in 1831 Michael Faraday (and independently Joseph Henry) discovered the reverse effect the production of an electric potential or current throughmagnetism (see induction): these two discoveries are the basis of the electric motor and the electric generator,respectively.

4. Advances in Electricity, Magnetism, and Thermodynamics

Faraday invented the concept of the field of force to explain these phenomena and Maxwell, from c.1856, developed these ideas mathematically in his theory of electromagnetic radiation. He showed

that electric and magnetic fields arepropagated outward from their source at a speed equal to that of light and that light is one of several kinds of electromagnetic

radiation, differing only in frequency and wavelength from the others.

Experimental confirmation of Maxwell's theory was provided by Heinrich Hertz, who generated and detected electric waves in 1886 and verified their properties, at the same time foreshadowing their application in radio, television, and other devices.

The wave theory of light had been revived in 1801 by Thomas Young and received strong experimental support from the work of A.J.Fresnel and others; the theory was widely accepted by the time of Maxwell's work on the electromagnetic field, and afterward the study of light and that of electricity and magnetism were closely related. By the late 19th cent, most of classical physics was complete, and optimistic physicists

Birth of Modern Physics

Turned their attention to what they considered minor details in the complete elucidation of their subject. On the experimental side, the discoveries of X rays by Wilhelm Roentgen (1895). radioactivity by A. H. Becquerel (1896), the electron by J. J. Thomson 1897), and new radioactive elements by Marie and Pierre Curie raised questions about the supposedly indestructible atom and the nature of matter.

Ernest Rutherford identified and named two types of radioactivity and in 1911 interpreted experimental evidence as showing that the atom consists of a dense, positively charged nucleus surrounded by negatively charged electrons. Classical theory, however, predicted that this structure should be unstable.

5. Relativity and Quantum Mechanics Classical theory had also failed to explain successfully twoother experimental results that appeared inthelate 19th cent.

One of the sewas the demonstration by A. A. Michelson and E.W. Morley that there did not seem to be a preferred frame of reference, at rest with respect to the hypothetical luminiferous ether, for describing electro magnetic phenomena. In 1905, Einstein's special theory of relativity eliminated the need for the ether and implied,among other things, that mass and energy are equivalent and that the speed of light is the limiting speed for all bodies having mass. Hermann Minkowski provided (1908) a mathematical formulation of the theory in which space and time were united in a four-dimensional geometry of space- time. Einstein extended his theory to accelerated frames of reference in his general theory (1916), showing the connection between acceleration and gravitation. Newton's mechanics was interpreted as a special case of Einstein's, valid as an approximation for small speeds compared to that of light. A second theoretical problem was the explanation of the distribution of electromagnetic radiation emitted by a blackbody: experiment showed that at shorter wave-lengths, toward the ultraviolet end of the spectrum, the energy approached zero, but classical theory predicted it should become infinite. This glaring discrepancy, known as the ultraviolet catastrophe, was solved by Max Planck's quantum theory (1900) In 1905, Einstein used the quantum theory to explain the photoelectric effect, and in 1913 Niels Bohr again used it to explain

the stability of Rutherford's nuclear atom.

In the 1920s the theory was extensively developed by Louis de Broglie, Werner Heisenberg, Wolfgang Pauli, Erwin Schrödinger, P. A. M. Dirac, and others, the new quantum mechanics became an indispensable tool in the investigation and explanation of phenomena at the atomic level.

6. Particles, Energy, and Contemporary Physics

Dirac's theory, which combined quantum mechanics with the theory of relativity, also predicted the existence of antiparticles. During the 1930s the first antiparticles were discovered, as well as otherparticles.Among those contributing to this new area of physics were James Chadwick, C. D. Anderson, E. O. Lawrence, J. D. Cockcroft, E. T. S. Walton, Enrico Fermi, and Hideki Yukawa.

The discovery of nuclear fission by Otto Hahnand Fritz Strassmann (1938) andits explanation by Lise Meitner and Otto Frisch provided a means for the large- scale conversion of mass into energy, in accordance with the theory of relativity, and triggered as well the massive government involvement in physics that is one of the fundamental facts of contemporary science.

Mount Wilson astronomer Harlow Shapley championed the model of a cosmos made up of the Milky Way star system only; while Heber D. Curtis argued for the idea that spiral nebulae were star systems in their own right as island universes. The debate was resolved when Edwin Hubble detected Cepheid Variables in the Andromeda Galaxy in 1923 and 1924. Their distance estab- lished spiral nebulae well beyond the edge of the Milky Way.

Subsequent modelling of the universe explored the possibility that the cosmological constant, introduced by Einstein in his 1917 paper, may result in an expanding universe, depending on its value.

7. Advances incosmology

Thus the Big Bang model was proposed by the Belgian priest Georges Lemaître in 1927 which was subsequently corroborated by Edwin Hubble's discovery of the redshift in 1929 and later by the discovery of the cosmic microwave background radiation by Arno Penzias and Robert Woodrow Wilson in 1964. These findings were a first step to rule out some of many alternative cosmologies. Since around 1990, several dramatic advances in observational cosmology have transformed cosmology from a largely speculative science into a predictive science withprecise agreement between theory and observation. These advances include observations of the microwave background from the COBE, WMAP and Planck satellites, large new galaxy redshift surveys including 2dfGRS and SDSS, and observations of distant supernovae and gravitational lensing.

These observations matched the predictions of the cosmic inflation theory, a modified Big Bang theory, and the specific version known as the Lambda-CDM model. This has led many to refer to modern times as the "golden age of cos- mology".

On 17 March 2014, astronomers at the Harvard-Smithsonian Center for Astrophysics announced the detection of

gravitational waves, providing strong evidence for inflation and the Big Bang. However, on 19 June 2014, lowered confidence in confirming the cosmic inflation findings was reported.

On 1 December 2014, at the Planck 2014 meeting in Ferrara, Italy, astronomers reported that the universe is 13.8 billion years old and is composed of 4.9% atomic matter, 26.6% dark matter and 68.5% dark energy

8. LIGO the observation of gravitationalwaves

The first direct observation of gravitational waves was made on 14 September 2015 and was announced by the LIGO and Virgo collaborations on 11 February 2016.

Previously, gravitational waves had only been inferred indirectly via their effect on the timing of pulsars in binary star systems.The wave form, detected by both LIGO observatories, matched the predictions of general relativity for a gravitational wave emanating from the in ward spiral and merger of a pair of black holes of around 36 and 29 solar masses and the-subsequent "ring-down" of the single resulting black hole.

The signal was named GW 150914 (from "Gravitational Wave" and the date of observation 2015-09-14). It was also the first observation of a binary black hole merger, demonstrating both the existence of binary stellar-mass black hole systems and the fact that such mergers could occur within the current age of the universe.

This first direct observation was reported around the world as a remarkable accomplishment for many reasons. Efforts to directly prove the existence of such waves had been ongoing for over fifty years, and the waves are so minuscule that Albert Einstein himself doubted that they could ever be detected.

The waves given off by the cataclysmic merger of GW150914 reached Earth as a ripple in space-time that changed the length of a 4 km LIGO arm by a thousandth of the width of a proton, proportionally equivalent to changing the distance to the nearest star outside the Solar System by one hair's width.

AND THE QUEST GOES ON..

Timeline of Physics Greatest discoveries

Discoveries made by women in physics

Event	Time Period
Babylonians collected information of planets and stars	2000 BC to 1600 BC
Ancient Indians explained the evolution of universe and also explained about sun, moon, earth, and other planets	1500 BC to 1000 BC
Greek philosopher Anaxagoras explained the physical During universe	5th Century BC
Two Greek philosophers namely Leucippus and Democritus established the school of Atomism	During 5th Century BC
Aristotle, the Greek philosopher, described a geocentric universe	During 4th Century BC
The Greek philosopher Heraclides explained the motions of planets and stars	During 4th Century BC
Eratosthenes, the Greek mathematical geographer proposed the round shape of the Earth	During 3rd Century BC
Hipparchus was the first who measured the precession of the equinoxes	During 2nd Century BC
Based on Aristotelian ideas the Roman-Egyptian mathematician and astronomer Ptolemy described a geocentric model	During 2nd Century AD
The Indian astronomer and mathematician Aryabhata described the earth's elliptical orbit around the sun and its axis (heliocentric view)	During 5th Century AD
Brahmagupta, the Indian mathematician and astronomer noticed the gravity of earth	During 7th Century AD
Abu al-Rayhan al-Biruni the Persian astronomer described the Earth's gravitation	During 11th Century AD
Nicolaus Copernicus, the Polish astronomer and polymath explain the heliocentric principal scientifically	During 16th Century Ad
Johannes Kepler, the German mathematician and astronomer propounded Laws of Planetary Motion	During 17th Century AD

Galileo Galilei the Italian mathematician and physicist invented an astronomy telescope	During 17th Century At
Sir Isaac Newton, the English mathematician astronomer and physicist propounded Laws of Motions and Universal Law of Gravitation	During 17th Century AD
Emanuel Swedenborg first suggested parts of the nebular hypothesis	1734 AD
Immanuel Kant publishing Universal Natural History and Theory of the Heavens end explained nebular hypothesis	1755 AD
Max Planck, the German physicist described the law of body radiation and led the foundation of quantum blackphysics	During 20th Century AD
Albert Einstein, the German physicist propounded the theory relativity	During the 20th Century AD
Max Planck introduced formula for Black Body radiation	1900 AD
Kamerlingh Onnes experimented and noticed superconductivity	1911 AD
Wolfgang Pauli the Austrian theoretical physicist proposed an important quantum mechanical principle namely the 'Pauli exclusion principle	1925 AD
Georges Lemaitre proposed Big Bang theory	1927 AD
Edwin Hubble explained the expanding nature of universe (known as Hubble's Law)	929 AD
Otto Hahn discovered nuclear fission discovered	1938 AD
Black Hole Entropy	1972 AD
Richard Feynman proposes quantum computing	1980 AD
Theory of cosmic inflation	1981 AD
Top quark discovered	1995 AD
Gravitational waves detected	2015 AD

Women in Physics

● **Prof. Anjali oudhia**
Prof. physics Govt. nagarjuna pg college of science, Raipur(CG)

- Progress in Science and Technology are considered as two major markers of the development of human civilization and the intellectual superiority of human race. The story of scientific women in history is not one of a simple progression over time. However, history of Science and Technology, whether it is Indian or Western, tell us very little about the involvement of women in these fields. It has mostly been men's story. The invisibility of women in science is further underscored by various thinkers questioning on women cerebral power; more precisely, on the lack of it.
- According to D.D. Kosambi, women were the first potters, basket weavers and agriculturists with cultivation. Women have been occupying a high place of pride and honor in India during Aryan times. They have enjoyed symbolic respect and importance in many cultures.
- An Indian scholar invokes archaeological evidence that the prevedic civilisation was women centered. The earliest myths and religions have often placed women at the beginning of technologies of agriculture, law and medicine.
- There are two very notable goddess mentioned in the Rig Veda, viz., Saraswati and Sinivali. Saraswathi is the first female physician in the history of ancient medicine in India.
- She worked with the celebrated physicians called the Asvins. She is stated to be the creator of a formula of a medicine (Sarswati Ghrta) for cure of sterility in women and seminal insufficiency in men. Saraswati was revered by the physicians. Where Sinivali was either an obstetrician or a birth attendant. She seemed able to prevent miscarriage. A hymn reads: "Sinivali. O' Saraswati hold the embryo". Raka, Gunga and Anumati are other medical goddesses.
- Midwifery or dhatrividya is mentioned in ancient medical texts of Egypt, Mesopotamia, China, India and Japan. They deal with problems of pregnancy, childbirth and the immediately post birth stages. Though male physicians were interested in obstetrical and gynecological problems, midwives in pre – modern cultures were generally women. Many cultures till today retain the image of the "wise woman", the healer, having access to natural and supernatural knowledge.

Ref: Anil Kumar Tyagi, 1994, Women workers in Ancient India, Radha Publications, New Delhi, P.34. 43B.L. Raina, 1990, Health Science in Ancient India, Common Wealth Publishers, New Delhi, P.51. 44Ibi

- The Vedic literature mentions the names of many eminent women philosophers. Lopamudra composed two verses, Ghosha the daughter of

SagaKakshivam, a learned lady. She was the most outstanding of the twenty seven Brahmavadins who voiced Vedic wisdom through hymns. Several scholarly women like Alpa, Indrani Silkata and Nivavari were also famous during this period.

- A passage from the Atharva Veda states that, "The knowledge a woman possesses is the completion of all study".
- One of the repute philosophers of those times was Gargi. She participated in the philosophical congress convened by King Janaka of Videhas and challenged Yajnavalkya with several unanswerable questions. For, there are occasional Vedic references to Maitreyi, Vishvavara and Apala, as earnest seekers of knowledge and worthy disciples of great Gurus.
- According to one tradition, Leelavati was the daughter of the well-known Hindu mathematician Bhaskaracharya or Bhaskara II (born AD 1114), who taught her arithmetic. Bhaskaracharya is best known for his Siddhanta Siromani, and the first section of the Siddhanta Siromani, , shares the Lilavati's name with Bhaskaracharya as his daughter. Buddhism and Jainism offered a more honourable career to women. During Vikramaditya's reign, there was supposedly a women by name Khana whose scientific prowess was said to have been superior to that of her contemporaries. Popularly, Khana is often considered to be the daughter – in – law of Varahamitra,a prodigy in astronomy in the days of King Vikramaditya (380-413AD) of Ujjayini. Along with a traditional portrayal of women within the family, it refers to women taking part in performing a variety of agricultural functions such as planting seeds, weeding, husking and winnowing of the paddy and keeping a watch over the corn. Extraction of oil from gingerly seeds and fish was an important industry in ancient South India. Of these, the extraction and sale of fish oil is seemed to have been carried on by fisherwomen. Similarly, the production of salt from the seas was the work of castes living in the neytal or coastal regions. Salt makers or umanars wives played a significant role in the making as well as marketing of salts (Perumppanarruppatai 50-65)

Ref: Hari Narain Verma & Amrit Verma, 1978, Eminent Indian Women, Great Indian Publishers, New Delhi, P.28.

Dr. B.S. Chandrababu & L. Thilagavathi, 2009, Woman : Her History and her struggle for emancipation, Bharathi Puthakalayam, Chennai, P.36

The 16th and 17th Science and Technology in ancient and medieval India covered all the major branches of human knowledge and activities, including mathematics, astronomy, physics, chemistry, medical science and surgery, fine arts, mechanical and production technology, civil engineering and architecture, shipbuilding and navigation, sports and games. There are a variety of complexed social and psychological reasons for this situation where only a few women enter the fields of centuries, however, were the glorious epochs in the educational and cultural history of Mughal India.In 1882, Pandita Ramabai persuaded the Hunter Commission for allowing women to become doctors and teachers.

In 1883, Chandramukhi Basu and Kadambini Ganguly become the first female graduates of India. The conservative practice of segregation of Indian women necessitated the examination of female patients by women doctors. Hence, qualified women doctors were needed.

In 1885 Lady Dufferin established the National Association for Supplying Female Medical Aid to the Women of India, referred to as the Dufferin Fund.

1886 saw two Indian women Kadambini Ganguly and Anandi Gopal Joshi qualifying in western medicine . Thus the field of medical education opened up for women of India.

The independence brought about a change of outlook and problems of women were examined with care. Women became equal partners in the development of the nation. Article 15(1), 16(1), 16(2) of our Constitution provide for equal rights and privileges for both men and women and guaranteed equality, social, economic and political justice and liberty of thought, expression, belief and worship to all the citizens. Men and women were declared equal before law.

The Kothari Education Commission (1964-1966) emphasized that Mathematics and Science are important subjects and adequate preparation therein is essential to gain admission to significant courses at the university stage. It recommended that special efforts should, therefore, be made to encourage girls to study mathematics or science at the secondary stage and special efforts should be made to prepare women teachers in these subjects

Ref: Bharati Ray, (Ed) 2005, Women of India: Colonial and Post-colonial Periods, Volume IX, Part3, Project of History of Indian Science, Philosophy and Culture, Centre for Studies in Civilisation, New Delhi, P.191.

Barbara N. Ramusack, 2004, The Indian Princes and their States, Cambridge University press, New York, P.143.

The Department of Science and Technology began to coordinate science plans since 1974 and plays a unique role in promoting women in research and technology development in the country.

A shift in the approach from 'welfare' to 'development' is viewed with the vision and farsightedness of Dr. M.S. Swaminathan, a special chapter on 'Women and Development' and a section on 'Women in Science' were introduced in the Plan Document. Amazing scientists like Anna Mani, Asima Chatterjee, E. K. Janaki Ammal, Kamala Sohonie, Rajammal, Girija Rajaram and Durga Krishnamoorti have profiled and described exciting vignettes in their works, their passions, struggles and accomplishments. Over the past few decades, the United Nations intergovernmental processes have been playing a leading role in identifying key issues and proposing strategic actions to enhance women's empowerment through Science and Technology.

- Prejudice at many levels is one reason why there are far fewer women scientists than men in the higher echelons of science in India. A 2016-17 report, "Status of Women in Science Among Select Institutions in India: Policy Implications", supported by NITI Aayog, found that while women constitute over a third of science graduates and postgraduates, they make up only

15-20% of tenured faculty across research institutions and universities in India.

- As a group, it is not easy for women to stay in science. Only 14% of scientists are women," science writers Nandita Jayaraj and Aashima Dogra write in their recent book, 31 Fantastic Adventures in Science: Women Scientists in India. However, there are women who have beaten odds and shattered stereotypes and glass ceilings.
- Gagan Deep Kang is the first Indian woman to be elected as a fellow of the Royal Society, says, "If you see role models, you see areas you can aspire to. You need to see women doing this to understand this is feasible for you."

Incredible Indian women in Physics

Tessy Thomas (born April 1963)

Indian scientist and Director General of Aeronautical Systems and the former Project Director for Agni-IV missile in Defence Research and Development Organisation.

She is the first woman scientist to head a missile project in India. She joined DRDO in 1988. She was placed in the department of design and development of the new generation ballistic missile, Agni. For the Agni Programme, she had been appointed by Dr. APJ Abdul Kalam. Tessy was associate project director of the 3,000 km range Agni-III missile project. She was the project director for mission Agni IV which was successfully tested in 2011. Tessy was appointed as the Project Director for 5,000 km range Agni-V in 2009. The missile was successfully tested on 19 April 2012. She was appointed as Director-General, Aeronautical Systems of DRDO in 2018. Thomas received the Lal Bahadur Shastri National Award for her contribution for making India self-reliant in the field of missile technology.

●✻●

Bindu A Bambah

Ph.D. (1983, Chicago), of the School of Physics, University of Hyderabad, is a recipient of the UNESCO Young Scientists Award and the P M S Blackett Scholarship. She works in the areas of theoretical high energy physics and dynamical systems.

●✻●

Prerna Sharma

At just 29, the assistant professor at the Indian Institute of Science was on the Forbes' 30-under-30 India list which includes people who are doing commendable work in their professional fields. She studies soft condensed matter like colloids, emulsions and surfactants. She was part of a team which made great headway in two-dimensional physics.

Bibha Chaudhary

Chowdhuri (1913-1991) served in renowned institutions of the country and was a tireless researcher till she died, unsung and unheralded, in Calcutta.

Education

Chowdhuri obtained her MSc in Physics from Calcutta University in 1936 - the only woman in that batch and plunged headlong into research, mostly at the Bose Institute.

Contribution

Bibha Chowdhuri is well-known for her work in particle physics and cosmic rays, and discovery of a new subatomic particle, the pi-meson, from experiments in Darjeeling. Debendra Mohan (DM) Bose [nephew of Sir J.C. Bose] and Chowdhuri published three consecutive papers in Nature, but could not continue further investigation on account of "non-availability of more sensitive emulsion plates during the war years. Seven years after this discovery of mesons by DM Bose and Bibha Chowdhuri, C.F. Powell made the same discovery of pions and muons and further decay of muons to electrons using the same technique" and won the Nobel Prize in 1950. Powell acknowledged Bose and Chowdhuri's pioneering contribution in his work.

Judging by her publications in journals such as Nature and Proceedings of the Physical Society of London, and her doctoral research work at the laboratory of renowned physicist P.M.S. Blackett in the UK, Bibha Chowdhuri was a gifted physicist. Upon moving to India, she worked in the field of nuclear physics. She was involved in the Kolar Gold Field experiments to detect neutrinos.

Achievements

No wonder she was one of the young scientists the first woman researcher selected by Homi J. Bhabha to join the newly established Tata Institute of Fundamental Research (TIFR), Bombay, in 1949.

A public competition by the International Astronomical Union (IAU), which names planetary bodies, the yellow-white dwarf star HD 86081 was renamed Bibha in her honour.

Radha Balakrishnan

She works at Institute of Mathematical Sciences, Chennai primarily related to nonlinear dynamics and applications in physics.

Education

Balakrishnan pursued her Physics Honours from Delhi University and finished her M.Sc in 1965. She has a Ph.D from Brandeis University where her thesis was one of the earliest studies of quantum crystals on the effects of 4He impurities in solid 3He.

Contribution

During the 1980s, when Balakrishnan returned to India, she worked at the Department of Theoreti- cal Physics, University of Madras as a Research Associate. She joined Institute of Mathematical Sciences, Chennai in 1987. She retired in the year 2004 and since that time, Balakrishnan is continuing her research as a CSIR Emeritus Scientist. Her current research is on Nonlinear Dynamics, Solitons and Applications in Physics, Connections to Classical Differential Geometry.

Awards & Achievements

From the 1990s, she had been studying the deep connections between nonlinearity and the differential geometry of curves and surfaces. Balakrishnan received the Tamil Nadu Scientists Award in the Physical Sciences (1999) for her work. She also received INSA's Professor Darshan Ranganathan Memorial Lecture Award (2005) for original and pioneering contributions in nonlinear dynamics.

Lilabati Bhattacharjee

Lilabati Bhattacharjee (née Ray) was a mineralogist, crystallographer and a physicist.

Education

She studied with scientist SatyendraNath Bose and completed her M.Sc. in Physics from the University of Calcutta in 1951.

Contribution

Mrs Bhattacharjee specialised in the fields of structural crystallography, optical transform methods, computer programming, phase transformations, crystal growth, topography, instrumentation and made important contributions to these fields. She served as a Senior Mineralogist at the Geological Survey of India and later went on to become the Director (Mineral Physics) of the organisation.

Archana Bhattacharyya

Archana Bhattacharyya (born 1948) is an Indian physicist. She specializes in the field of ionospheric physics, geomagnetism, and space weather and is Director of the Indian Institute of Geomagnetism, Navi Mumbai.

Education

Bhattacharyya completed B.Sc (Hons) and M.Sc in Physics from the University of Delhi in 1967 and 1969, respectively. She also held a National Science Talent Scholarship (1964-69). She received PhD degree in Physics from Northwestern University (1975), working in the area of theoretical condensed matter physics.

Contribution

Bhattacharyya joined the Indian Institute of Geomagnetism (IIG), Mumbai in 1978. She worked with the group of KC Yeh at the University of Illinois, Urbana-Champaign during 1986-87 and during 1998-2000 she was a Senior NRC Resident Research Associate at the Air Force Research Laboratory in Massachusetts, USA. She was the Director of IIG during 2005-2010. Currently, she is an Emeritus Scientist at IIG.

Her research interest and are is in Plasma instabilities in the equatorial ionosphere Probing the ionosphere with radio waves Effects of space weather on the ionosphere Spatio-temporal variations of the geomagnetic field.

Awards and honours

The Professor KR Ramanathan Memorial Lecture and Medal by the Indian Geophysical Union in 2008, Dr. KS Krishnan Gold Medal by the University of Delhi in 1969, Fellow of the Indian Academy of Sciences and National Academy of Sciences, India.

Maitree Bhattacharyya

Maitree Bhattacharyya is working for the progress of scientific and societal interactions.

Education

She graduated from Presidency College with Honours in Physics and obtained M.Sc degree from the University of Calcutta. She started her research career in the Department of Biophysics and Molecular Biology, University of Calcutta with a Ph.D. degree in 1991. She pursued research with a Research associate ship from CSIR and in 1994 joined University of Calcutta as an Assistant Professor. Later, she was awarded a DBT Overseas fellowship and worked as Visiting Scientist in UCSD, USA. Now she is the Professor, Department of Biochemistry in University of Calcutta.

Contribution

Bhattacharyya joined as director at Jagadis Bose National Science Talent Search (JBNSTS), Kolkata from January 2015.

Fourteen students have been awarded PhD degree under her supervision and in 2015 she is leading a group of ten research scholars which comprises PhD and post doctoral students. She has published several research articles and chapters in books of International repute. During 2016 Bhattacharyya has been bestowed the fellow of the West Bengal Academy of Science and Technology.

Her Research interest and areas are Study of microbial diversity in coastal and estuarine water and soil sediment in the world heritage site, Sundarbans. Exploration of dynamic correlations among physical, chemical and biological domains of this estuarine ecosystem. Inventorisation of microbial diversity along Indian coast has cocaine.

Identification of risk factors and biomarkers in the disease dynamics of diabetes associated cardio-vascular disease and dyslipidemia.

Application of green chemistry in bioremediation and biotransformation of heavy metal toxicity in industrial effluent, green synthesis of nanoparticles Protein structure-function and interactions with special interest to heme proteins, bio molecular interaction.

Indrani Bose

Indrani Bose is an Indian physicist, senior Professor at Department of Physics, Bose Institute, Kolkata. Her fields of specialization are in theoretical condensed matter, quantum information theory, statistical physics, biological physics and systems.

Education

Bose obtained her Ph.D. (Physics) in 1981 from University of Calcutta.

Contribution

Bose's research interests include the problem of quantum many body systems, quantum information theory, statistical mechanics and systems biology.

She is a fellow of the Indian Academy of Sciences, Bangalore and of the National Academy of Sciences, Allahabad. She also developed a strong solid-state theory group in the Bose Institute.

Awards

Bose was the first recipient of the Stree Shakthi Science Samman award (2000)[6] for her work on exact solutions of model Hamiltonian (low dimensions) in the context of magnetic systems.

Bimla Buti

BimlaButi is an Indian physicist and specializes in the field of plasma physics. She was the first Indian woman Physicist Fellow of Indian National Science Academy(INSA).

Education

Buti obtained a BSc (Hons) and a MSc degree in Physics from University of Delhi. She was admitted to the University of Chicago for doctoral studies. She worked under the supervision of Subrahmanyan Chandrasekhar and in 1962 she earned a PhD degree in plasma physics.

Contribution

After earning her doctorate, Buti returned to India and took up a teaching role at Delhi University. Two years later, she went back to the US to work at Goddard Space Flight Center.In 1968 Buti came back to India and took a job at the Indian Institute of Technology, Delhi. Vikram Sarabhai, the then Director of Physical Research Laboratory (PRL), invited Buti to join PRL, where Buti served from 1970 to 1993 as Associate Professor, Professor, Senior Professor and Dean of Faculty. Buti, in her career, published a large number of research papers and edited four books. Between 1977-83, she was an Associate Editor of IEEE Transactions on Plasma Science, USA.

Social impact

At PRL, Buti started a new section for the experimental Plasma Physics programme. Shortly thereafter, this group was spun off as a separate institution known as Institute of Plasma Research under the aegis of the Indian Department of Atomic Energy. Between 1985-2003,Buti was the Director of Plasma Physics at the International Centre for Theoretical Physics, Trieste, Italy.

She founded Plasma Science Society and worked there as its president between 1992-1993.

Awards &achievements

Buti has received the following awards during her career Vikram Sarabhai Award for Planetary Sciences (1977) Jawarharlal Nehru Birth Centenary Lectureship Award, 1993

INSA-Vainu Bappu Award for Astrophysics, 1994, Professional Achievement Citation Award of University of Chicago, USA (1996), US Medal for Fundamental Contributions in the Physics of Nonlinear Waves and Chaos (2010) Fellow of TWAS, Fellow of National Academy of Sciences (India) Fellow of American Physical Society, Fellow of the Indian National Science Academy.

Bulbul Chakraborty

Bulbul Chakraborty is the Enid and Nate Ancell Professor of Physics at Brandeis University. She is a condensed matter theorist, studying systems far from equilibrium, such as granular materials.

Education

Chakraborty graduated with a BSc in Physics from the Indian Institute of Technology in 1974 and earned a PhD in 1979 from State University of New York, Stony Brook. The title of her PhD thesis is "Influence of thermal disorder on electronic properties of solids".

She was a postdoctoral fellow at Argonne National Laboratory, NORDITA, Denmark, and a Research Associate at the Indian Institute of Science.

Contribution

She was a Scientific Officer (equivalent of Assistant Professor) at the Materials Science Laboratory, Indira Gandhi Center for Atomic Research (1984-1986), and an Associate Research Physicist and Lecturer, in Applied Physics, at Yale University (1987-1989). Chakraborty joined the faculty in the Physics Department at Brandeis University in 1989 where she has been Full Professor since 2000.

Her recent research has been focused on a) exploring emergence in the macroworld where thermal fluctuations are irrelevant, and specifically how shearing leads to solidification in the natural world, b) analyzing the origin of glassy dynamics in supercooled liquids with a specific focus on the question of an underlying critical point, c) the collective behavior of active matter, which consists of individual entities that can produce and dissipate energy.

Awards and achievements

Chakraborty is the Enid and Nate Ancell Professor of Physics at Brandeis University. She was elected fellow of the American Physical Society (APS) in 2008 "for important theoretical contributions to diverse areas of condensed matter physics, including frustrated magnets, diffusion of light particles in metals, the glass transition, and jamming in granular systems". In 2018, the Simons Foundation awarded Chakraborty a Simons Fellowship in Theoretical Physics.

Rajeshwari Chatterjee

Rajeshwari Chatterjee was an Indian scientist and an academic. She was the first woman engineer from Karnataka. During her tenure at the Indian Institute of Science (IISc), Bangalore, Chatterjee was a professor and later chairperson of the department of Electrical Communication Engineering.

Education

Chatterjee was born in 1922 in Karnataka. She had her primary education in a "special English school" founded by her grandmother. After finishing her schooling she got admitted into Central College of Bangalore where she earned B.Sc (Hons) and M.Sc degrees in Mathematics.In both these exams she ranked first in the Mysore University. She received Mummadi Krishnaraja Wodeyar Award and M.T. Narayana Iyengar Prize and the Walters Memorial Prize respectively for her performances in the B.Sc and M.Sc examinations.

In 1943, after her M.Sc, she joined the Indian Institute of Science(IISc), Bangalore as a Research Student in the then Electrical Technology Department in the area of Communication.

She went to C.V. Raman to work under him. Some sources say that Raman refused to take her stating that Rajeshwari had no degrees in Physics. While others say that he was averse to the idea of having women students.

In 1946, she was selected as a "bright student" by the Government of Delhi and was given a scholarship to go abroad to pursue higher studies and she decided to the United States. In the 1950s it was very difficult for Indian women to go abroad to pursue higher education. But Chatterjee was determined to do so. In July 1947, one month before India's independence, she started her journey to the USA on a converted troop ship SS Marine Adder and reached there after 30 days. In the US, she was admitted to the University of Michigan and obtained her master's degree from the Department of Electrical Engineering. Then following the guidelines of the contract she had with the Government of India, she underwent an eight months' practical training in the Division of Radio Frequency Measurements at the National Bureau of Standards in Washington D.C. After the completion of the training she went back to the University of Michigan and resumed her studies. In early 1953 she obtained her Ph.D degree under the guidance of Professor William Gould Dow.

Contribution

In 1953, after obtaining her PhD degree, she returned to India and became a faculty member at the IISc Department of Electrical Communication Engineering, later saying that she taught "electromagnetic theory, electron tube circuits, microwave technology, and radio engineering". Over her lifetime, she mentored 20 PhD students, wrote over 100 research papers, and authored seven

booksElements of Microwave Engineering,ntenna Theory And Practice, A Thousand Streams: A Personal History, Dielectric And Dielectric Loaded Antennas, Advanced Microwave Engineering: Special Advanced Topics, Vasudhaiva Kutumbakam: The Whole World Is But One Family: Real Stories of Some Women and Men of India.,Antennas for Information Super Skyways: An Exposition on Outdoor and Indoor Wireless Antenna, co-authored by Perambur S. Neelakanta.

Social impact

She and her husband built a microwave research laboratory and began research in the field of Microwave Engineering, the first such research in India.In the same period, Chatterjeewas selected for the position of Chairman in the Department of Electrical Communication Engineeing.Following her retirement from the IISc in 1982, she worked on social programs, including the Indian Association for Women's Studies.

Awards and achievements

For her contribution and works in the field of Microwave engineering, she won many awards. Some of the notable awards and honours are Mummadi Krishnaraja Wodeyar Award for first rank in the BSc (Hons), M T Narayana Iyengar prize and the Waters Memorial prize for the first rank in M. Sc. Mountbatten prize for the best paper from the Institute of Electrical and Radio Engineering (UK) J.C Bose Memorial prize for the best research paper from the Institution of Engineers, Ramlal Wadhwa Award for the best research and teaching work from the Institute of Electronics and Telecommunication Engineers.

Joyanti Chutia

Joyanti Chutia is an Indian physicist. She was the among the first women who have headed scientific institutions in India when she became the Director of the Institute of Advanced Study in Science and Technology in Guwahati, Assam, which is the first major research institution in North East India. She is a fellow of National Academy of Sciences. She is an Emeritus Scientist at the Department of Science & Technology in the Government of India.

Education

Chutia was one of the first girls to take Mathematics as a main subject in her school. She later studied physics at Cotton College, Assam where she obtained a BSc in 1967. She continued teaching at Cotton College before obtaining an MSc in physics at Dibrugargh University in 1969. Following this, Chutia taught for some time as a lecturer, eventually deciding to continue with research by pursuing a PhD at Dibrugargh University. Her research focused on the conduction mechanism of thin polymer films and she was awarded her degree in 1981.

Contribution

After finishing her fellowship given by the Japanese Government in 1988 to work in the Plasma Laboratory of the Institute of Space and Astronautical Science, Tokyo, in 2005 she became the Director of the Institute of Advanced Study in Science and Technology.

Chutia's research focuses on biomedicine, material science and biotechnology. Her research has led to the development of a highly durable and degradable wound suturing material from Muga Silk.

Achievements

She is a fellow of National Academy of Sciences. She is an Emeritus Scientist at the Department of Science & Technology in the Government of India.

Moumita Dutta

Moumita Dutta is an Indian Physicist working at the Space Applications Centre (SAC), Indian Space Research Organisation (ISRO) - Ahmedabad, as a scientist/engineer. She has expertise in the development and testing of the Optical and IR sensors/instruments/payloads (i.e. cameras and imaging spectrometers). She was part of the team Mars Orbiter Mission (MOM) to put a probe into orbit around Mars in 2014. She contributed significantly in the development of one of the five payloads of MOM..

Education

Dutta was raised in Kolkata. She read about the Chandrayaan mission as a student and became interested in joining the Indian Space Research Organisation (ISRO) in 2004. Dutta's interest in physics, studied in the ninth grade, led to her career as an engineer. Dutta currently works as a Project Manager for the Mars Mission. Dutta obtained her M Tech degree in Applied Physics from the University of Kolkata.

Contribution

She joined the Space Applications Centre, Ahmedabad in 2006. Since then she has been involved in many prestigious projects like Oceansat, Resourcesat, HySAT, Chandrayan I and Mars Orbiter Mission. She was chosen to work as Project Manager for the Methane Sensor for Mars and was given the responsibility for the development of the complete optical system, optimisation and characterisation and calibration of the sensor.

Social impact

Presently she is also leading a team in the indigenous development of optical instruments (i.e. imaging spectrometers) and working towards the realisation of the 'Make in India' concept. Her research area includes miniaturisation of gas sensors which involves state-of-the-art technologies in the field of optics.

Awards

She is a recipient of the ISRO Team of Excellence Award for the Mangalyaan.

Rupamanjari Ghosh

Rupamanjari Ghosh is the present Vice-Chancellor of Shiv Nadar University, Uttar Pradesh, India. She is also the former Director of School of Natural Sciences and Dean of Research & Graduate Studies at Shiv Nadar University, and a Professor of physics and former Dean at the School of Physical Sciences, Jawaharlal Nehru University, New Delhi. Her areas of interest include Experimental and Theoretical Quantum Optics, Laser Physics, Nonlinear Optics, Quantum Information, Quantum Measurement and Magneto-Optics.

Education

Professor Rupamanjari Ghosh is a researcher, teacher, orator and an academic administrator par excellence. Professor Ghosh has B.Sc.(Physics honors) and M.Sc.(Physics) degrees from the University of Calcutta, and a very well-recognized Ph.D. in Physics from the University of Rochester, NY in Quantum Optics where she worked as a Rush Rhees Fellow, chosen for "outstanding scholarly ability and the promise of exceptional contributions to scholarship and teaching." Her research interests are in Experimental and Theoretical Quantum Optics, Laser Physics, Nonlinear Optics, and Quantum Information. Her pioneering work with Prof Leonard Mandel on two-photon interference (using the nonlinear optical process of spontaneous parametric down-conversion) has yielded a new direction in quantum optics and quantum information, in the creation and use of a source of entangled photon pairs, and of single photons, at the forefront of research. After her Ph.D., she returned to India and joined the School of Physical Sciences, Jawaharlal Nehru University, where she held many important academic and administrative positions over a span of 24 years. She has also held several Visiting Positions on invitation at Université Paris-Sud, Universite de Rennes I and École NormaleSupérieure among others.

Contribution

Professor Ghosh is a former Dean, School of Physical Sciences at Jawaharlal Nehru University, New Delhi. She has held several Visiting Faculty / Scientist positions on invitation abroad, and delivered numerous invited research seminars in India and abroad.

She joined the Shiv Nadar University in 2012 as the Founding Director of the School of Natural Sciences. Over the years, she has shaped the vision and mission of the School, which has started drawing attention of the world community in this very short period of time. She also took charge as the Dean of Research & Graduate Studies, the Head of the Faculty Development Center, and later, as the Director of the School of Engineering. She became the Vice-Chancellor of Shiv Nadar University in early 2016.

Social impact

She serves as an expert in crucial DST (Government of India) committees in

Physical Sciences, and in many Central and State universities and institutes. She has also served as the Chief Advisor for the National Council of Educational Research and Training (NCERT) Science textbooks for Classes IX and X, developed a fresh under the National Curriculum Framework-2005.

Besides her contribution to science research and training from the university to the school level, she is also well known for her stand and efforts to bring in gender justice and environment consciousness in the higher education system.

Awards

Ghosh was awarded the Streeshakti Science Samman in 2008.

Rohini Godbole

Prof. Rohini Godbole is an Indian physicist and academic. She is a professor at the Centre for High Energy Physics, Indian Institute of Science, Bangalore. She has worked extensively on different aspects of particle phenomenology over the past three decades, in particular on exploring different aspects of the Standard Model of Particle Physics (SM) and the physics beyond it (BSM).Her work regarding hadronic structure of high-energy photons outlined a variety of ways in which to study it and has had implications for the design of next generation electron positron colliders. She is an elected fellow of all the three academies of Science of India and also the Science Academy of the Developing World (TWAS).

Apart from her work in academics, Prof. Godbole is also a much sought-after communicator of science, often delivering talks to young students, scholars and scientists on everything physics. She is also an avid supporter of women pursuing careers in science and technology, and along with Ram Ramaswamy, edited the book Lilavati's Daughters a collection of biographical essays on women scientists from India.

Education

Rohini Godbole obtained her BSc from Sir Parshurambhau College, University of Pune, MSc from the Indian Institute of Technology, Mumbai, and PhD (1979) in theoretical particle physics from the State University of New York at Stony Brook. Prof. Godbole joined Tata Institute of Fundamental Research, Mumbai as a visiting fellow in 1979. She was Lecturer and Reader at the Department of Physics, University of Bombay from 1982 to 1995. She joined the Centre for Theoretical Studies, Indian Institute of Science, Bangalore, as Associate Professor in 1995 and has been Professor since June 1998. Currently she is Professor at the Centre for High Energy Physics, Indian Institute of Science, Bangalore.

Contribution

Her work regarding hadronic structure of high-energy photons outlined a variety of ways in which to study it and has had implications for the design of next generation electron positron colliders. She is an elected fellow of all the three academies of Science of India and also the Science Academy of the Developing World (TWAS).

She is the author of books and more than 150 research papers and many of which have some of the largest citation indices in her area.

Godbole has been working in the following areas-New Particle Production at current and future colliders, Physics at Large Hadron Collider and Next Linear Collider, QCD phenomenology: Structure Functions of a proton, photon and nucleus, Supersymmetry and Electroweak Physics

Social impact

Prof. Godbole is part of the International Detector Advisory Group

(IDAG) for the International Linear Collider in the European research lab, CERN. The International Detector Advisory Group monitors the ILC detector research and development of the Research Directorate and the detector design groups. She is the Chair of the Panel for Women in Science initiative of the Indian Academy of Sciences.

Apart from her work in academics, Prof. Godbole is also a much sought-after communicator of science, often delivering talks to young students, scholars and scientists on everything physics. She is also an avid supporter of women pursuing careers in science and technology, and along with Ram Ramaswamy, edited the book Lilavati's Daughters a collection of biographical essays on women scientists from India.

Awards

Padma Shri for her contributions in science and technology (2019),Satyendranath Bose Medal of Indian National Science Academy (2009) Fellowship of National Academy of Sciences, India (NASI) (2007) Fellowship of Academy of Sciences of the Developing World, TWAS 2009, Devi Award of the New Indian Express Group, August 2015.

Chanda Jog

Chanda Jayanth Jog is an Indian astrophysicist working at the Indian Institute of Science, Bangalore. Her study specializes in Galactic Dynamics, Interacting & Star Burst Galaxies and Inter- stellar Molecular Clouds. She has published around 85 articles surrounding galaxies and galactic dynamics.

Education

Ph.D. from State University of New York, Stony Brook, U.S.A.

Contribution

After her Doctoral Studies from Stony Brook University. She worked as a post-doctoral fellow at Princeton and as professor in Virginia. She returned to India in 1987, where she continued her work at Indian Institute of Science. Her work has been in the area of star-gas instabilities and vertical-disk dynamics in galaxies, triggering of starbursts by shock compression of gas, lopsided galaxies, and the dynamics of interacting galaxies. More than 125 papers published in the reputed journals.

Awards

Prof. S. K. Chatterjee Award of IISc (2012),Elected Fellow of the National Academy of Sciences, Allahabad (2011) Elected Fellow of the Indian Academy of Sciences, Bangalore.

Anita Goel

Anita Goel is a physicist and physician in the United States. She is globally recognized for her pioneering research in nano biophysics, particularly for the study of molecular mechanics behind the reading and writing of information in DNA.

Education

Goel received a PhD in physics from Harvard University, where she was mentored by Nobel laureate Dudley R. Herschbach. Her thesis was entitled Single Molecule Dynamics of Motor Enzymes Along DNA. She received a BS in physics with honors and distinction from Stanford University,where her mentor was Nobel laureate Steven Chu. She also holds an M.D. from the Harvard-MIT Joint Division of Health Sciences and Technology (HST).

Contribution

Dr. Goel has a deep passion for fundamental science, especially elucidating the physics of living systems at the nanoscale. Her work in applied science to develop nanotechnology platforms such as those for portable disease detection and nanosystems for novel energy harvesting and biocomputing applications. Dr. Anita founded Nanobiosym as an R&D innovation engine and hi-tech incubator at the convergence of physics, nanotechnology and biomedicine.

Social impact

She is also piloting a global initiative to build innovative public-private partnerships with academic, commercial, global thought leaders and NGO's, to collectively harness innovations at this convergence to sustainably address in healthcare, energy, and the environment.

Awards

Nominated Technology Pioneer Award, World Economic Forum, Hosted in Dalian, China, 2015, Top 100 Most Influential in Biotech, The Worldview 100: The Visionaries Who Continue to Reshape Biotechnology- and the World, Scientific American Worldview, 2015, Winner of the Galactic Grant to conduct research on the International Space Station (ISS), The Center for the Advancement of Science in Space (CASIS) and the Massachusetts Life Sciences Center (MLCS), 2015, awarded to Dr. Goel via Nanobiosym Research Institute, USAID: Saving Lives at Birth Grand Challenges Competition, 2015 Awarded to Dr. Goel via Nanobiosym Research Institute10 Women to Watch in Tech, Inc. Magazine, 2014, Nokia Sensing XChallenge Grand Prize, (the first X Prize ever awarded for Healthcare), 2013, Awarded to Dr. Goel via Nanobiosym Research Institute, USAID: Saving Lives at Birth Grand Challenges Competition, 2013.

Neelima Gupte

Neelima M. Gupte is an Indian physicist. She is presently Professor in the Department of Physics, IIT Madras.

Education

She obtained her B.Sc. from Bombay University in 1976, M.Sc. from IIT Bombay in 1978 and Ph.D from SUNY at Stony Brook in 1983. She has subsequently worked at the University of Hyderabad, and was on the faculty of Pune University from 1985 to 1993.

Contribution

Her research interests lie in the field of nonlinear dynamics, and chaos. Some important results obtained by her and her collaborators include the phase transition analogs of the thermodynamics of multifractals, the method of impulsive synchronisation and the enhancement of the efficiency of load-bearing and communication networks. Her current research interests include the analysis of spatiotemporal intermittency in extended systems, chaotic advection and the study of networks. Number of papers published and book on Perspectives in Nonlinear Dynamics edited by her.

Social impact

In addition to her academic interests, she has also participated in the activities of the 'Women in Physics' group of the International Union of Pure and Applied Physics.

Awards and achievements

She is included in Lilavati's Daughters, the compendium of biographical and autobiographical essays on Women Scientists of India.

Ritu Karidhal

ISRO Young Scientist Award Ritu Karidhal Srivastava is an Indian scientist working with the Indian Space Research Organisation (ISRO). She was a Deputy Operations Director to India's Mars orbital mission, Mangalyaan. She has been referred to as a "Rocket Woman" of India. She was born and brought up in Lucknow and is an aerospace engineer.

Education

Karidhal was born in Lucknow, Uttar Pradesh. She has two brothers and two sisters. Lack of resources and unavailability of coaching institutions and tuitions left her to rely only on her self-motivation to succeed. As a child, she knew that her interest was in the space sciences. Gazing at the night sky for hours and thinking about outer space, she wondered about the moon, as to how it changes its shape and size; studied the stars and wanted to know what lay behind the dark space. In her teens, she started collecting newspaper cuttings about any space-related activity and kept track of the activities of ISRO and NASA.

Karidhal completed her B. Sc. in Physics from University of Lucknow. She passed the I. I.Sc. Entrance Test, and joined Indian Institute of Science (IISc) to pursue three-year M. E. degree in Aerospace engineering.

Contribution

Karidhal has worked for ISRO since 1997. She played a key role in the development of India's Mars Orbiter Mission, Mangalyaan, dealing with the detailing and the execution of the craft's onward autonomy system. She was also the Deputy Operations Director of this mission.

Social impact

Mangalyan was one of the greatest achievements of ISRO. It made India the fourth country in the world to reach Mars. It was done in 18 months time and at far lesser cost to the taxpayers-450 crores only. Her job was to conceptualize and execute the craft's onward autonomy system, which operated the satellite's functions independently in space and responded appropriately to malfunctions. She supervised the Chandrayaan 2 mission as the mission director.

Awards and Achievements

Karidhal received the ISRO Young Scientist Award in 2007 from A. P. J. Abdul Kalam, then president of India. Karidhal has also presented at TED and TEDx events describing the success of the Mars Orbiter Mission. Karidhal was awarded an honorary doctorate by the Lucknow University, her alma mater. It was conferred by Governor Anandiben Patel.

Vinod Krishan

Vinod Krishan, a physicist, is a Senior Professor and Dean of Sciences at the Indian Institute of Astrophysics, Bangalore. She is involved in teaching and research in Plasma Physics. .

Education

Vinod Krishan's academic career includes a BSc Degree (1966) and M.Sc.(Physics) degree in 1968 from the University of Delhi. She also holds a diploma in German (1968) from the University of Delhi. She did her doctoral degree (Ph.D) from the University of Tennessee, United States in 1971 and her thesis was on "Damping of plasmons in a nearly free electron gas" in the field of Solid State Physics, and was a Post-doctoral Fellow at the University of Alberta, Edmonton, Alberta, Canada (1971-73).

Contribution

Vinod Krishan initially worked as Pool Officer at the Centre for Theoretical Studies, Indian Institute of Science, Bangalore from November 1973 to August 1975 and then worked as a UGC Research Associate. She worked in various capacities as Visiting Scientist, a Fellow, Reader, Associate Professor, and Professor at the Indian Institute of Astrophysics, Bangalore, and was a senior Professor at the institute since 1998, teaching Plasma Astrophysics in the Joint Astronomy Programme. She retired from the IIA in 2008. Her research activities encompass the fieldss of Modelling of Solar Coronal Loops, Solar Granulation, Extragalactic Plasmas, and Structure Formation Through Hydrodynamics.

Publications and books

She has a large number of papers to her credit in the fields of Laboratory Plasmas, Plasma Processes in Extragalactic Sources, Solar Physics, cometary plasmas, Structure Formation Through Hydrodynamics and many miscellaneous subjects. She edited proceedings of many conferences on solar and plasma physics including the IAU symposium (1989) in addition to being the chief Editor of the Bulletin of the Astronomical Society of India for several years. She has published three books: 1. Astrophysical Plasmas and Fluids, Kluwer Academic Press, 1998; 2. Plasmas the First State of Matter, Cambridge University Press, 2014 and 3. Physics of Partially ionized Plasmas, Cambridge University Press, 2016.

Awards

Vinod Krishan is recipient of the Dr. Vikram Sarabhai Research Award for Space Sciences for the year 1992. Apart from membership of various scientific institutions , she is also a Fellow of the National Academy of Sciences India, 1996.

Sulabha K. Kulkarni

Sulabha Kashinath Kulkarni is an Indian physicist, whose research spans the areas of Nanotechnology, Materials Science, and Surface Science. She is currently a visiting faculty member at Indian Institute of Science Education and Research, Pune,India.

Education

Born in 1949, Kulkarni was educated in Pune and earned her Bachelor of Science (1969), Master of Science (1971), and Doctor of Philosophy (1976) in Physics from the University of Pune. From 1976 to 1977, she conducted her postdoctoral research on gas/solid interactions using surface science techniques in the Physics Department (E20) at Technical University, Munich, Germany.

Contribution

Kulkarni joined as a faculty member in the Department of Physics at the University of Pune upon her return to India. She continued to research and teaches for 32 years, also introducing a course on Nanotechnology at the post-graduate level. In March 2009, she joined the Indian Institute of Science Education and Research (IISER) in Pune and continued as a UGC scientist. From 2010 to2011, she served as Pro Vice Chancellor at the Banasthali University, Rajasthan. She returned to IISER Pune as UGC Professor and is currently a Visiting Faculty at IISER Pune.

Besides nanotechnology, Kulkarni also teaches Condensed Matter Physics, Surface Science, Materials Science, Experimental Methods in Physics, and supervises laboratory courses at the post-graduate level.

She has supervised over 38 Ph.D. students. She was the coordinator of the Department of Science and Technology (DST) Nano Unit at the University of Pune as well at IISER Pune. She has worked at various institutes and universities abroad including Germany, France, Italy, UK, Japan, and South Korea. She has attended many national and international conferences. She is a fellow of the Indian National Academy of Science (Allahabad), Indian Academy of Science (Bengaluru), Indian National Science Academy (New Delhi), Asia Pacific Materials Society (Beijing) and Maharashtra Academy of Sciences (Mumbai). She has been very active in the popularization of science in India.

She has authored over 270 research publications including 120 publications in anotechnology in peer-reviewed journals of international repute. Her publications are on metal, semiconductor and oxide nanoparticles, core-shell particles, metallic multilayers, hard coatings, gas-solid interactions, metallic glasses, etc. She has written a popular textbook - "Nanotechnology: Principles and Practices" (English) whose third edition has been copublished with Springer International. Apart from this, she has also authored the books "Carbon: the wonder

element" (English) and "Carbon: Ekvismaykarakmuldravya" (Marathi) and "Nanoscience and Nanotechnology" (Marathi) and "Nanotechnology of Nature" (Marathi). She has also received an award and recognition from the State Government of Maharashtra. In addition, she has co-authored, "Laboratory Manual in Solid State Physics" for undergraduate students.

Awards & Honors

Fellow, Asia Pacific Materials Society (2013),,Associate Editor, Journal of Nanophotonics (2011-),Fellow (FNA), Indian National Science Academy (New Delhi) (2011-), Maharashtra State Award for Book Writing (2009), Member, Program Advisory Committee, All India Radio (Akashvani) Pune (2008-2010) Executive Council Member, Banasthali Vidyapeeth (2008-2010), Bharatiya Stree Shakti "Women and Technological Innovation National Award (2007) Lokshikshan Puraskar, Vidya Mahamandal, Pune (2007), Member, 'Task Force Committee Nanomedicine', Indian Council of Medical Research, New Delhi, Chairperson, Women Scientists Scheme -A, DST, Govt. of India (2007-) Hon. Visiting Fellow, Dr. M. S. Patel Trust, UICT, Mumbai, (2007) Member, Council & Governing Board, IUAC, N. Delhi, (2007-2010), Hon. Fellow, Iranian Nanotechnology Society May (2006), Associate Editor, International Journal of Nanoscience & Nanotechnology (2006-) Materials Research Society of India (MRSI) Medal (2005), Member, IUC-DAE Consortium Scientific Advisory Committee, (2005-2008) Member, National Committee for Utilization of Indus Rings (NCUIR), (2004-2010) Member, PAC Condensed Matter, DST, India, (2004-2007) and many more.

Anna Mani

Anna Mani(1918-2001) was an Indian physicist and meteorologist.She retired as the Deputy Director General of the Indian Meteorological Department and further served as a visiting professor at the Raman Research Institute. She made several contributions to the field of meteorological instrumentation, conducted research and published numerous papers on solar radiation, ozone and wind energy measurements.

Anna Modayil Mani was born in 1918 at Paramakudi, Ramanathapuram to an ancient Syrian Christian family. During her childhood, she was a voracious reader. She was impressed by the activities of Gandhi during Vaikom satyagraha. Inspired by the nationalist movement, she took to wearing only khadi garments.

Her formative years were spent engrossed in books. By the age of eight, she had read almost all the books in Malayalam at her public library and, by the time she was twelve, all the books in English. On her eighth birthday she declined to accept her family's customary gift of a set of diamond earrings, opting instead for a set of Encyclopædia Britannica. The world of books opened her to new ideas and imbued in her a deep sense of social justice which informed and shaped her life.

Education

She was FASc, FNA, Ph.D. She wanted to pursue dancing, but she decided in favour of physics because she liked the subject. In 1939, she graduated from the Pachaiyappas College in Madras, with a B.Sc Honors degree in physics and chemistry. In 1940, she won a scholarship for research in the Indian Institute of Science, Bangalore. In 1945, she went to Imperial College, London to pursue graduate studies in Physics. The only woman scientist to work with C.V. Raman, is well known for her work in atmospheric physics and instrumentation. However, she ended up specializing in meteorological instruments.

Contribution

After graduating from the Pachaicollege, she worked under Prof. Solomon Pappaiah, re- searching the optical properties of ruby and diamond. She authored five research papers and submitted her PhD dissertation, but she was not granted a PhD degree because she did not have a master's degree in physics. After returning to India in 1948, she joined the Meteorological department in Pune. She published numerous research papers on meteorological instrumentation. She was mostly responsible for arranging for meteorological instruments, imported from Britain. By 1953, she had become the head of the division with a 121 men working for her.She retired as deputy director general of Indian Meteorology Institute in 1976.

Social impact

Anna Mani wished to make India dependent in weather instruments. She standardised the drawings of close to 100

different weather instruments. From 1957-58, she set up a network of stations to measure solar radiation. In Bangalore, she set up a small workshop that manufactured instruments for the purpose of measuring wind speed and solar energy. She worked on the development of an apparatus to measure the ozone. She was made a member of the International Ozone Association. She set up a meteorological observatory and an instrumentation tower at the Thumba rocket launching facility.

Awards and achievements

Deeply dedicated to her work, Anna Mani never married. She was associated with many scientific organizations such as the Indian National Science Academy, American Meteorological Society, International Solar Energy Society, World Meteorological Organisation (WMO), the International Association for Meteorology and Atmospheric Physics, etc. In 1987, she was a recipient of the INSA K. R. Ramanathan Medal.

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Mrinalini Puranik

MrinaliniPuranik is lead scientist at Unilever Limited. Her areas of research include bio-molecular spectroscopy, Raman spectroscopy of proteins, and nucleic acids. She started her career as associate professor at Indian Institute of Science Education and Research, Pune (IISER).

Education

Puranik studied for her M.Sc in Physics from University of Puneand Ph.D from Indian Institute Of Science.

Contribution

Her research areas are ultraviolet resonance Raman, time-resolved resonance Raman, Biochemistry, Biology, Chemistry. More than 35 research papers published with 456 citations in reputed journals.

Achievements

Puranik was a Chevening Rolls-Royce Science and Innovation Leadership Programme (CRISP) scholar at University of Oxford.In 2015, her article "Solution structures of purine base analogues 9-deazaguanine and 9- deazahypoxanthine" was published by the Journal of Biomolecular Structure and Dynamics.

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Anita Mehta

Anita Mehta is an Indian physicist. She is a Leverhulme Visiting Professor at the University of Oxford. Her current research is aimed at deciphering complexity in natural and artificial systems, with special emphasis on granular physics, long-term memory and optimisation. She is currently an Academic Visitor of Somerville College.

Education

After her B.Sc. in Physics from Presidency College, Calcutta, Mehta went to Oxford as the second Indian woman Rhodes Scholar to St Catherine's College, Oxford University, graduating with an MA and a DPhil in Theoretical Physics. She then did postdoctoral work at IBM, following this with a Research Associateship under the mentorship of Professor Sir Sam Edwards, when she pioneered the field of granular physics at the Cavendish Laboratory, Cambridge.

Contribution

Her work as a scientist has been extremely interdisciplinary and strongly collaborative: work on granular physics, literature of civil and chemical engineering. In the recent past, she used the methods of theoretical physics to work on problems in neuroscience (long- and short-term memory), biology (the role of gap junctions in the onset of diabetes, and stochasticity in the visual system of the fruit-fly) and computer science (the use of landscapes in optimisation problems), mathematical modelling of speech perception in the presence of mishearings, as well as on the evolution of linguistic forms, in current embedding as Leverhulme Visiting Professor at the Faculty of Linguistics in Oxford.

Awards

Mehta was elected India's first Radcliffe Fellow to Harvard in 2006 and in 2007, awarded the Fellowship of the American Physical Society. Mehta has been a visiting professor at the University of Rome, the University of Leipzig, the Institut de Physique Theorique, CEA Saclay and the Max Planck Institute for Mathematics in the Sciences among others.

Anuradha Misra

AnuradhaMisra is a professor and former head of the department of physics at University of Mumbai. She was born in Faizabad, Uttarpradesh, India. A graduate of the University of Allahabad, she joined as a professor for physics at the University of Mumbai in 2008. She specializes in the study of theoretical high energy physics, including Light front quantization, resummation in quantum chromodynamics.

Education

Misra completed her primary education from Government Girls college in Faizabad, Uttar Pradesh. She did her bachelors in mathematics, physics, and statistics, from University of Allahabad, masters in physics from IIT Kanpur in 1983. Being inspired by the works of physicist Marie Curie and mathematician Srinivasa Ramanujan, she pursued doctorate at IIT Kanpur. Her research was in the areas of chiral anomaly, trace anomaly and Stress-energy tensor in 1989.

Contribution

She published papers on renormalization theory under the guidance of S. D. Joglekar. Her first research paper was under the guidance of George Sterman, an American theoretical physicist at the Stony Brook University. She took up her first job at Saha Institute of Nuclear Physics as a research associate. In 1993, she moved to the United States to work at Stony Brook University as a lecturer. She returned to India in 1994 and spent a brief time in Allahabad before joining as research associate at the University of Mumbai in October 1994. She continued her research on high energy physics, quantum chromodynamics and light front field theories. In November 2008, she was promoted to be a professor and appointed the head of the department of physics, a position which she held until 2014.

She has published several journal articles. Her co-authors include Satish D. Joglekar, Swati Warwadekar, Rohini M. Godbole, Patrick Motylinski, and Jai D. More.

Shobhana Narasimhan

Shobhana Narasimhan is a Professor of Theoretical Sciences at the Jawaharlal Nehru Centre for Advanced Scientific Research in Bangalore, India. Her main area of interest is computational nanoscience. Her research examines how the lowering of dimensionality and reduction of size affect material properties.

Education

Narasimhan earned her B.Sc. in Physics from St. Xavier's College, Mumbai in 1983 and her M.Sc. in Physics from IIT Bombay in 1985. She received her Ph.D. in Theoretical Physics from Harvard University in 1991. Subsequently, she did her postdoctoral work at Brookhaven National Laboratory, USA and at Fritz-Haber-Institute of the Max Planck Society in Berlin, Germany. She joined the Theoretical Sciences Unit of Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India as a faculty member in 1996. She was formerly Chair of the Theoretical Sciences Unit and Dean of Academic Affairs at JNCASR.

Contribution

Narasimhan has a strong interest in innovative teaching methods and has organized and participated in many interactive workshops in several countries. She is also keen on promoting women in science causes. She is a member of the Standing Committee on Women in Science of the Government of India and was formerly a panel Member of the Women in Science initiative of the Indian Academy of Sciences, and has also organized several Career Development Workshops for Women in Physics at the International Centre for Theoretical Physics in Trieste, Italy and at the East African Institute for Fundamental Research in Kigali, Rwanda.

Social impact

JNCASR Professor elected as International Honorary Member to the American Academy of Arts and Sciences.Professor ShobhanaNarasimhan has been elected as an International Honorary Member to the American Academy of Arts and Sciences..Albert Einstein, Nelson Mandela and Charles Darwin are some of the previous International Honorary Members being honoured by the American Academy of Arts and Sciences.

Awards and achievements

Narasimhan became a Fellow of the National Academy of Sciences, India in 2011. She also received the Stree Shakti Samman Science Award in 2010 and the Kalpana Chawla Woman Scientist Award of the Government of Karnataka in 2010.

Priyamvada Natarajan

Priyamvada (Priya) Natarajan is a professor in the departments of Astronomy and Physics at Yale University. She is noted for her work in mapping dark matter and dark energy, particularly with her work in gravitational lensing, and in models describing the assembly and accretion histories of supermassive black holes.

Education

Natarajan has undergraduate degrees in Physics and Mathematics from M.I.T. She was also enrolled in the M.I.T. Program in Science, Technology & Society and the M.I.T. Program in Technology and Public Policy from 1991 to 1993. She did her graduate work in theoretical astrophysics at the Institute of Astronomy, University of Cambridge in England, where she was a member of Trinity College and was elected to a Title A Research Fellowship that she held from 1997 to 2003. Prior to coming to Yale, she was a visiting postdoctoral fellow at the Canadian Institute for Theoretical Astrophysics in Toronto, Canada.

Contribution

She is a theoretical astrophysicist interested in cosmology, gravitational lensing and black hole physics. Her research involves mapping the detailed distribution of dark matter in the universe exploiting the bending of light enroute to us from distant galaxies. In particular, she has focused on making dark matter maps of clusters of galaxies, the largest known repositories of dark matter. Gravitational lensing by clusters can also be utilized to constrain dark energy models and she has been developing the methodology and techniques to do so. Her work has demonstrated that cluster strong lensing offers a unique and potentially powerful laboratory to test evolving dark energy models.

Priya is also actively engaged in deriving and understanding the mass assembly history of black holes over cosmic time. She is exploring a new channel for the formation of the first black holes and its observational consequences at high and low redshift. This channel produces massive seeds derived from the direct collapse of pre-galactic gas disks at the earliest epochs. This is in contrast to the conventional picture wherein light seeds are produced from the end state of the first stars. Current measurements of the masses of black holes hosted in nearby faint galaxies supports the existence of a massive seeding model. In earlier work, she argued for the existence of an upper limit to black hole masses in the universe by showing that black holes eventually stunt their own growth. This self-regulation implies the presence of ultra-massive black holes with capped masses in the centers of nearby galaxies that have since been observationally detected.

In addition to her academic position at Yale, she also currently holds the Sophie and Tycho Brahe Professorship of the Dark Cosmology Center, Niels Bohr Institute, at the University ofCopenhagen,

Denmark. She has been recently elected to an Honorary Professorship for life at the University of Delhi, India.

Social impact

She is invested in the public dissemination of science and is on the Advisory Board of NOVA ScienceNow. Priya is actively engaged in developing strategies to enhance numerical and scientific literacy for the public at large. She is also interested in inter-disciplinary scholarship within the academy and along with Michael della Rocca (Yale Philosophy) and Denys Turner (Yale, Religious Studies) she co-organized a conference titled Why is there anything in the Universe? in October 2011.

Awards and achievements

Natarajan was awarded the Emeline Conland Bigelow Fellowship at the Radcliffe Institute of Harvard University in 2008. In 2009, she was awarded a Guggenheim Fellowship. Natarajan was also the 2009 recipient of the India Abroad Foundation's "Face of the Future" Award and the recipient of the award for academic achievement from the Global Organization for the People of Indian Origin (GOPIO). Natarajan was elected a fellow of the Royal Astronomical Society in 2009, the American Physical Society in 2010, and the Explorers Club in 2010. She was awarded a JILA (Joint Institute for Laboratory Astrophysics) Fellowship in 2010. In January, 2011 she was awarded an India Empire

NRI award for Achievement in the Sciences in New Delhi, India. She was the Caroline Herschel Distinguished Visitor at the Space Telescope Science Institute in Baltimore for 2011-2012. In addition to her current appointments at Yale and Harvard, she also holds the Sophie and Tycho Brahe Professorship, Dark Cosmology Center, Niels Bohr Institute at the University of Copenhagen, Denmark and was recently elected to an honorary professorship for life at the University of Delhi.

Uma Ramakrishnan

Uma Ramakrishnan is an Indian molecular ecologist working as an assistant professor at National Centre for Biological Sciences (NCBS), Bangalore. Her research investigates population genetics and evolutionary history of mammals in the Indian subcontinent, including work to save India's tigers.

Education

Ramakrishnan did a Bachelor of Science in Physics, Chemistry and Mathematics and a Master's in biotechnology. She subsequently received a PhD from the University of California, San Diego, following which she was a postdoc at Stanford University.

Contribution

Ramakrishnan joined NCBS in 2005 as an assistant professor. Her lab has developed methods to conduct population monitoring and landscape/population genetics with tiger fecal samples. Her research has been published in scientific journals Science, Molecular Biology and Evolution, Biological Conservation, Scientific Reports and Conservation Genetics. Her previous projects include work on contrasting population structure between commensal and wild rodents, and understanding drivers of diversification in montane bird communities in the Western Ghats.

Social impact

Ramakrishnan has worked with the tiger expert and former director of Wildlife Conservation Society- India, K. UllasKaranth. Together with Karanth, Ramakrishnan's lab used genetic sampling to estimate the tiger population in Bandipur National Park. Her research on the connectivity of tiger populations in Central India was presented in court to stay the widening of NH7 which cuts acrossthe Kanha-Pench corridor. Although the highway has been opened, conservation NGO has cited the study by Ramakrishnan and her team to push for an mitigation structure to allow for animal movement across the highway.

Awards and achievements

Ramanujan Fellowship, Department of Science and Technology, Government of India (2010) Parker/Gentry Award by Field Museum, ChicagoSenior Research Visiting Fellow, Department of Biological Sciences, National University ofSingapore (2011), Outstanding Scientist Award, Department of Atomic Energy (2012) Fellow, Indian National Science Academy (INSA). She is the first Indian to receive the Parker-Gentry Award. In July 2019, she was elected as a fellow to the Indian National Science Academy.

Tanusri Saha-Dasgupta

Tanusri Saha-Dasgupta is an Indian physicist. She is a Senior Professor and Satyendra Nath Bose Chair at Indian Association for the Cultivation of Science as well as Senior Professor at S.N. Bose National Centre for Basic Sciences.

Education

She graduated from University of Calcutta. Msc, 1990 - Physics, Univ. of Calcutta (ranked 1st) and Ph.D, 1995-Condensed. Matter physics, University of Calcutta.

Contribution

Her main area of research work is on first principles electronic structure calculation and study of magnetic, optical and electronic properties of complex material and Realistic theory of strongly correlated electron system.

Awards and achievements

She is a Swarnajayanti Fellow. She is a fellow of The World Academy of Science (2019), American Physical Society (2015), Indian Academy of Sciences, Bangalore (2010), National Academy of Sciences, India(2010), West Bengal Academy of Science & Technology,(2013). She is recipient of APJ Kalam HPC award (2018), "MRSI-ICSC Superconductivity & Materials Science Annual Prize" for the year 2016, Dr. P. Sheel Memorial Lecture Award, National Academy of Sciences, 2012, and appointed Head of MPG-India partner-group program, 2005.

Suchitra Sebastian

Suchitra Sebastian is a condensed matter physicist at Cavendish Laboratory, University of Cambridge. She is known for her work in quantum materials. In particular, she is known for the discovery of insulating materials which display simultaneous conduction-like behavior under high magnetic fields.

Education

Suchitra Sebastian obtained an undergraduate degree in physics from the Women's Christian College, Chennai. She attended the Indian Institute of Management, Ahmedabad, where she received an MBA. She received a PhD in applied physics from Stanford University.After her MBA degree, Sebastian worked as a management consultant for a few years. She then decided to pursue physics as a career, and joined Stanford University for doctoral studies.

Sebastian has been active in theatre. She performed at the Edinburgh Festival Fringe as a member of the Two Shades of Blue theatre troupe, and toured India and Nepal with the Rickshaw Theatre Project.

Contribution

Suchitra Sebastian's doctoral research was into barium copper silicate's transformation from a non- magnetic into a magnetic insulator under high magnetic field and low temperature. She discovered that the point of phase transition, the quantum critical point, occurs when the electrons' behavior becomes two-dimensional, with the third dimension having almost no effect. In 2006, she co-published a paper revealing these findings. When the silicate is in its insulating state, the electron spins cancel each other out, but in the magnetic phase, under strong magnetic fields and low temperatures,the electrons form a Bose-Einstein condensate, with the electron spins suddenly unified. At the critical point, the spins from parallel layers stop affecting each other, and the magnetic waves stay within the plane of each layer, propagating in two dimensions. Sebastian's experiment was the first exploration

of the immediate neighbourhood of the critical point in Bose-Einstein condensates.

In 2015, Sebastian received a five-year grant from the European Research Council to work with cuprates to determine why they behave as high temperature superconductors. This entailed the suppression superconductivity under strong magnetic fields, and the examination of their resistivestate. This revealed that electrons were forming twisted pockets in the weakest areas of superconductivity, in contrast to other researchers' finding that pockets formed in strong superconductive regions. She also discovered that the waves formed by alignment of electrons by their charge, called charge ordering, produce the pockets that are involved in the substance's superconductivity.

Social impact

In 2015, Sebastian and her team discovered that samarium hexaboride, an insulator at low temperatures, displays simultaneous conduction-like properties under strong magnetic fields. Sa- marium hexaboride also belongs to the class of topological insulators, which are insulators within their bulk but conductive on their surface. Sebastian found that samarium hexaboride acts as a simultaneous conductor and insulator within its bulk.

Awards

(2007) Lee Osheroff Richardson North American Science prize, (2012) Young Scientist Medal in Magnetism (International Union of Pure and Applied Physics), (2012) Moseley Medal (Institute of Physics), (2013) The World Economic Forum named her one of thirty Exceptional Young Scientists in 2013.

L'Oréal-UNESCO Awards for Women in Science, (2015) Philip Leverhulme Prize (2015) Brian Pippard Prize.

Srubabati Goswami

SrubabatiGoswami is an Indian scientist specliasing in High Energy Physics, Astroparticle Physics, and Neutrino Physics .

Education

She is the first Indian woman to earn a Ph.D. in neutrino oscillations from the University of Calcutta. She did her research in the PRL and Saha Institute of Nuclear Physics and later worked in the Harish Chandra Research Institute.

Contribution

She is a Senior Professor in Theoretical High Energy Physics in the Physical Research Laboratory.She is a fellow of Indian Academy of Sciences, National Academy of Sciences, India and Indian National Science Academy.

Goswami is a phenomenologist, originally a stream of philosophy that links theories to observations, at the Physical Research Laboratory (PRL), Ahmedabad. Her job is to verify logic-based hypotheses proposed by theorists, using evidence gathered by experimentalists at observatories and reactors. By closely reading experimental data, phenomenologists like Goswami open doors to new physics, bringing us closer to answers to many big questions - such how the universe was formed, why there is more matter than antimatter in our universe and what really is going on.

Prajval Shastri

Prajval Shastri is an astrophysicist at the Indian Institute of Astrophysics, Bangalore and specializes in the area of phenomenology of active galaxies driven by supermassive blackholes using multiwavelength observations ranging from radio to X-ray wavelengths.

Education

Shastri was brought up in Mangalore and after her schooling she completed her B.Sc. in Physical Sciences from St. Agnes College Mangalore (University of Mysore). She then went on to pursue M.Sc. in Physics from Indian Institute of Technology, Mumbai. She completed her Ph.D. from Tata Institute of Fundamental Research, India on the topic "Relativistic Beaming in Active Galactic Nuclei" in the year 1989 under the supervision of Vijay Kapahi.

Contribution

Shastri's current research specialization is the phenomenon of Active Galactic Nuclei. Her present research areas are:

- AGN Emission-line Regions (Integrated Field Spectroscopic Imaging, WiFeS at Siding Spring) X-ray Emission from AGN (XMM-Newton, Suzaku)
- Jets in Radio-Quiet AGN (Very Long Baseline Interferometry, GMRT) Hot Gaseous outflows in AGN (Far-Ultraviolet Spectroscopic Explorer)
- Blazar Variability: WEBT monitoring campaigns (VainuBappu&Hanle Telescopes)

Her core research interest is the empirical investigation of giant black holes that are found in the centres of distant galaxies. She believes that nurturing learning environments pave the way towards excellence,While acutely aware of privilege of being paid to be fascinated by the universe. More than 125 research papers published with > 820 citations.

Awards and achievements

Shastri holds memberships of the following organizations:

Distinguished Visitor Fellowship (Australian National University) (2017) Fulbright Senior Research Fellowship (Stanford University, USA) (2012) DST Indo-Italian Co-operation programme grant (2005-2007) DST Indo-Russian Co-operation programme grant (1999-2003) NASA Astrophysics Data Program grant (1994) American Astronomical Society Research Grant (1992 & 1993) NASA Roentgen Satellite grant (1990-1993).

Purnima Sinha

Purnima Sinha (12 October 1927 – 11 July 2015) was an Indian physicist and had the distinction of being the first Bengali woman to receive a doctorate in physics.

Education

Purnima's early education started in Lake School, Kolkata, which was established by her elder sister Sushama Sengupta. She attended Asutosh College, followed by the Scottish Church College, and finally the University of Calcutta. Her own artistic interests are varied and include learning Hindustaniclassical music from Yamini Ganguly, and painting from the well-known painter Gopal Ghosh. She has also taken tabla lessons from PanditJnan Prakash Ghosh.She earned her doctorate in x-ray crystallography of clay minerals. She received her doctorate from the University of Calcutta as a student of the Rajabazar Science College in 1956-57, under the guidance of professor SatyendraNath Bose.

Contribution

She had written extensively on many subjects in both English and Bengali. She had also been a regular contributor to Jnan O Bijnan (Knowledge and Science), a scientific journal in the Bengali vernacular published by BangiyaBijnanParishad (Bengal Science Association), founded by SatyendraNath Bose. Recently BangiyaBigyanParishad awarded and felicitated her for popularizing science in Bengali, a passion she shared with her teacher.

She has written extensively on Satyendra Nath Bose and the works on him are: Bijnan Sadhanar Dharay Satyendranath Bose, a book published by Visva Vidya Sangraha. Amar Katha, a book published by Bangiya Bijnan Parishad.Satyen Bose-erByaktitto O mononerdhara, article published in Desh.

Social impact

At the start of joining Professor SatyendraNath Bose, she had scoured surplus army equipment sold as scrap on the footpaths of Calcutta after the Second World War. Purnima Sinha was looking for spare parts to build the X-ray equipment she needed for her doctoral research. We must remember that X-ray techniques were being applied to unravel DNA structure on other side of the globe around 1953. Most interestingly her research was funded by Assam Oil Company (research-industry collaboration in that era was unheard of). Not only did she build it, but she also went on to study different types of clay from all over India. Later on, Dr Sinha joined the Biophysics Department at Stanford University's 'Origin of Life' project, which had an interface with her work. She compared the X-ray structure of clay with DNA patterns, geometrically, and was fascinated to find a connection.

Sudeshna Sinha

Sudeshna Sinha is a professor at the Indian Institute of Science Education and Research Mohali. She was at the Institute of Mathematical Sciences, Chennai for over a decade. She works in the field of nonlinear physics. Her work on 'chaos-based' hardware (so-called "Chaos computing") is being developed commercially by the US based company Chaologix.

Education

Sudeshna is a Master of Science (Five Years Integrated Programme in Physics) from the Indian Institute of Technology Kanpur in 1985. She completed her Ph.D. from the Tata Institute of Fundamental Research, Mumbai, in 1990.

Contribution

Sudeshna is currently a Professor at the Indian Institute of Science Education and Research Mohali and works in the field of nonlinear physics. Her research areas include Nonlinear Dynamics, Chaos, Complex Systems, Networks, and Computation. She is an Editor of the AIP journal Chaos: An Interdisciplinary Journal of Nonlinear Science.

Awards

Elected Fellow of the World Academy of Sciences, 2018

J.C. Bose National Fellowship (2015)

Elected Fellow of the Indian National Science Academy, New Delhi in 2014

Elected Fellow of the Indian Academy of Sciences, Bangalore in 2010

Awarded the B.M. Birla Prize for Physics in 1998 : The B M Birla prizes are awarded to Indian scientists, below the age of 40 years, who have made outstanding original contributions in their fields

"Associate Member of the International Centre for Theoretical Physics, Trieste, Italy during 1995-2000 General Proficiency Prize from the Indian Institute of Technology, Kanpur (1985): Awarded to the "Best Outgoing Student in the master's degree (five years integrated programme in Physics) for the year"

National Talent Search Scholarship, during 1978-1985

Annapurni Subramaniam

Annapurni Subramaniam is the director of the Indian Institute of Astrophysics, Bangalore and works on areas like star clusters, stellar evolution and population in galaxies and Magellanic Clouds.

Education

Dr. Subramaniam finished her schooling from Victoria College, Palakkad, in science. She did her PhD on the topic "Studies of star clusters and stellar evolution" from Indian Institute of Astrophysics in 1996.

Contribution

Dr. Subramaniam was a Research Fellow at the Indian Institute of Astrophysics from 1990-96. She then became a Post-Doctoral Fellow in 1998 at the institute and currently works as a professor and director of institute. She is an active member of the International astronomical Union.

Dr. Subramaniam's major field of research includes: Star clusters (open and globular)Star formation and pre-MS stars Classical Be &Herbig Ae/Be stars Galactic structureMagellanic CloudsStellar population .

She is currently working on projects as At Indian Institute of Astrophysics, her current projects include: Emission line stars in star clusters, Star formation history of young star clusters , Candidate old open clusters - unraveling the old disk Accurate photometry of unstudied open clusters, Halo of the Small Magellanic Cloud, Stellar population in the Large Magellanic Cloud, Outer limits Survey: Magellanic Clouds.

Shikha Varma

Shikha Varma is an experimental condensed matter physicist at the Institute of Physics, Bhubaneswar, India.

Education

Shikha went to IIT Kanpur in 1982 for an MSc. She developed interest towards "experimental methods" at IIT and decided to pursue research in experimental field. She finished M.Sc. in 1984 and then completed her Ph.D. from Syracuse University in the U.S. For her Ph.D., she studied the electronic structure and the band structure of thin mercury films on silver substrate, using Ultraviolet Photoemission Spectroscopy and Synchrotron Radiation.

Contribution

For postdoctoral work, Shikha went to Case Western University in Cleveland, and then to the University of Wisconsin-Milwaukee, where she studied the core level photoemission spectroscopy of oxides using X-ray photoelectron diffraction. In 1993, she went to the University of California-Santa Barbara where she studied the MBE and MOCVD grown quantum dots structures by AFM and STM.

Shikha joined Institute of Physics, Bhubaneswar on 10 October 1994. Currently she is a professor ofPhysics at the institute. Some other positions that Shikha held include:

Visiting Scientist, Chemical and Nuclear Engineering, University of California, Santa Barbara, (CA) USAAssociate Lecturer & Research Associate, Surface Science, Physics Department, University ofWisconsin-Milwaukee, Milwaukee, (WI) USA, Research Associate, Surface Science, Physics Department, Case Western Reserve University, Cleveland, (OH) USA

Her areas of interest include Surface Science, Thin film growth and Growth Modes at Early Stages, Electronic Structure/Band Structure of thin films, Nanostructures and Nanoclusters, Surface Modifications with Ion Implantation, Ion Beam Assisted Structural Modifications.

B. Vijayalakshmi

Introduction

B. Vijayalakshmi was a physicist from India.Viji joined the Department of Theoretical Physics in 1974 .Hers was a conservative background, and it was remarkable that she could overcome conventional gender restrictions and consider research an option

Education

Born into a conservative family, she obtained her Masters from Seethalakshmi Ramaswami College, Tiruchirapalli in 1974 and joined the Department of Theoretical Physics. In 1982, she completed a Ph.D from Madras University, and soon met and married T. Jayaram.

Contribution

B. Vijayalakshmi's studies explored the topics of relativistic equations of higher spin in external electromagnetic and gravitational fields, looking for ways higher spin theories could be constructed. Soon after she worked on spinning particle in non-relativistic quantum mechanics. It was around 1978 when the Association of Research Scholars of the Madras University was formed and was contributed to by B. Vijayalakshmi. In 1980 she gave talks at the biannual High Energy Physics Symposium of the Department of Atomic Energy held at the University in Kochi. She was treated with high regard after this and respect for her studies. Although her health deteriorated due to cancer she published five publications on the relativistic wave equations in external fields and completed her requirements for Ph.D., describing large classes of relativistic equations previously unknown to the scientific community. As supersymmetry became more popular her work shifted and she wrote two papers on the topic. For more than two more years B. Vijayalaxmi was studying relativistic .

CHEMISTRY

Journey of Chemistry with special reference to Contribution of Indian Chemists

Dr. Manisha Khaladkar
Associate Professor of Chemistry, College of Engineering Pune, Maharashtra, India

Even today, the Iron Pillar of Delhi continues to astonish tourists and locals: how has such a piece of ancient artistry remained rust-free? The structure weighs more than 6 ton and its accurate chemical composition is engraved on it. This shows that more than 1600 years also Chemists in India were not only capable of making tall structures which were not only rust free Iron but their exact composition was also attainable and could be analysed accurately.

Separation and use of noble metals was relatively easy to believe and expect as they occur in native state but it is even more significant that even smelting of Copper and making alloys like Bronze and Brass was known to Indian Chemists 4000 years back.

Coins punched out of Silver, Gold, PanchDhatu (5 metal alloy), Bronze, the famous seals of Indus valley civilization (4000 -3000 years old), the art of making wine, paints, Mirrors, sintered earthen pottery, ornaments, perfumes, the art of dyeing and painting, the art of food grain preservation and processing ayurvedic medicines, mercury nanomaterial(ParadBhasma), silver nanomaterial (RoupyaBhasma) their applications as pesticide, antimicrobial activity are all tell us the tales of advances in Chemistry, Metallurgy, materials science and technology that prevailed in yester years.

Baked bricks, pottery, seals, ornaments, cementing material used in multistoried structures, even waterproofing chemicals used for preventing underground drainage lines and found at the Great public baths found at archeological sites of Dholavira, Mohen jo daro, Lothal, Harappa , Rakhigrahi are blinding evidences of knowledge of Chemistry, metallurgy and material processing technology as early as 2650-1400 BC.

According to Rig Veda the art of leather tanning, Cotton fabric dyeing, gray pottery with golden polishing is described in detail, this can't be replicated toady also with all known Chemical technology and strikingly this all dates back in 1000-300 BC.

Brahmanas, Puranas and Upanishadasdescribe the art and science of making and using chemicals used for processing metals, gems stones like Lapis Lazuli, making salt from sea water, alkalis their classification into strong, weak and moderate, the art of making colored glass from lime, alkali, sand and colored metal oxides is described in Brihad Samhita Hastinapur, Kolhapur, Takshshila,Nevasawerecentres that specialize in glass blowing, and glazed pottery. Use of Chemicals used in plastics surgery is described in Sushrut Samhita.

Detail process of making soap from alkali, salt and oil was known and commonly used in 1800 AD.

Nagarjuna a great Indian Scientist was born in Gujrath in 931AD, he was a Chemist, Alchemist, Metallurgist and wine maker. His most coveted work is Rasratnakar which discusses formulations of Mercury compounds, He also explained extraction of Gold, Silver, Mercury , Tin and Copper.

Rishi Kanada much senior to Nagarjuna born in 6th century BC in Prabhaspatan near Dwarka in Gujrath state stated for the first time that all matter is made up of small particles known as Atoms, there are different type of Atomes which aggregate into different substances with varied properties. The word Anu (for atom) which he said to be smallest indivisible particle was introduced to the world by Kanad.

Charak was an ancient Royal Doctor in the court of King Kanishka, he developed several medicines elaborated in Charaksanhita which describes digestion, metabolism, medicine for their cure.

In 18, 19 and 20th Century chemistry research outside India work of Robert Boyle, Volta, Mendeleev, Mosley, John Dalton, NeilsBhor, Berzelius, Lavoisier, Alfred Nobel, J Willard Gibbs, Mary and Pierre Curie made most significant contributions which resulted into Development of Chemistry.

The concept of atoms and molecules, Discovery of various elements, gases, classification of elements into periodic table, chemical reactions based analysis of materials, radio activity, Classification of materials into Organic and Inorganic, metals, ceramics, oxides, extractive metallurgy, Polymers, Gas laws, Avogadro number, Electrochemistry, photochemistry, catalysis, explosives, Einstein's equation, Nano materials synthesis, green chemistry are significant milestones in the progress of Chemistry.

Though we do not find large number of references and names of women Innovators; probably its owing to the Innovations and applications were given more focus in yester years rather than names of the Innovators. There was not Reward for the person or there was no tradition to keep records of the Innovators, patenting of Intellectual property but focus was utilizing materials and Innovation for the benefit of Society.

Darshan Ranganathan

Darshan Ranganathan was born on June 4, 1941 and passed away from metastasis of cancer on June 4, 2001, exactly at the age of sixty.

Darshan Ranganathan is well known for her work in bio-organic chemistry. She is noted for her work in supramolecular assemblies, molecular design, chemical simulation of key biological processes, synthesis of functional hybrid peptides and synthesis of nanotubes.

Education

Ph.D. (1967, Delhi), FASc, FNA.

Contribution

Ranganathan's special passion was reproducing natural biochemical processes in the laboratory. She created a protocol which achieved the autonomous reproduction of imidazole, an ingredient of histadine and histamine with pharmaceutical importance. She also developed a working simulation of the urea cycle. As her career developed, she became a specialist in designing proteins to hold a wide variety of different conformations and designing nanostructures using self-assembling peptides.

Social impact of work

The biennial "Professor Darshan Ranganathan Memorial Lecture", which is to be "delivered by a woman scientist who has made outstanding contributions in any field of Science and Technology", was established in her memory by her husband, in 2001

Awards and Achievements

Her honours 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, and Sukh Dev Endowment Lectureship. Third World Academy of Sciences Award in Chemistry for her outstanding contributions to bio-organic chemistry, particularly supramolecular assemblies, molecular design, chemical simulation of key biological processes, synthesis of functional hybrid peptides and synthesis of nanotubes, in 1999.

Lakshmi Kantam

Mannepalli Lakshmi Kantam is an Indian scientist. She is the Director of CSIR-IICT. She joined as a Scientist B in Indian Institute of Chemical Technology, Hyderabad in the year 1984. In 2005, she has been elevated as Head of the Inorganic and Physical Chemistry Division, consisting of 30 scientists and 150 Ph.D students.

Education

B. Sc. Chemistry, Botany, Zoology Andhra University M.Sc. in Chemistry (Inorganic), Kurukshetra University Ph.D. in Chemistry, Kurukshetra University. Title of Thesis: Studies in the Synthesis and Characterization of Some Lower Valent Rhenium Compounds; Research Supervisor: Late Prof. V.Yatirjam Contribution She has guided 27 PhD students and 15 students are presently working under her guidance for their Ph.D. She has more than 260 research publications and 43 US patents to her credit. She has made outstanding contributions towards the development of specially designed homogeneous/ heterogeneous catalysts for chemical reactions with innovative scientific inputs to achieve highest possible atom economy. In particular, utilization of nanomaterials, hydrotalcites and hydroxyapatites as supports and catalysts for asymmetric catalysis and C-C / C-N coupling reactions is noteworthy.

Social impact of work

Development of ligand-free heterogeneous layered double hydroxide supported nanopalladium catalyst using basic LDH in place of basic ligands exhibiting higher activity and selectivity in the Heck olefination chloroarenes is a success story.

Innovative design of catalysts for the conversion of waste plastics into oil is another success story. Nanomaterials as catalysts and supports are another area which she has systematically exploited for the advancement of science.

Awards and Achievements

She has received many academic awards viz., Fellow of the National Academy of Sciences, India, BD Tilak Visiting Fellow, UICT, Mumbai; AP Akademi Fellow and RMIT Foundation Fellowship, RMIT university, Melbourne, Australia. She is an adjunct professor at RMIT University, Melbourne, Australia. She is the Chairperson, Subject Expert Committee, Women Scientists Scheme, Department of Science and Technology, Government of India. She is a member of several committees, Expert Committee Nano-Agri. Department of Biotechnology, Govt. of India., Member, International Advisory Board (CAFC-9), 9th Congress on Catalysis Applied to Fine Chemicals, Spain, 2010; Editorial Board Member, The Chemical Record (TCR), Wiley-VCH; Editorial Board Member, The Open Catalysis Journal; Editorial Board Member, Bulletin of the Catalysis Society of India; President, Catalysis Society of India (CSI); Member, Board of Studies, JNTU Hyderabad and Board of studies, Andhra University, Visakhapatnam; Member, Selection Committee, JNTU Hyderabad.

Munia Ganguli

Munia Ganguli is an Indian biochemist, biotechnologist and a scientist at the Institute of Genomics and Integrative Biology (IGIB).

Education

PhD (Solid State and Structural Chemistry Unit, Indian Institute of Science, Bangalore, 1998) MSc (Physical Chemistry, Jadavpur University, Kolkata, 1992) BSc (Chemistry, Jadavpur University, Kolkata, 1990).

Contribution

She is known for the development of non-invasive protocols of drug delivery and the team led by her was successful in developing a drug delivery system for skin disorders, using a nanometer-sized peptide complex carrying plasmid DNA which has since shown effective penetration and apparently without harming the skin. She holds two patents for the processes she has developed.

Social impact of work

At IGIB, she has established her laboratory where she hosts several research scholars and scientists. Her studies have been documented by way of a number of articles and, an online repository of scientific articles has listed 76 of them. She has been the leader of the IGIB project, Nanomaterials and nanodevices for applications in health and disease,

Awards and Achievements

Ganguli is a member of the contingent which represented IGIB in the Joint Research Initiative between CSIR and IGIB for interfacing chemistry with biology and has been a member of the editorial advisory committee of Nano Science and its Application, a national level seminar sponsored by the University Grants Commission.

She was recipient of The National Bioscience Award for Career Development, one of the highest Indian science awards, for her contributions to biosciences, in 2012.

Padmasree Warrior

Padmasree Warrior is the former Chief Executive Officer of NIO US as well as a member of its board of directors. In these capacities, she was responsible for the brains of NIO's autonomous electric vehicles and the overall user experience. Prior to this she held senior executive positions in Motorola and Cisco.

Education

Bachelor's degree in chemical engineering from Indian Institute of Technology, Delhi in 1982. Master's degree in chemical engineering from Cornell University.

Contribution

Warrior joined Motorola in 1984 Over the course of her 23 years at the company she served as Corporate Vice-President and general manager of Motorola's Energy Systems Group, and Corporate Vice-President and Chief Technology Officer in its Semiconductor Products Sector. Immediately prior to becoming Motorola's CTO, she served as general manager of Thoughtbeam, a product of Motorola, in Tempe, Arizona. When named Motorola's CTO in January 2003, Warrior became a senior vice-president and in 2005 she was promoted to executive vice-president.

Social impact of work

During Warrior's tenure as CTO, Motorola was awarded the 2004 National Medal of Technology by the President of the United States, the first time the company had received this honour. During this period she was a proponent of "Seamless Mobility" - the concept of having seamless communication across all facets of a person's life.

Awards and Achievements

Fortune Magazine called her one of four rising stars on its Most Powerful Women list, placing her between the 10 "highest paid" and the "Young and Powerful" categories. In 2005, The Economic Times ranked Warrior as the 11th Most Influential Global Indian. In 2001 she was one of six women nationwide selected to receive the "Women Elevating Science and Technology" award from Working Woman Magazine. As of 2014, she is listed as the 71st most powerful woman in the world by Forbes. In 2018 she was also featured among "America's Top 50 Women In Tech" by Forbes. Warrior is featured in the Notable Women in computing cards.

Warrior has been a member of various boards like

NIO, Microsoft Corporation, Spotify, Thorn, The Joffrey Ballet, Museum of Science and Industry, Chicago.

Prabha R. Chatterji

Prabha R. Chatterji is an Indian scientist at John F. Welch Technology Centre (formerly General Electric Global Research and Technology Development center), Bangalore, India. She has been formerly a senior scientist at Indian Institute of Chemical Technology, Hyderabad and a past member of the Executive Committee of the Society for Biomaterials and Artificial Organs, India. She works primarily related to scientific and technical education in India

Education

She graduated from a small college in a nondescript village near Ottappalam in Kerala. Prabha's career trajectory involves stint in academia to governmental R&D and then to Industry.

Contribution

Chatterji has published 41 papers and has an h-index of 16.

Social impact of work

She is also involved in policies of scientific and technical education in India

Awards and Achievements

National Science Talent Search Scholarship by Indian Institute of Science, Bangalore

Vasvik Award for industrial research and the MRSI Lecture award.

Rashna Bhandari

Rashna Bhandari is Head, Laboratory of Cell Signalling at the Centre for DNA Fingerprinting and Diagnostics, Hyderabad.

Education

M.S. and Ph.D. degrees in Biological Sciences from the Indian Institute of Science, Bangalore,S (2001).

Contribution

She worked with Sandhya Visweswariah at IIS, Bangalore on signal transduction by the membrane-bound guanylyl cyclase, GCC, which is involved in maintaining fluid and ion homeostasis across the intestinal membrane. In 2001, she moved to the laboratory of John Kuriyan at the University of California at Berkeley as a post-doctoral fellow, to work on the structural biology and biochemistry of proteins involved in cell signaling. There she studied the structure-function relationship of JAK-STAT proteins and the EGF receptor. In 2003, she relocated to the Johns Hopkins School of Medicine in Baltimore, where she worked with Solomon Snyder on deciphering the role of inositol pyrophosphates as signalling molecules. She was involved in the discovery that inositol pyrophosphates are mediators of protein phosphorylation in eukaryotes.

Social impact of work

Her work revealed that inositol pyrophosphates transfer their high-energy beta phosphate moiety to pre-phosphorylated serine residues to generate pyrophosphoserine, a novel protein modification. The characterization of a knockout mouse with low levels of inositol pyrophosphates highlighted a role for these molecules in fertility, growth and insulin secretion. In January 2008, Rashna joined CDFD as a staff scientist, where she continues to pursue her study of signal transduction in biological systems, with particular emphasis on understanding the role of inositol pyrophosphates in physiology and metabolism.

Awards and Achievements

Wellcome Trust/DBT India Alliance Senior Fellowship 2009.

Innovative Young Biotechnologists Award, from the Department of Biotechnology, Govt. of India, 2008.

W. Barry Wood Young Investigators Award given by the Johns Hopkins School of Medicine, Baltimore, USA for research conducted as a post-doctoral fellow, April 2007.

Alumni Association Scholarship (1994-95), Indian Institute of Science, Bangalore, India.

Seema Bhatnagar

Seema Bhatnagar is an Indian scientist, working in the field of anticancer drug discovery. Bhatnagar is currently working as Assistant Director at Amity Institute of Biotechnology with Amity University, Noida. Bhatnagar has been associated with the University since its inception. She began her research career with project sponsored by the Department of Science

Education

B.Sc. in Chemistry, Biology and Zoology (1992), M.Sc. in Organic Chemistry (1994) from Isabella Thoburn College, Lucknow. Ph.D. in Chemistry (1999) from Chaudhary Charan Singh University, Meerut.

Contribution

Bhatnagar has been associated with research and development in the field of drug discovery and worked with various government and non-government organizations including National Institute of Immunology, India Ranbaxy Laboratories, Central Drug Research Institute, Wellcome Trust, Genome Campus, Cambridge UK. She has started her career as Senior Research Fellow (Extended) in Medicinal Chemistry Division, associated with "Lactam Acetals in Organic Synthesis" under the supervision of Nitya Anand. Project fully sponsored by Council of Scientific and Industrial Research being executed at New Drug Discovery Research (NDDR), Ranbaxy Laboratories.

She has developed active collaboration with Bhyravabhotla Jayaram at Indian Institute of Technology Delhi, Thankayyan Retnabai Santhosh Kumar at Rajiv Gandhi Centre for Biotechnology (RGCB), Thiruvananthapuram and Drug Discovery Unit at the University of Dundee to strengthen the research work.

Prof Bhatnagar's research credentials include several patents and publications.

Impact

She primarily works on synthetic chemistry approaches for targeted delivery of anticancer drugs in breast cancer. At Amity University along with the research, Prof. Bhatnagar also leads various initiatives, including collaboration of Foreign Universities and Scientific Research organizations,

Fellowships/Awards

She was awarded as Senior Research Fellowship (Extended) by the Council of Scientific and Industrial Research, New Delhi. Nominated member of the Jury Panel (level 1) for the 'Dupont India Challenge- 2002 Science Paper Contest '

Seetha Coleman-Kammula

Seetha Coleman-Kammula is an Indian chemist, environmentalist and entrepreneur. Her main research interests relate to instability and transition to turbulence of shear flows, physics of interfacial flows.

She started her career as scientist in the Computational and Theoretical fluid dynamics division of National Aerospace Laboratories, Bangalore, and worked there for a decade from 1988 to 1998. She became a faculty member at the Jawaharlal Nehru Center for Advanced Scientific Research and worked in that position between 1998 and 2012. Since 2012, she is a professor at the TIFR Centre for Interdisciplinary Sciences.

Education

Undergraduate degree (B.Tech.) in Chemical engineering from IIT Delhi, in 1984 Master's degree (M.S.) in Chemical Engineering, from Drexel University, Philadelphia, United States, in 1986.

Doctoral degree (Ph.D) in the subject of Aerospace Engineering from the Indian Institute of Science Bangalore, in 1994, as Post-Doctoral Research, in Dept. of Aeronautics, Caltech during 1994.

Contribution

She has published a large number of technical papers in her field of specialization of fluid physics and has also published a few books. Her firm focuses on industrial ecology and assessment of the life cycle of products , both as a means of protecting the environment and providing jobs in disposal and recycling.

She works on the Sustainability External Advisory Council of Dow Chemical Company and with other corporate entities

Social impact of work

After over 25 years working in the petrochemical industry developing plastics, she began an environmental consulting firm in 2005. She promotes "industrial ecology" and recommends that corporate entities make environmental impact assessments over the life cycle of products as a means of increasing value of products and decreasing the negative impacts to the environment.

Awards and Achievements

Of the many awards that she has received so far, the most notable is the Shanti Swarup Bhatnagar Award for the year 2007 for her "original contributions to the understanding of instabilities in shear and non-parallel flows, flow entrainment, turbulent transition and small-scale hydraulic jumps". She was also awarded with the Young Scientist award of 1987 and Outstanding scientist award of 1996 given by the National aerospace laboratories. She received the CNR Rao Oration award of 2004 at JNCASR Bangalore.

Sharmila Bhattacharya

Dr. Sharmila Bhattacharya (born in Lagos, Nigeria and grew up in India) is the Chief Scientist for Astrobionics and head of the Biomodel Performance and Behavior laboratory at NASA Ames Research Center.

Education

\Bachelor's degree in Human Physiology in Presidency College, Kolkata and Biological Chemistry from Wellesley College, Master's degree and Ph.D. at Princeton University for her research in Molecular Biology, Post-doctoral research at Stanford University in Neurobiology.

Contribution

She is the Subject Matter Expert of the US Senate Committee on Commerce, Science and Transportation and the Principal Investigator for Biomodel Performance Laboratory of Space Biosciences Division of NASA Ames Research Center.

Social impact of work

She was part of projects like which sent fruit flies into the space to study human illnesses and to study the effects of radiation in space which will help space explorers.

Awards and Achievements

She has received the Ames Honor Award the successful launch of the MVP-Fly-01 experiment, 2018, NASA Exceptional Scientific Achievement Medal, 2018, etc She was the lead scientist on several projects of NASA Ames Research Cente.

Shipra Guha-Mukherjee

Shipra Guha-Mukherjee was worked on plant tissue culture, plant molecular biology, and biotechnology and cell molecular biology.

Education

Botany (Hons) in 1954 and MSc from Jawaharlal Nehru University, Delhi. She remained in Jawaharlal Nehru University, first as student and then as professor and researcher, for more than 30 years. PhD under Prof. B. M. Johri on the tissue culture of an onion and completed her PhD at 1963.

Contribution

Shipra the woman scientist who was behind the breakthrough discovery of "The technique of production of haploid plants through anther culture."

This work led to the establishment of techniques of culture of young ovules and ovaries. This technique has also been used as an additional tool for obtaining improved varieties of rice, wheat, potato and other crops.

She has also worked on regeneration of plants and mechanism of regeneration involving various enzymes, membrane phospholipids and second messengers during her time at the School of Life Sciences, Jawaharlal Nehru University, Delhi.

Social impact of work

She is quoted as saying: "I decided to study botany because it was my favourite subject in school. As a school student I was awed by the contribution of Sir Jagadish Chandra Bose, and fascinated by his work that showed that plants were living organisms and had a metabolism similar to that of animals. His hypothesis that ascent of sap in plants is due to pulsatory activity of an inner layer of cortical cells (a theory no longer tenable) infused a huge excitement in me, as earlier I used to think that plants were inert objects which could never respond to any external stimuli. As a student in classes five and six, I developed a strong determination to find the locations of the "heart" and "brain" of plants and to understand the way they functioned."

Awards and Achievements

She received the Senior National Bio-scientist Award, the Om Prakash Bhasin Foundation Award in Biotechnology and the Kanishka Award from the Lion's Club. She was elected a Fellow of the Indian Academy of Science, Bangalore and also at the National Academy of Science, Allahabad. She also served as the dean of life sciences between 1993 and 1995, as member of the task force and scientific advisory committee, Department of Biotechnology, Govt. of India, and also on the board of the University Grants Commission.

Anju Chadha

Anju Chadha is an Indian biochemist. She is a professor at Indian Institute of Technology Madras She works in the fields of biocatalysis and enzyme mechanisms, enzymes in organic synthesis, asymmetric synthesis using enzymes, chirotechnology, green chemistry and biosensors

Education

In high school she was named best student. While getting her bachelor's degree at Nowrosjee Wadia College, she was awarded a Maharashtra State Government Scholarship. She was also awarded a prize in chemistry from the college.She graduated with her degree in chemistry in 1975 She received her Masters of Science in 1977 from the University of Poona with an emphasis in chemistry. In 1984, she completed her PhD from the Indian Institute of Science, Bangalore. She focused on bioorganic chemistry.

Contribution

Chadha is a lifetime member of the Indian Society of BioOrganic Chemists, the Chemical Research Society of India and the IISc Alumni Association, Bangalore. She is also an elected member of Madras Science Foundation.

Social impact

She encourages young people, especially young girls, to take up research in science as a professional activity and work together with other researchers to build strong centers of science. She also also committed to supporting the entry and participation of young women in public life as citizens

Awards and achievements

Chemistry Prize, Nowrosjee Wadia College, Poona, India, Mrs. Hanumantha Rao Medal, Indian Institute of Science, Bangalore, India, , Fellow, Fogarty International Center, National Institutes of Health, Washington, D.C,Fellow, Alexander von Humboldt Foundation, - International Women's Day Award from the University of Madras.

BIOLOGY

Journey of Biology and Contribution of Indian women scientist in biological sciences

Dr (Smt) Suneeta Patra
Dept. of Botany. Govt.N.P.G College of Science, Raipur, C.G.

Biology is the study of living things .Biology deals with all the physicochemical aspects in living organism. The word "Biology" first appeared in 1802 Reproduction ,cell division and transmission of genetic material are the common biological phenomenon which are common in all living .

For convenience of study biology is subdivided into separate branches. In terms of major kinds of organisms, biology can be divided into at least three different branched, Botany known as the study of plants. Zoology is known as the study of animals and Human biology known as the study of man.

To study the special group of organisms, biology has been divided into different branches like Bacteriology- study of bacteria, Virology- study of viruses, Mycology- study of fungi, Entomology- study of insects, Ichthyology-study of fishes, Herpetology- study of lizards, snakes, etc. Ornithology- study of birds.

There are different approaches to study the biology, on the basis of which biology can be divided into different branches such as, Anatomy- study of gross structure of an organism,n Morphology- study of forms and structure of plants and animals, Histology- study of microanatomy of cells, tissues and organs, Cytology- study of structure and function of animal and plant cells, Physiology- study of functions and activities of organisms and their parts, Embryology- study of formation and development of embryo of plants and animals, Taxonomy- science of naming, and classifying plants and animals, Ecology- study of interaction among organism and environment, Biogeography- study of geographical distribution of plants and animals, Paleontology- study of fossils, Evolution- study of origin and descent of organisms, Genetics- study of transmission of characteristics from parents to offspring, Parasitological- study of parasites, Pathology- study of diseases of plants and animals, Immunology- study of immune system, Eugenics-study that aims to improve the quality of human population.

The interdisciplinary research, scientific knowledge and investigation from different fields have resulted in significant overlap of the field of biology with other scientific disciplines. In modern age the basic fields like chemistry, medicine, and physics are integrated with of biology such as biophysics, biochemistry, biomedicine, bioclimatology, bioengineering, biogeography, bioinformatics, biomathematics, biotechnology. All these subdivisions remain interrelated by basic principles.

The research and the knowledge in the field of biology is very ancient, we can trace it back from 300 BC when Threophrastos began the systematic study

of Botany. In 350 BC Aristotle attempted to classify animals .His work is mentioned in his book Historion Animalium, a general biology of animals, De Partibus Animalium, a comparative anatomy and physiology of animals, and De Generatione Animalium, on developmental biology.

The research and the knowledge in the field of medicine can be traced out back from 450 BC when Sushruta Samhita was written by Sushruta which describe about 120 surgical instruments and 300 surgical procedures. In Sushruta Samhita human surgery has been classified into eight categories, and cosmetic surgery has also been introduced in it.In520 BC when Alcmaeon of Croton discovered optic nerves and distinguished veins and arteries.

Initially it was thought that the animals were generated spontaneously from mud or excreta but later on in 1651 William Harvey concluded that all animals, including mammals, develop from eggs. Protozoa were observed by Anton van Leewenhoek in 1676 and he gave them the name animalcules, he later observed spermatozoa in 1677 and bacteria in 1683 and these microorganisms produce fermentation was stated by Louis Paster in 1856. The Escherichia coli bacterium a major research, development, and production tool for biotechnology was discovered in1855. In 1898 Martnus Beijerinck did filtering experiments and showed that tobacoo mosaic disease is caused by smaller particles than a bacterium, which he named virus. Phages, or bacterial viruses, were discovered in1915.

Later in 1665 Robert Hook using a microscope observed cells in cork and Theodor Schwann proposed that all animal tissues are composed of cells in 1839. It was then suggested by Schwann and Schleinden that cells are the unit of life and they gave cell theory. Robert Brown discovered the nucleus in cells. Friedrich Miescher in 1869 discovered that in nucleus of every cell there is nucleic acid. The term 'Chromosome was coined in 1888 by Heinrich Wilhelm Gottfried Von Waldeyer-Hartz .Chromosomes are present in the nucleus of every eukaryotic cell which carry the hereditary information was proposed by Walter Sutton and Theodor Boveri in 1902 and these characters are inherited from one generation to other. The name Genetics was given to the study of inheritance by William Bateson. Gregor Mendel did experiments on pea plant and gave laws of inheritance in 1865 long before when the chromosomes were discovered and the chromosomal theory was proposed.

In 1909 Wilhelm Johannsen coined the physical and functional unit of heredity as gene which are made up of DNA. He also coined the name genotype and phenotype. In 1953 James D.Watson and Francis Crick published a double-helix structure for DNA, with one sugar-phosphate backbone running in the opposite direction to the other. The combined work of James D.Watson and Francis Crick with the Hershey and Chase experiment and Chargaff's data on nucleotides, finally led biologists to conclude that DNA is the genetic material, not protein.

A very important discovery of first antibacterial toxin penicillin was made by Alexander Fleming in1928 from the mold Penicillium notatum, which is used

against many infectious diseases and it brought a revolution. There were very important discoveries which led to the origins of a new disciplines named biotechnology and genetic engineering was the base of it. The term "genetic engineering" was first used by a Danish microbiologist in 1941.Biotechnology is an application or technology which has developed to use biological systems and organisms processes for a specific use. The key events that unite genetics with biotechnology were discovery of the structure of DNA, by Watson and Crick in1953 and the discovery of a recombinant DNA technique in1973 by Cohen and Boyer by which a section of DNA was cut from the plasmid of an E. coli bacterium and transferred into the DNA of another, the technique was known as recombinant DNA technology and the product was known as recombinant DNA (rDNA).

. The key events which played crucial role for the development of the technique genetic engineering were discovery of enzyme DNA polymerase in 1955 by Arthur Kornburg, the knowledge of existence of enzyme reverse transcriptase in 1964, discovery of restriction endonuclease enzymes in 1970 by Hamilton Smith and Daniel Nathans, discovery of reverse transcriptase enzymes independently by Howard Temin and David Baltimore in 1970 and discovery of DNA ligase enzyme in 1972, which links DNA fragments together.

In the field of medicine with help of this technique recombinant human insulin was produced for the first time in1978, Human growth hormone in 1979 and first recombinant hepatitis B vaccine for humans was approved in 1986. The first genetically engineered plant was reported in 1981.In 1975 the techniques for producing monoclonal antibodies were developed. Berkeley, chemist Dr. Peter Schultz combined antibodies and enzymes (abzymes) to create therapeutics in 1986 at University of California.

In the field of agriculture the first pest-resistant corn,Bt corn, was produced in 1988 and in 1996 the first genetically engineered crop was commercialized.

In 1997 first successful cloning was done in an adult animal, using sheep as model and naming the cloned sheep Dolly by Ian Wilmut with the help of recombinant DNA technology and reproductive cloning. In the same year 1997 the first human artificial chromosome was created.

The genetically modified organisms became crucial components of biomedical research, where genetically modified (GM) mice and other animals were developed as research model for certain human diseases, GM crops, including pest-resistant forms of cotton and herbicide-resistant forms of maize (corn) and soybeans were developed using recombinant DNA technology. The development in recombinant DNA technology further accelerated when in 1983Karry Mullis invented "PCR" (polymerase chain reaction), an automated method for invitro rapid amplification of DNA sequences. Another very important research finding advised by Alec Jeffery in 1984 was DNA fingerprinting . In 1990 the first approved gene therapy on a human patient was performed by Anderson et.al.

With the help of recombinant DNA technology researchers found new era of research by recombining nucleic acids and modifying organisms , genetic codes and

giving organisms new traits or eliminating undesirable traits. Tatum stated that modification of organisms can be done by three ways through biological engineering either by the recombination of existing genes, or eugenics , by the production of new genes by a process of directed mutation, by genetic engineering or by modifying or controlling the gene expression.

Recombination technique is used in the field of medicine, agriculture and industries. The first enzyme produced from a genetically modified source-yeast was Chymosin (known as Rennin) which was used in food industry in 1988.The first vaccine for Hepatitis A was developed in1995. The first genetically engineered crop in 1996 was made commercially available. Scientist created the first human artificial chromosome in 1997 and in 1998 for the first time in the laboratory human skin was produced. The Human Genome Project was completed in 2003 which was related with the sequencing of the human genome. In 2007 scientists found out the technique to use human skin cells to create embryonic stem cells which was not possible earlier.2008 the chemists in Japan got success in creating the first DNA molecule entirely from artificial parts. In 2012 use of CSISPR-Cas9 a DNA-editing biotechnology tool was discovered taking advantage of a defense strategy used by bacteria.

2012 an interesting invention was done by synthesizing XNA a polymer synthesized by molecular biologists Vitor Pinheiro and Philipp Holliger of the Medical Research Council in the United Kingdom. XNA is just like DNA and RNA and is capable of storing genetic information. 2013 Japanese researchers developed functional human liver tissue from reprogrammed skin cells. A synthetic and fully functional yeast chromosome was constructed by an international team of scientists in 2014. In 2015: scientists discovered a new generation of antibiotics to fight growing drug-resistance. Many common bacterial infections such as tuberculosis, septicaemia, and C. diff.can be treated with the antibiotic, teixobactin.

Doctors for the first time in 2015, using cells from human donors, built a set of vocal cords from scratch. In 2016, CRISPR Cas9, the gene-editing tool was used by chinese scientists to treat a human patient for the first time. In 2016 for the first time, a completely 3D-printed heart on a chip was created by bioengineers.

Cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution was developed by Jacques Dubochet, Joachim Frank and Richard Henderson for which Nobel prize was given them in2017.

In the field of agriculture new promising findings were seen like in 2017 for the first time step was taken toward epigenetically modification of cotton and scientists also revealed that DNA demethylation is involved in tomato ripening process.

Disease-resistant rice was developed in 2017 by scientists without sacrificing yield. Drastic development and advancement in biotechnology in India is seen in 21st century. Nowadays biotechnology is being used in the field of agriculture, bioremediation and forensics.DNA fingerprinting is in common practice in forensic laboratory for identification of culprits and other issues. Gene manipulation and biotechnology is the promising science of future.

Janaki Ammal

Janaki Ammal Edavalath Kakkat was an Indian botanist who conducted scientific research in cytogenetics and phytogeography. Her most notable work involves those on sugarcane and the eggplant (brinjal). She has collected various valuable plants of medicinal and economic value from the rain forests of Kerala.

Education

Ammal finished her bachelor's degree from Queen Mary's College, and then moved on to the Presidency College to complete her honours degree in botany in 1921. She took a position teaching at the Women's Christian College in Madras (now Chennai), before moving to the United States to complete her master's degree at the University of Michigan in 1925.

She returned to teach in India briefly, before becoming the first oriental barbour fellow at the University of Michigan. Ammal completed her doctor of science degree in 1931.

In 1932, Ammal returned to India to accept a professorship in botany at the Maharaja's College of Science. Two years later, she took a position as a geneticist at the Sugarcane Breeding Institute.

Contribution

Ammal was an Indian scientist of extraordinary accomplishment in the fields of botany, taxonomy and cytogenetics. She is highly regarded by scientists for her cytogenetical studies on sugarcane, egg plant, cymbopogon, terminalia, dhatura and dioscorea.

Her studies on chromosome numbers and policy in many cases threw light on the evolution of species and varieties. The Chromosome Atlas of Cultivated Plants which she wrote jointly with C. D. Darlington in 1945 was a compilation that incorporated much of her own work on many species.

She attributed the higher rate of plant speciation in the cold and humid northeast Himalayas as compared to the cold and dry northwest Himalayas to polyploidy. Also, according to her, the confluence of Chinese and Malayan elements in the flora of northeast India led to natural hybridisation between these and the native flora in this region, contributing further to plant diversification. After retirement she continued to publish the original findings of her research. In the Centre of Advanced Study Field Laboratory where she lived and worked she developed a garden of medicinal plants.

Social impact of work

In the Centre of Advanced Study Field Laboratory where she lived and worked she developed a garden of medicinal plants.

Janaki is mentioned among Indian Americans of the Century in an India Currents magazine article published on 1 January 2000, by S. Gopikrishna&Vandana Kumar: "In an age when most women didn't make it past high school, would it be possible for an Indian

woman to obtain a PhD at one of America's finest public universities and also make seminal contributions to her field?!" The Kerala-born Ammal was arguably the first woman to obtain a PhD in botany in the U.S. (1931), and remains one of the few Asian women to be conferred a DSc (honoris causa) by her alma mater, the University of Michigan.

The John Innes Centre offers a scholarship to PhD students from developing countries in her name.

Awards and achievements

Ammal was elected Fellow of the Indian Academy of Sciences in 1935, and of the Indian National Science Academy in 1957. The University of Michigan conferred an honorary LL.D. on her in 1956 in recognition of her contributions to botany and cytogenetics said: "Blest with the ability to make painstaking and accurate observations, she and her patient endeavours stand as a model for serious and dedicated scientific workers." She was awarded the Padma Shri - one of the highest honours Indian civilians can receive - for her work with the Botanical Survey of Indian. Ammal continues to be honored for her work in botany. India's Ministry of Environment and Forestry created the E. K. Janaki Ammal National Award of Taxonomy in 2000. In 2016, the Botanical Survey of India opened an exhibition in Kolkata to celebrate her life and contributions to botany.

Kamal Ranadive

Kamal Ranadive, was an Indian biomedical researcher who is known for her research in cancer about the links between cancers and viruses. She was a founder member of the Indian Women Scientists' Association (IWSA).

Education

She got her Bachelor of Science (B.Sc) degree with distinction in 1934 from Fergusson college with Botany and Zoology as her main subjects . She then moved to the Agriculture College at Pune where she did her master's degree (M.Sc.) in 1943 with cytogenetic of annocacae as special subject. She also worked for her doctoral degree (Doctor of Philosophy) at the Bombay University under the guidance of Dr. V. R. Khanolkar.

After she got her Ph.D., from the University of Bombay in 1949, she was encouraged by guide to seek fellowship in any American University. She got a post-doctoral research fellowship to work on tissue culture techniques and work with George Gay (famous for his innovation laborator HeLa cell line) in his laboratory at Johns Hopkins University in Baltimore.

Contribution

She was instrumental in establishing Experimental Biology Laboratory and Tissue Culture Laboratory in Bombay. From 1966 to 1970 she had assumed the mantle of the Director of the Indian Cancer Research Centre in an acting capacity. In the early 1960s, she along with her assistants in the fields of biology and chemistry, developed tissue culture media and related reagents. She was also responsible for establishing new research units in Carcinogenesis, Cell biology and Immunology.

Social impact of work

Her research on the pathophysiology of cancer through the medium of animals which led to a further appreciation of causes of diseases such as leukaemia, breast cancer and Esophageal cancer. Another notable achievement was in establishing a link to the susceptibility of cancer and hormones and tumour virus relationship. Evolution of the leprosy vaccine was a result of her basic research on the bacteria related to leprosy. She was a great inspiration to Indian women scientists to work on cancer research, in particular on the subject cancer among women and children. One such project was on "Immunohaematology of Tribal Blood" related to study of infants.

Awards and achievements

Kamal was awarded the Padma Bhusan (the third highest civilian award) for Medicine, in 1982. She was awarded the first Silver Jubilee Research Award 1964, of the Medical Council of India. This award included a gold medal and a cash award of Rs. 15,000. She was also awarded the G. J. Watumull Foundation Prize for 1964 in micro-biology. She was an Emeritus Medical Scientist of the Indian Council of Medical Research .

Priyambada Mohanty Hejmadi

Priyambada Mohanty Hejmadi is an Indian classical dancer of Odissi, art writer, a biologist and a former vice chancellor of Sambalpur University.

Education

She secured a master's degree and subsequently, obtained a doctoral degree in zoology. She also learnt Odissi from an early age under Ban Bihari Maiti and her Odissi performance at the Inter-University Youth Festival in New Delhi in 1954 is reported to have helped the dance form to gain international attention through Charles Fabri, the renowned art critic from Hungary, who was present at the function.

Contribution

Priyambada is a Fellow of the Indian Academy of Sciences. She has written several articles and a book, Odissi: An Indian Classical Dance Form, detailing the history and evolution of the Indian classic form of Odissi.

Her research on marine turtles has been globally recognised. Of the seven species of turtles in the world, five species are known to occur in Indian coastal waters-the Olive Ridley (the smallest), Hawksbill, Loggerhead, Green, and Leatherback (the largest). Sea turtle females come ashore to lay their eggs.

Social impact

Priyambada has been at the forefront of the efforts to protect the Olive Ridley Turtle. With the active campaigns and efforts of a number of groups, and with inspiration and support from people like Priyambada, there is now a resurgence of nesting turtles.

Advocating policy changes, supporting local NGOs to create awareness, and guiding plans for protection, while also pursuing academic research and writing, Dr Priyambada has been an inspiring supporter of the Turtles.

Her academic excellence saw her as the Vice Chancellor of Sambalpur University. Her passion for, and life-long immersion in dance has led her to write a number of books and articles on Odissi and related subjects.

Awards and Achievements

She is a recipient of the Odissi NrutyaSanman which she received in 2013. The Government of India awarded her the fourth highest civilian award of the Padma Shri in 1998 for her contributions to the fields of science and technology.

Vijaya Melnick

Vijaya Lakshmi Melnick is an India-born American academic specializing in biological and environmental sciences and immunology. She is Professor Emeritus of Biological and Environmental Sciences at the University of the District of Columbia. She was the First Vice President and then Co-President of the International Health Awareness Network, an affiliate of the United Nations.

Education

She attended a girls' school run by Franciscan nuns, where she received an English medium school education. She then attended a girls' college and an Agricultural College. In her senior year at the Agricultural College, she won an International Peace Scholarship to study in the United States and enrolled at the University of Wisconsin. She obtained her Master's and doctoral degrees from the University of Wisconsin and continued there for her postdoctoral training in cell biology

Contribution

Melnick has worked in teaching and research, including at the University of the District of Columbia in the Georgetown University Medical Center, International Center for Interdisciplinary Studies in Immunology, Howard University Medical College, Lemelson Center for Inventions & Innovations, the National Museum of American History, the Smithsonian Institution, and the Einstein Institute for Science, Health and the Courts.

At the University of the District of Columbia, Melnick holds the rank of Professor Emeritus of Biological and Environmental Sciences. Here, she also held the post of the Director of the Office of Sponsored Research & Programs. At the Georgetown Univer- sity Medical Center, she has held the post of Associate Director at the International Center for Interdisciplinary Studies in Immunology. She is a member of the Health Care Ethics Faculty at the Howard University Medical College. Melnick is also Principal Investigator on several research projects.

Several books published on Alzheimer's Dementia: Dilemmas in Clinical Research Contemporary Issues in Biomedicine, Ethics, and Society, inorities in Science: The Challenge for Change in Biomedicine, Physiological studies on fruit development using in vivo organ transplantation (1964); Boarder Babies and Drug Affected Children in the District of Columbia: A Case for Public/private Partnerships Comprehensive Planning and Coordinated Services (1992) and Papers jointly with Daniel Melnick "Innovation and Development: India as an Example etc.

Social impact

Speaking at the 2014 Conference on the Culture of Peace, Melnick addressed the problem of violence against women by citing several reasons for the phenomenon, including poverty, living under a patriarchal system, economic inequality,

and under-representation in the political venue. She said: "The assault on women begins even before they are born and continues to adolescence and into adulthood and old age. Globally, it continues to be our greatest shame and tragedy". Commenting on the demographic status of women versus men she mentioned that "We know from demographic reports, that over 4 to 5 million women go missing every year from the world! This is attributed to sex selective abortion occurring in countries like China, India, Armenia, Vietnam and many others".

Awards and Achievements

She holds memberships on the boards and executive committees of national and international organizations related to either health and education or both. She has written several research papers and books.

Paramjit Khurana

Paramjit Khurana is an Indian scientist in Plant Biotechnology, Molecular Biology, Genomics who is presently Professor in the Department of Plant Molecular Biology in the University of Delhi, Delhi.

Education

She graduated from University of Delhi with degrees in Botany; Bachelor of science degree (B.Sc.) in (1975), Master of Science degree (M.Sc.) in 1977), and Master of Philosophy (M.Phil.) in (1978). She obtained her doctoral degree, Ph.D. in Botany in 1983 from University of Delhi.

Contribution

Khurana's career achievements cover Wheat and Seribiotechnology, Comparative Genomics, in wheat biotechnology genetic transformation of Indian wheat for resistance against the cereal cyst nematode and for abiotic stress tolerance, development of mulberry transgenics capable of withstanding salinity and drought stress conditions, effective genetic engineering strategies leading to stress tolerance in crop plants and sustaining agriculture under changing climatic conditions, sequencing of chromosome 11 of rice, chromosome 5 of tomato, and chloroplast genome of mulberry. As professor she has mentored 10 Post-Doctorates, 15 Ph.D scholars, 4 M.Phil. and 20 Master's students.

Social impact of work

Development of all-weather crops which would enable rise of the India's productivity several fold. She has developed modified mulberry which can cultivated in wastelands. She says that professional goal is: "Ten years down the line, I will still be working in my laboratory. I hope my products benefit everyone."

She produced India's first genetically modified food, the Bt brinjal. She is the Joint Director of Research at Maharashtra Hybrid Seeds Company Limited in Jalna and one of the most sought after researcher in the field of Botany.

Awards

She has received many awards and published more than 125 scientific papers Khurana is recipient of the 'Certificate of Honour' awarded by the Gantavaya Sansthan on International Women's Day (2011), and Professor Archana Sharma Memorial Award of the Indian Science Congress Association in 2011-2012.

Fellow of the Indian Academy of Sciences , Fellow of the National Academy of Sciences, India, Fellow of the National Academy of Agricultural Sciences , Prof. J.C. Bose Fellowship (2012-2017) by the Department of Science & Technology, Government of India.

Manju Sharma

Manju Sharma is an Indian biotechnologist and administrator of several scientific research and policy-making bodies in India. She was most recently the president and executive director at the Indian Institute of Advanced Research in Gandhinagar, Gujarat.

Education -

Sharma graduated from Lucknow University, winning the first rank and receiving the Birbal Sahni Memorial Gold Medal and completed her Ph.D. at Lucknow University in 1965 and then worked at Purdue University as a post-doctoral researcher. Collaborating with A. Carl Leopold and Richard Hall, her research on enhancing latex production through the use of ethereal oil found commercial application in Malaysian rubber plantations.

Contribution

Sharma's research on plant idioblasts led to her becoming a visiting scientist at the Institute of Plant Anatomy and Cytology, University of Copenhagen. She then joined the Forest Research Institute, Dehra Dun, where in researching woody plants, she established a correlation between silica content and the hardness of wood. After moving to Delhi, she became a research officer at the Indian Council of Medical Re- search and co-authored a monograph on Indian medicinal plants.

She was instrumental in the creation of the Biotech Consortium India Limited, a public-private partnership to promote the commercialization of biotechnology research.

Sharma founded the Indian Institute of Advanced Research in 2006, helped by endowments from the Puri Foundation for Education in India, to conduct research and provide higher education in plant sciences, human health, biomolecular medicine and bioinformatics. When M. S. Swaminathan took initiative in introducing a chapter on science and technology for women in the Sixth Five-Year Plan (1980-85), a team led by Sharma prepared a report which was incorporated in the plan document on women and development. This was the first focused scheme on the subject, which has since been operated by the Department of Science and Technology.

Social impact

Being a pioneering biotechnology research in India, She played a significant role in establishing several institutions in the country, including the National Institute of Immunology, the National Institute of Plant Genome Research, the Biomass Research Centres at Lucknow and Madurai, the Plant Molecular Biology Unit in University of Delhi and the Centre for DNA Fingerprinting and Diagnostics.

Awards and achievements

The Chandaben Mohanbhai Patel Industrial Research Award for Women Scientists (1991) The Borlaug Award (1995) The first woman president of the

National Academy of Sciences (1995-96) President of the Indian Science Congress Association (1999) The Dr B. P. Pal Memorial Award from the Indian Science Congress Association (2001) G. M. Modi Science Award (2002).

Padma Bhushan (2007) Honorary Doctorate, Purdue University (2012)[Fellow, The World Academy of Sciences Honorary Fellow, Indian Society of Agricultural Biochemists. The first chair-person of the International Council for Science's Forum on Science for Women (2004).

Veena Tandon

VeenaTandon is an Indian parasitologist, academic and a NASI senior scientist at Biotech Park, Lucknow. She is a former professor of zoology at the North Eastern Hill University and serves as the chief instigator for the North-East India Helminth Parasite Information Database.

Education

After graduating in zoology (BSc-hons) from Panjab University, Chandigarh in 1967, she completed her master's degree (MSc) in 1968 before securing a doctoral degree (Ph.D) from the same institution in 1973. She also did post doctoral research at the Department of Molecular Biology and Biochemistry of University of California, Irvine during 1978-79; her research topic being the adverse effect of alcohol on brain and liver tissues. She started her career as an assistant professor at Himachal University but moved to the Department of Zoology of the North Eastern Hill University, Shillong, as an assistant professor where she served till her superannuation as a professor. After retirement, she joined Biotech Park, Lucknow to continue her helminthological researches on a platinum jubilee fellowship of the National Academy of Sciences, India and is the NASI senior scientist of the institution.

Contribution

Tandon is known to have done pioneering research on parasites affecting live- stock and her researches have been reported to have helped in the better understanding of parasite biodiversity of the northeast region of India. She is the principal investigator of the DIT - North-East Parasite Information Analysis Centre which is involved in the preparation of a North-East India Helminth Parasite Information Database (NEIHPID). Her researches have been documented by way of over 340 articles, many of them published in international peer reviewed journals. Besides, she has authored two books, Pictorial Guide to Trematodes of Livestock and Poultry in India and Bamboo Flowering and Rodent Control. She is also a co-author of the North- east India Helminth Parasite Information Database (NEIHPID): Knowledge Base for Helminth Parasites, a database on the parasite biodiversity of the region

She is known for her researches on worm infections afflicting the animals of food value and is the author of two books and several articles on parasitology.

Social impact

She investigated the efficacy of many medicinal plants to scientifically authenticate their vermicidal / vermifugal potential. Such plant-based cures and offer valuable therapeutic alternatives of affordable healthcare to socio-economically underprivileged and rural societies. She is deepaly involved in science promotion and awareness programmes for school children in less privileged or facilities-deprived educational institutions in rural and remote areas of the northeastern states

of the country.

Awards and achievements

The Government of India awarded her the fourth highest civilian honour of the PadmaShri, in 2016, for her contributions to science.

She has delivered key note addresses in many science conferences and award orations such as Prof. R. P. Choudhuri Endowment Lecture of the Guwahati University, Prof. M. M. Chakravarty Commemoration Oration of the Zoological Society, Kolkata and Professor Archana Sharma Memorial Lecture of the National Academy of Sciences, India.She is a recipient of the E. K. Janaki Ammal Award in Animal Taxonomy of the Ministry of Environment and Forests and she received the Lifetime Achievement Award of the Indian Society for Parasitological in 2011.

Manju Bansal

Manju Bansal specializes in the field of Molecular biophysics and is currently a professor of theoretical Biophysics group in Molecular Biophysics unit of in the Indian Institute of Science, Bangalore. She is the founder director of the Institute of Bioinformatics and Applied Biotechnology at Bangalore

Education

Manju Bansal earned her BSc and MSc degrees from Osmania University, Hyderabad. n 1972 she joined the Molecular Biophysics Unit, Indian Institute of Science, Bangalore for her doctoral degree and worked under the guidance of world-renowned biophysicist GN Ramachandran, on the theoretical modeling of the triple helical structure of the fibrous protein collagen and received her PhD in 1977. She continued working at IISc as a post-doctoral fellow with Professor Sasisekharan, on left handed and other unusual structures of DNA till 1981. She then went to Germany as an Alexander von Humboldt Fellow at the European Molecular Biology Laboratory, Heidelberg, for a year and worked on the structure of filamentous phages. She has been awarded an EMBL Visiting Fellowship and AvH Fellowship, Germany and Senior Fulbright Fellowship, USA. She has been a Visiting Professor at Rutgers University, USA, and Visiting Consultant at NIH, Bethesda, USA.

Contribution

Manju Bansal's early work on structure modeling of the fibrous protein collagen, particularly on the role of hydroxyproline and other aminoacids in the triple helical structure of collagen, has recently been experimentally confirmed by others. After joining Indian Institute of Science, Bangalore as a faculty member in 1982, her research has been directed towards better understanding of the sequence dependent stability as well as variability in DNA structure and its role in biological function. Her work has clearly showed that the rules of sequence dependent variability in DNA structure, as observed in oligo-nucleotide crystal structures, can be used to predict intrinsic curvature of longer DNA molecules. This is now well known to play a decisive role in such important functions as transcription initiation and replication. A promoter identification algorithm based on relative stability of neighboring regions in genomic DNA has been developed. She has authored over 80 research articles and published more than 20 other papers/chapters in various symposium proceedings and multi-author volumes. She has mentored a large number of students including about 15 PhD students. She has served on the Editorial Boards of three journals for several years.

Social impact

Professor Bansal was involved in setting up the first Interactive Graphics laboratory for Molecular Modeling in India at IISc. She was also the Founder Director of

the Institute of Bioinformatics and Applied Biotechnology at Bangalore, set up under a unique Public-Private partnership arrangement, which has been recognized as a Centre of Excellence by the Ministry of Information Technology. In recognition of her contribution to improving understanding of biological structures, she has been invited to join the Advisory Board of International Protein Data Bank.

Awards and achievements

Dr Bansal was awarded the INSA Medal for Young Scientists in 1979. She is a Fellow of the Indian Academy of Sciences, Bangalore and National Academy of Sciences (India), Allahabad, since 1998.

Dr Bansal has been awarded an EMBL Visiting Fellowship and AvH Fellowship, Ger many and Senior Fulbright Fellowship, USA. She has been a Visiting Professor at Rutgers University, USA, and Visiting Consultant at NIH, Bethesda, USA.

B K Thelma

B K Thelma is a Professor in the Department of Genetics at the University of Delhi, South Campus, New Delhi, India. She is the Principal investigator and Co-ordinator of the Centre of excellence on Genomes Sciences and Predictive Medicine funded by the Govt. of India

Education

She had completed BSc and MSc in Zoology from Bangalore University in 1973 and 1975 respectively and PhD in Bio-medical research in 1982 from the University of Delhi. Thelma had a short stint as Postdoctoral Fellow in the Human Genetics Laboratory at Children's Hospital, Switzerland with Professor Hans Jakob Muller. She was CSIR Pool Officer and Research Associate in the Zoology Department, University of Delhi. In 1987, she started as a lecturer at Department of Genetics, University of Delhi South Campus. She has also been a Visiting Scientist at prestigious institutions abroad and undertook several international research collaborations. She has also been a Visiting Scientist at prestigious institutions abroad and undertook several international research collaborations.

Contribution

Thelma has extensively worked on Human genetics and Medical genomics. Her areas of specialisation and interest include: Molecular genetic analysis of complex disorders in humans (Schizophrenia, Parkinson's disease, Rheumatoid arthritis, Inflammatory bowel disorders) Pharmacogenetics of commonly used antipsychotic, anti-Parkinsonian, anti-rheumatoid drugs. Identification of new gene(s) for X-linked mental retardation and Parkinson's disease, unraveling genome signatures with implication for diseases Functional genomics: Genotype-phenotype correlations Diagnostic genetics

She also served on various expert committees of ICMR, DBT, and CSIR. and as Member of the XV International Genetics Congress Trust.

She is also the Co-ordinator of a major project on newborn screening for inborn errors of metabolism in Delhi state which aims to demonstrate the feasibility of mandatory screening of newborns in the country and to generate epidemiological data for the testable IEMs in the genetically distinct Indian population, for the first time. Discovery genomics is the major thrust of her research and ongoing projects include genetic analysis of complex traits including brain and inflammatory disorders and Mendelian forms of neurological and neuropsychiatric diseases. Her most recent engagement is in the area of Ayurgenomics wherein individuals can be deep phenotyped based on the principles of Ayurveda to obtain homogeneous case-control cohorts to be used for disease gene mapping. This approach is expected to overcome the issue of clinical/ phenotypic heterogeneity which is a major limitation in contemporary complex trait genetics research.

Social impact

Thelma established the DNA-based diagnosis facilities for fragile X syndrome, the most common form of inherited mental retardation, with financial support from Department of Biotechnology. Her Lab is one of the few which offers this national level diagnostic service. Thelma has extensively worked on Human genetics and Medical genomics.

Awards and achievements

Thelma has been recognised for her work. Some of her accomplishments are:

Member of International Commission on the Clinical Use of Human Germline Genome Editing, Washington DC, USA, 2019, The Sanghvi Oration Award, Indian Society of Human Genetics, 2015, The Sunder Lal Hora Medal, Indian National Science Academy, 2014, Stree Shakti Science Samman, 2012, J.C. Bose Fellow, Department of Science & Technology, India, 2011, Member, Scientific Advisory Committee to Prime Minister, Govt. of India, 2009, Fellow of Indian National Science Academy, India, Delhi, 2009, Fellow of the Indian Academy of Sciences, Bangalore, 2006, Fellow of National Academy of Sciences (India), Allahabad, 2003, Fogarty International Research Career Award, 1997, Vice President of the Indian Society of Cell Biology.

Sudha Bhattacharya

Sudha Bhattacharya is an Indian academic, scientist and a writer. She is recognized primarily for her in-depth study of Entamoeba histolytica, a parasitic protozoan that causes amoebiasis: Dr. Bhattacharya's laboratory first detected Riboso mal RNA genes on Circular DNA, while studying the parasite, and also discovered families of retrotransposons in the parasite genome. Her work has primarily been in the fields of Molecular Parasitology and Gene Regulation.

Bhattacharya is a professor at the School of Environmental Sciences, Jawaharlal Nehru University (JNU). She is a fellow at The National Academy of Sciences, India, Indian Academy of Sciences and Indian National Science Academy (2014).

Education

Sudha Bhattacharya attended University of Delhi where she graduated with a BSc.(Hons) degree in Botany in the year 1971 and then proceeded to the Indian Agri- cultural Research Institute, New Delhi where she obtained her MSc. in Biochemistry and Molecular Biology. She completed her post-graduation in 1973 and then, in 1977, earned a Ph. D. for research on regulation of RNA synthesis in Escherichia coli. She has conducted post-doctoral research on bacteriophage genetics at Stanford University (1977-79), bacterial DNA replication at the Boston Biomedical Research Institute (1979-1981) and studied axenic cultivation at the National Institutes of Health (1985-86). Prior to joining the Jawaharlal Nehru University, Bhattacharya has worked at the All India Institute of Medical Sciences as a research officer from 1981-82 and at the Tata Research Development and Design Centre as a scientist from 1982-85 to research on DNA-based diagnostic methods for common diseases. She joined JNU in 1986 as an Assistant Professor and set up her lab to study E. histolytica. She has also served on the academic committee of various boards affiliated to JNU.

Contribution

Dr. Bhattacharya received global acclaim for her novel findings in the field of simple molecular biology of E. Histolytica. Her lab found the existence of ribosomal RNA genes on round DNA, and located families of retrotransposons inside the parasite ge- nome. Study on the replication of DNA established the existence of replication origins inside the rDNA circle, which were differentially used in response to growth strain. Expression evaluation of rRNA and r-proteins discovered the post-transcriptional regu- lation of ribosomal biogenesis. Her work on retrotransposons confirmed that retrotransposition is observed by means of excessive frequency recombination- which could contribute to series polymorphism determined in retrotransposons. Her lab also applied the widespread insertion site polymorphism

of retrotransposons to broaden a way for pressure typing of E. Histolytica clinical isolates.

Social impact

In her attempt towards recognizing environmentalists who rely on traditional knowledge, she found JadhavPayeng from Assam who converted 1,00 acres of dense land into a forest for rhinos and elephants.

Awards and achievements

She was awarded as Robert McNamara Fellowship, World Bank (1985), Rockefeller Biotechnology Career Development Award (1987), Fogarty International Research Collaboration Award (1996 and 2001), Fellow of Indian Academy of Sciences (2001), National Academy of Sciences, India (2008) and Indian National Science Academy (2014), J.C. Bose National Fellow (2015) , Member of the Guha Research Conference (1993).

Aparna Dutta Gupta

Aparna Dutta Gupta is an Indian scientist and professor. She teaches in the Department of Animal Biology, School of Life Sciences, University of Hyderabad. Her research is on zoology, developmental biology and endocrinology. She has carried out research in the field of insect physiology, focusing on pests and their control.

Education

Prof. Aparna Dutta Gupta, obtained her bachelors, masters and doctoral degrees from Banaras Hindu University. She has trained a large number of post-graduate students and mentored more than 25 Ph.D students. Gupta received her Ph.D. from Banaras Hindu University.

Contribution

She is an outstanding teacher and well-known researcher in the field of insect biology and has served the University of Hyderabad with distinction for more than 35 years. . Her studies using biochemical and molecular tools have unraveled the developmental and hormonal regulation of various genes, their proteins and the specific physiological processes in insects. Her research revolves around (i) fat body hexamerin gene expression and their hormonal regulation during the postembryonic development, (ii) membrane receptor mediated sequestration of hexamerins by various tissues and their role in immunity, reproduction, silk secretion and during the metamorphosis, (iii) identification of novel candidates with immune function, (iv) identification and characterization of Bacillus thuringiensis Cry toxin binding receptors in larval midgut and other visceral tissues and (v) deciphering the basis for the development of resistance against Bt toxins in various lepidopteran insects. Her group has identified several candidate genes and their corresponding proteins, growth regulators, which disrupt insect development and reproduction.

Social impact

Her novel contribution includes that insect fat body expresses hexamerin genes, and the expressed proteins are sequestered by various tissues including male accessory-glands and play a role in reproduction.

Awards and Achievements

She was Fulbright Scholar (1984-1985), Indo-German Exchange Programme Fellow (1991), INSA-Czech Academy Exchange Fellow (2000), DST-DAAD Personal Exchange Fellow (1999-2003), INSA-DFG International Exchange Fellow (2008) and INSA- JSPS Bilateral Exchange Fellow (2012). She is also an elected Fellow of Indian Na- tional Science Academy (FNA), Indian Academy of Sciences (FASc), and The National Academy of Sciences (FNASc).

Veronica Rodrigues

Veronica Filomena Rodrigues was a Kenyan born Indian biologist.

Education

Veronica completed a B.A with honors in microbiology from Trinity College Dublin. After being inspired by the work of Obaid Siddiqi and his co-workers, she moved to India to carry out her Ph.D. While doing her PhD, considering her exceptional work, she was offered a permanent faculty position at TIFR. She also served as a senior professor at the National Centre for Biological Sciences, Bangalore.

Education

Veronica had to leave Makerere University in Uganda owing to turmoil in the country. She eventually ended up getting a scholarship to study at Trinity College Dublin. She obtained a B. A. with Honours in Microbiology in 1976. She moved to India to pursue her Phd from Tata Institute of Fundamental Research (TIFR), Mumbai in 1977 under the supervision of Dr Obaid Siddiqi. Veronica describes why she decided to come to TIFR for her PhD:

She completed her PhD in 1981 and then went on to obtain a post-doctoral training from Max-Planck Institut Fuer Biologische Kybernetik, Tuebingen, Germany. Here, she pioneered the study of coding of olfactory information in the brain.

After her post-doc, she came back and worked for the Tata Institute of Fundamental Research (TIFR) and subsequently became a fellow of the Indian National Science Academy.

Veronica began a programme to first chart the molecular, cellular and developmental biology of the olfactory sense organs and then of the antennal lobe. These studies have proved to be the foundations of the field, and a huge body of superb work from excellent groups all over the world, has emerged from this work. More recently, Veronica's work has focussed on how properties of neural networks emerge from their molecular and cellular composition. These studies, many of which have been published on link gene expression, the cellular localization of key molecules, the communication between neurons and the behaviour of the animal.

Social impact

She was passionate about gender equality in the world of sciences. in 1990, she wrote a letter the then Dean Dr R Vijayaraghavan against the usage of titles for women scien- tists including 'Smt', 'Kum', or 'Ms'.

In 2004 she received the Senior National Woman Bioscientist Award. She died in 2010 after suffering from breast cancer for five years.

Shyamala Chitaley

Sixty-seven years of research span in one life!Reallyan unique example of perseverance and tenacity.Madam chitaleywas an outstanding scientistand world authority in the field ofpaleobotany and palynology.She is regarded as one of the pioneers in her research areasand established a research school of excellence at the Institute of science,Nagpurand at Cleveland (Ohio),U.S.A.Madam was one of the world'stop authorities on upper cretaceous fossil plants of deccanintertrappean floraof India(144millions years ago)and on the flora of upper Devonian Cleveland shale in U.S.(354 to417 millions of years ago).

Education

Chitaley was born in 1918 at Nasik, brought up and educated in India. She was native of small town Nasik,in Maharashtra After her B.Sc.and M.Sc.(Botany)at Institute of Science, Nagpur she went to England under the international IFUW Ida Smith Fellowship and did research for a Ph.D. at the University of Reading, under the eminent scientist Prof. T.M. Harris from 1952 to 1955.. In India, Shya taught botany for a total of 28 years, first as Lecturer (1948-1961), then as Associate Professor (1961-1974) and finally as Professor (1974-1976) in the Botany.

Contribution

She successfully supervised 13 students at Institute of Science Bombay and Nagpur. Students opted Ph.D. in different subjects such as paleobotany, Palynology, Algae, plant ecology etc. She started subject paleobotany in M.Sc. 1967 and Palynology in 1970.Throughout her life she continued her research in paleobotany and Palynology.. In India, at Institute of Science-Nagpur,she was pioneer in introducing Palaeobotany as a special subject in the botany department at Nagpur University. She worked extensively on the exquisitely preserved Deccan Intertrappean plant fossils of Central India with special attention to permineralized angiosperm and conifer reproductive organs from very near the Cretaceous-Tertiary boundary. During her "first"inning in India she published 110 research papers.She was a founder and Chief Editor of the quarterly botanical journal "The Botanique" (1971-1980) and founder member of Science Research Institute International-Nagpur. Madam retired as Professor of Botany from the Institute of Science, Bombay. Then she moved to Cleveland with her husband in 1978 and became one of the World's leading authorities on the upper cretaceous plant fossils, found in the Deccan Intertrappean Sedimentary rocks from the Southern part of India.

Social impact of work

Internationally recognition for its outstanding collection of plant fossils from the Cleveland Shale and Deccan Intertrappean Beds. She developed a

parafin wax technique for preserving highly pyritic coal balls and, with the help of museum volunteers, applied the method to conserve about 1,500 coal balls of the Hoskins collection.

Shya started an informal group of volunteers in Palaeobotany in the Cleveland area in 1982, "The Fossil Society" at the Cleveland Museum. A second independent group, the North Coast Fossil Club (NCFC), was established in 1997. Through these groups Shya encouraged the participation of the public in Palaeontology, sharing both her expertise and, for the NCFC, her financial support.

Achievements and Awards

Madam Chitaley was honored with number of awards and prizes. She attended different International conferences in Japan, France, Russia, Poland, U.S.A. Canada and China. She delivered number of lectures and presented her research work at different places in world.

- 2004: Cardinal Award, Ohio Department of Natural Resources
- 2006: Medal for excellence in paleobotanical research and lifetime achievement award, Birbal-Savitri Sahni Foundation
- 2010: Award for Contributions to Paleobotany, The Paleobotanical Section of the Botanical Society of America
- 2011: Distinguished career award, Association of Midwestern Museums.

Sudha Anand Bhide

Sudha Anand Bhide (born 15th May, 1947) is Director, S.S. Maniar College of Computer and Management, Ex Professor of Zoology, Govt. Inst. of Science, Nagpur, Ex. Director, Govt. Pre-I.A.S. Coaching Centre Nagpur.

Education and Academics

She had passed her Masters degree in Zoology, from the then Nagpur University in 1969. From 1969 to 1971, she worked in the Embryology section of Cancer Research Institute, Tata Memorial Centre, Parel, Mumbai, where she gained experience in tissue culture techniques and 'in vitro' fertilization of embryos. In 1970, she was selected by Dr. Gopal Iyengar, Chairman of B.A.R.C. for an International fellowship of the 'Women Graduates Union', for pursuing Ph.D. in any University in the United States of America for 5 years. During the same year, she was also selected by the Maharashtra Public Service Commission for the post of lecturer in the then Govt. Science College, Nagpur (presently, Govt. Institute of Science, Nagpur). She decided to join as lecturer in Govt. Science College.

She served as Lecturer in Govt. Institute of Science from 1971 to 1986, as Assoc. Professor, from 1986 to 1998 and thereafter, as Professor of Zoology, up to her superannuation in 2005. In Germany, she worked as Research Associate in Molecular Biology in the Biologisches Institute, Stuttgart University, W. Germany, under Prof. Kurt Kohler. She could successfully isolate eukaryotic mRNAs and worked on chick thigh muscles. On her return to India after a year's stay in Germany, she was awarded the Ph.D. degree in 1979 on the 'Alimentary Canal of eleven Indian species of bats' under Dr. A. Gopalakrishna, the then Director of the Govt. Institute of Science.

Contribution

She was accepted as a recognized guide for the doctorate degree by R. T. M. Nagpur University, and ten students were awarded the Ph.D. degree under her guidance. Most of the research topics of her Ph.D. scholars (ten in all) were on human subjects in health and disease. She worked on two major and one minor sponsored research project worth eighteen lakhs. One was by CSIR on "Gut-Associated lymphoid tissue during human fetal development" based on which a much quoted paper was published in the international journal, 'Developmental Immunology' viz. "Peyer's patches are precocious to the appendix in human development". She was also granted a major research project by D.S.T. on the development of hypothalamic nuclei in the human fetus. She presented several research papers in various forums. Noteworthy among them were those presented in Monte Carlo, Monaco, Chengdu China and AIMS, Delhi.

She retired from Govt. service in 2005. In 2008 she joined as Principal of a college that was started in the same year

by Shri Nagpur Gujrati Mandal, which came to be known as "Sudha SureshbhaiManiar College of Computer and Management". With just 12 students to begin with, she was instrumental in increasing the strength to about 1300 in 2019 -2020.

Social Impact

She evaluated the nutritional protocol for treatment of cancer which one of her patients called the "Bhide protocol for cancer". It is a simple immune system booster dietary protocol in addition to other simple methods to be followed rigorously by cancer patients. Patients with ovarian, breast, brain, lung, stomach, oral, rectal, lung and blood cancer have benefited from the "Bhide protocol". Some have survived for more than 5 years and are leading normal lives and have been declared free of cancer.

Awards and Achievements

Befitting her contribution to Science, alleviation of human suffering, and selfless service to the society and nation, it was a matter of pride and honor, that Pratibha Shakti Vidarbha, conferred upon her the Shakti PrernaPuraskar 2018 - 2019, in appreciation of her work for developing an immune booster "Bhide Protocol" with special reference to cancer patients,.

ENVIRONMENT

Journey of Environmental Science and Role of Women scientist in Environmental protection in India

Smita Sundaram
Shaheed Rajguru College of Applied Sciences for Women
Delhi University

Sustainability is one of the core developmental concerns of a nation. Myraid challenges devastating in nature arise in the world in the form of global warming, climate change, pollution, industrialization, urbanization, population growth, plastic waste etc. which attract our attention towards environmental protection. In order to understand the dynamics of the challenges and to find novel solutions for sustenance of mankind, Environmental sciences is becoming an increasingly valued field of study.

The term environment is derived from the French word "environner" which means to encircle or surround. Thus our environment can be defined as the physical, chemical and biological world that surround us and the complex social and cultural condition affecting an individual or community. Thus Environmental Sciences is an applied science and very important in informing us about our surroundings.

It deals with interaction between biotic and abiotic components of nature within its surrounding. Despite Environmental sciences is a relatively new field, the knowledge involved in the traditional fields of physics, chemistry, biology and social sciences also forms an important part of it and is widely recognised as an important field of study to be pursued as an academic degree.

In the light of the fact that Environmental sciences is a newly emerging field of study, several concerns have been raised regarding the historical evolution and prospects of this field as an independent entity. Owing to the multi disciplinary nature of study, contributions have been made from scholars of various fields like, biology, chemistry, physics, geography and social sciences.

Our ancestors had know the importance of nature and live intune with it. Before independence of India, Gandhi emphasized on reform village community with sound environmental management. He stressed on recycling of waste material and had designed a sustainable life style, when these terms are not a part of general thinking. With decades, in the name of scientific development, man started distancing himself from Nature. Our Constitution underwent an amendment in 1976 by incorporating an Article 51A (g) of the Indian Constitution, "it shall be the duty of every citizen of India

to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures".

The Air Pollution Control Act came in 1981 and finally the "Environment Protection Act of 1986" came.The idea of sustainable development grew from various environmental movements, and defined in 1987 by the world commission on Environment and development also known as Brundtland commission.

It defined the sustainable development as "Development that meets the need of the present without compromising the ability of future generations to meet their own needs". , general awareness about importance of environment for the well-being of mankind had not been appropriately appreciated though over the years for more than a century there was a growing realisation that mankind had to live in tune with nature if life was to be peaceful, happy and satisfied.

Due to enhanced importance of Environment, Environmental topics have been included in many subjects and curriculum from time to time in the schools, colleges, universities and other institutions but a transformation in environmental law in India began in 1985 when an Indian lawyer, M.C. Mehta, persuaded India's Supreme Court to rule that Article 21 of the Indian Constitution, which guarantees each citizen the "right to life," necessarily includes the "right to a healthy environment." The implications of this ruling are far-reaching: Each Indian citizen now has the right to seek enforcement of India's environmental laws by filing a petition to the Supreme Court of India, or a State High Court. M.C. Mehta has achieved unparalleled success protecting the environment and public health through law in India, winning numerous Supreme Court judgments on behalf of India's citizens to preserve India's natural resources and cultural heritage.

In a recent victory, M.C. successfully petitioned the Supreme Court of India to enforce a 1991 decision requiring environmental studies as a compulsory subject at all levels of Indian education. The December, 2003, court order requires that green curricula be taught in all of India's 28 states. In 1991, M.C. obtained the original Supreme Court order, requiring mandatory environmental education to fulfill the fundamental duties of citizens to "protect and improve the natural environment," as set out in India's Constitution.

The Hon'ble Supreme Court in its Judgment delivered on 18th December 2003 in Writ Petition No 860 of 1991 has directed the NCERT to prepare a model syllabus for the Environmental Education to be taught at different grades. The Supreme Court directed all the States and educational agencies in the country to introduce environment as a compulsory subject in all classes in schools up to the higher secondary level from the academic year 2004-05.

It directed the National Council for Educational Research and Training (NCERT) to frame a model syllabus for the schools keeping in view the 1991 judgment and submit it before the court on or before 14th April 2004 so as to enable them to consider the feasibility to introduce such syllabus uniformly throughout the country.

The direction No 4 issued by the Hon'ble Supreme Court as per its order dated 22nd November 1991 read thus: "We accept on principle that through the medium of education awareness of the environment and its problems related to pollution should be taught as a compulsory subject. Learned Attorney General pointed out to us that the Central Government is associated with education at higher levels and University Grants Commission can monitor only the undergraduate and postgraduate studies.

The decision to create 6 modules of Environmental studies was taken by Supreme Court in year 1991 after public interest litigation filed by MC Mehta. According to the court UGC had to prescribe a course on environment at graduation level. Prof. SD Biju, Delhi University implemented this course since 2014.

This article aims at tracing the significant contributions of some noted women environmental scientists in developing this discipline of study. Very inspiring story we all heard about Amrita Devi, how she sacrificed life in the sake of to save Khejari trees. There are several women and women scientist who significantly contributed in protection of environment.

Rajani A. Bhisey

Introduction

Rajani A. Bhisey specializes in the field of environmental carcinogenesis and molecular epidemiology of cancer, occupational hazards.

Education

Bhisey completed her Bachelor of Science degree from the University of Bombay and joined Indian Cancer Research Centre (ICRC), Mumbai, as a research fellow to work for her Master of Science by research. She worked on skin carcinogenesis using electron microscope as the main tool, which led to her PhD degree from the University of Bombay in 1974.

Contribution

Bhisey worked at the University of Pennsylvania as a research assistant and later with Jerome J Freed at the Lankenau Institute for Medical Research on ultrastructural aspects of cell surface of drug resistant haploid frog cells. She established a genetic toxicology laboratory at Cancer Research Institute (CRI) to test mutagenic potential of putative mutagens, conduct toxicology investigations and monitor genetic hazards of environmental agents.

Social impact

Her laboratory monitored genetic damage in bidi rollers and tobacco processors who are chronically exposed to high levels of tobacco dust. She introduced courses in cancer biology and genetic toxicology for Master of Science students and helped train several students and scientists in techniques in carcinogenesis and mutagenesis. She is a member of Monograph Program Panel, International Agency for Research on Cancer on Cancer, Lyon, France.

Awards and honors

Bhisey has made significant contributions in her field and has been recognized for all her work. Some of her accomplishments are:

UICC Young Scientist Fellowship, Lifetime Achievement Award by the Association of Zoologists of India 2007, Fellow of Maharashtra Academy of Sciences and Indian Academy of Sciences.

Sunita Narain

Sunita Narain is an Indian environmentalist and political activist as well as a major proponent of the Green concept of sustainable development. Narain is director general of the India-based research institute the Centre for Science and Environment, director of the Society for Environmental Communications, and editor of the fortnightly magazine, Down To Earth. Career Narain began working with the Centre for Science and Environment in 1982.

Introduction

Sunita Narain(Born 1961) was working with the founder Anil Agarwal, while completing her studies at the University of Delhi. In 1985 she co-edited the State of India's Environment report, and then went on to study issues related to forest management. For this project, she traveled across the country to understand people's management of natural resources. In 1989 Narain and Anil Agarwal wrote 'Towards Green Villages' on the subject of local democracy and sustainable development. In her years at the Centre, she has studied the relationship between environment and development and worked to create public consciousness about the need for sustainable development. In 2012, she wrote the 7th State of India's Environment Reports, Excreta Matters, an analysis of urban India's water supply and pollution.For her contribution she has been awarded by prestigious award Padma Shri, Raja-Lakshmi Award, Stockholm Water Prize.

Over the years, Narain has also developed the management and financial support systems needed for the Centre, which has over 100 staff members and a dynamic program profile. In the early 1990s, she got involved with global environmental issues and she continues to work on these as researcher and advocate. Her research interests are wide-ranging - from global democracy, with a special focus on climate change, to the need for local democracy, within which she has worked both on forest-related resource management and water-related issues. Narain remains an active participant, both nationally and internationally, in civil society. She is currently in charge of the Centre's management and plays an active role in a number of research projects and public campaigns.

She serves on the boards of various organizations and on governmental committees and has spoken at many forums across the world on issues of her concern and expertise. In 2008 Narain delivered the K R Narayanan Oration on "Why Environmentalism Needs Equity: Learning from the environmentalism of the poor to build our common future".

Meenakshi Banerjee

Meenakshi Banerjee is an Indian cyanobacteriologist and presently works as the head of the Center for Applied Algal Research at Rice University in Houston, Texas. She is the former head of the Bioscience Department of Barkatullah University, Bhopal.

Education

Banerjee finished her schooling from Irish Convent, Loreto, in Asansol and then went ahead to take up science from Nirmala College, Ranchi University. She enrolled for a bachelor's degree at Women's College, Banaras Hindu University where she studied Botany. Her interest in the subject led her to pursue masters in Botany and this was where she developed her interest in cyanobacteria further leading her to become a cyanobacteriologist

Achievements

Banerjee joined Barkatullah University as lecturer in 1989. She became a Reader in 1997 and a Professor in 2005. Presently she is Head of Bioscience Department at the university.

Bannerjee has received various awards, including the Dr K. N. Katju state level science award for 2010.[

Banerjee is a life Member of the National Academy of Sciences India.

Her current interest lies in extensive research for the propagation of rare varieties of medicinal plants on algal biofertilizers and studies of the unique cyano bacteria from diverse habitats including the cold and hot deserts where these organisms survive at the borderline of life.

Krithi Karanth

Krithi Karanth is Chief Conservation Scientist and Director at the Centre for Wildlife Studies, Bangalore, Adjunct Faculty at Duke University and National Centre for Biological Sciences. Krithi Karanth has a Ph.D from Duke (2008), a M.E.Sc from Yale (2003), and, B.S and B.A degrees from the University of Florida (2001). Her research in India and Asia spans 22 years encompasses many issues in human dimensions of wildlife conservation. She has conducted macro-level studies assessing patterns of species distributions and extinctions, impacts of wildlife tourism, consequences of voluntary resettlement, land use change and understanding human-wildlife interactions. She has published 100+ scientific and popular articles. Krithi served on the editorial boards of journals Conservation Biology, Conservation Letters and Frontiers in Ecology and Environment. Krithi has mentored over 150 young scientists and engaged 700 citizen science volunteers in her research and conservation projects.

Priyadarshini Karve

Ph.D. (1998, Pune), was awarded the Yashwantrao Kelkar Youth Award and the Adishakti Award. Recipient of World Technology Award in 'Environment' category. Member of the Project Team which won the prestigious International Ashden award for renewable energy. She works on biomass energy, appropriate technology, and sustainable development.

Vidya Athreya

Vidya Athreya is a wildlife biologist with the Wildlife Conservation Society - India and is based in Pune. Her interests lie in understanding interactions between species and she has been working on human-leopard dynamics to better understand how problems can be reduced for both species in shared spaces.

Dr. Vidya Athreya initially joined WCS India Program in 2011. She currently works as Associate Director - Conservation Science.

Education

She obtained her MS in Ecology from Pondicherry in 1993 and a MSc in Ecology and Evolutionary Biology from University of Iowa, USA in 2000. Dr. Athreya obtained her doctorate from Manipal University in 2012 for her thesis, 'Conflict resolution and leopard conservation in a human dominated landscape'.

ContributionBased in Pune, Vidya has been studying human-leopard conflict in Maharashtra for the past decade. She also works closely with Protected Area managers and the public to mitigate conflicts involving big cats. Vidya has been working in landscapes of Western Maharashtra where leopards share spaces with humans. A member of the IUCN Cat Specialist Group, she has assisted in formulating state and national level policy guidelines on managing human-leopard conflict. Vidya's research work has led to an increased awareness of large carnivores outside Protected Areas in India.

Awards & Achievements:

Vidya was awarded the Carl Zeiss Wildlife Conservation Award in 2011, TN Koshoo Memorial Award in 2012 and the Maharana Udai Singh Award in 2013

Kavita Shah

Kavita Shah is an Indian environmental biotechnologist at the Institute of Environmental and Sustainable Development, Banaras Hindu University. She is one of the six directors and the only women director of Banaras Hindu University (BHU). She is notable for her role in the area of Environmental Biotechnology, Health and water Resource Management.

Educational Qualifications:

M.Sc, Ph.D. (Specialization: Environmental Biochemistry and Biotechnology)

Post Doctoral Experience:

Awarded and availed Swiss Post Doctoral Fellowship to Foreign Students funded by Swiss Federal Commission at University of Geneva, Switzerland (2001-2002). " Scientist Pool Officer, CSIR at Banaras Hindu University (2000-2001). " STA Post doctoral Fellow in Japan funded by Japan Science and Technology and Japan International Science and Technology Exchange Program at National Institute of Health Sciences, Tokyo, Japan (1997-2000). " Research Associate, CSIR at Banaras Hindu University (1995-1997).

Major Research Contribution

Purification and characterization of a pectin-binding cationic peroxidase from Arabidopsis leaves and its N-terminal protein sequence is a novel contribution to Plant Science (Phytochem., U.K., 65, 307-312, 2004). This peroxidase has similarity with P32 of zucchini important for cell wall antioxidant property. This postdoctoral work was carried at University of Geneva, Switzerland.

Histochemical localization of metal ions as well as enzyme peroxidase simultaneously is reported from the first time in root tissues in vivo in rice cultivars grown under metal stress. The antibody staining is under progress.

A major area of work also include the development of biosensors using immobilized plant enzymes (Biotechnology and Bioprocess Engineering, 13, 632-638, 2008) and studies pertaining to inhibitors of HIV protease (In Silico Biology, 8-033, 2008), HIV integrase (Archives of Virology 2014) and N. meningitides vaccine constructs (Indian Journal of Biotechnology, 2010) in silico using bioinformatics tools. Dr Kavita Shah has made significant contributions in the area of Enzyme Technology and Environmental Biotechnology and Bioinformatics. Developed a rice-peroxidase-enzyme-biosensor which is the novel contribution to help monitor neurological patients for dopamine levels and help to administer proper dose of drug to the patients of Alziehmer's/Parkinson's diseases (Talanta 2012). Presently involved in molecularly imprinted polymers as tools for environmental monitoring and

drug delivery. Development of drought and heat stress tolerant transgenic tomato lines is an important achievement of the biotechnology work undertaken during 2012-13

Recognition & Awards

- Awarded the prestigious "Women Scientist Award-2011" of The Biotech Research Society, India in recognition of pioneering work in the field of Enzyme Technology and Biosensors on 21st November, 2012.
- Awarded and availed Swiss Government Fellowship for Foreign students and worked with Prof. Claude Penel at the University of Geneva, Switzerland, from October 2002-September 2003.
- Awarded Senior Research Associateship (Scientist's Pool) from Dec 2000 to April 2003, by Council of Scientific and Industrial Research, New Delhi" Awarded Young Scientist Travel Fellowship Award, to present a paper at 18th International Union of Biochemistry and Molecular Biology Congress held during July 13-21st , 2000, Birmingham, U.K. " Awarded and availed the prestigious 'STA FELLOWSHIP' (Science and Technology Agency), granted by JISTEC (Japanese Institute for Science and Technology Exchange Center and JST (Japan Science and Technology), Ministry of Health Sciences, Tokyo, JAPAN for one 4 year from June 1998-June 1999 and worked with Dr. TamioMaitani, Section Chief, Division of Food Additives, National Institute of Health Sciences, TOKYO.
- Awarded and availed Research Associateship from October 1996 to 2001, granted by Council of Scientific and Industrial Research, New Delhi.
- Received 1996 'YOUNG SCIENTIST MERIT AWARD' at 83rd Session of Indian Science Congress held at Patiala, during Jan 3-7, 1996.
- Awarded UGC-GATE Senior Research Fellowship from 1995 to 1996, by University Grants Commission, New Delhi.
- Awarded UGC-GATE Junior Research Fellowship from 1993 to 1995, by University Grants Commission, New Delhi.
- Received Best Paper Presentation Award in the IVth Convention of Agricultural Biochemists and Symposium on Recent Developments in Biochemistry, held at Varanasi on March 20- 21,1995.
- Awarded 'BHU GOLD MEDAL' and cash prize for Rs 300/- for obtaining First Rank in B. Ed. examination of Banaras Hindu University held in 1992.

Aditi Pant

Aditi Pant is a noted oceanographer and was the first Indian woman to visit Antarctica in 1983. She participated in the third and fifth Indian expeditions to Antarctica to research about oceanography and geology.

Education

At this time, women were not permitted to receive a reputable education. Dr. Anita Pant overcame these barriers and has become role model to all aspiring women scientists.

Pant completed her BSc at University of Pune (also known as the University of Poona). She was inspired to take up oceanography as a profession when she came across the book The Open Sea by Alister Hardy from a family friend. She was happily surprised to be awarded a US government scholarship to take up a Master's in Marine Sciences in the University of Hawaii. Her academic interest lay in photosynthesis in plankton communities. She wrote her thesis on the effect of tropical light intensities on photosynthesis by natural plankton communities and the nature and amount of reduced carbon flow from phytoplankton to bacteria. Studying this target organism in the open sea proved to be very problematic and strenuous, and with help from her mentor Dr. M S Doty, Pant decided to focus on a single bacterium model before moving to a larger community. Pant then went on to pursue a PhD in Physiology in Marine Algae at Westfield College London University. Her thesis dealt with the subject matter of the physiology of marine algae. She went on to earn a SERC award and a stipend for her investigations.

Contribution

Due to financial constraints, her advanced education abroad was not easy to obtain, so it was a joyous event when she got a US Government grant to the University of Hawaii. Her proposition depended on photosynthesis in tiny fish networks as she was first presented to this marine structure in the book "The Open Sea". As she approached the finish of her work for the PhD, she had her sights on two or three labs where she would have wanted to work, however meanwhile she met Professor N K Panikkar, a senior researcher with CSIR, who was the author Director of the National Institute of Oceanography, (NIO) Goa. At NIO between 1973-76 they were bound by the exigencies of our circumstance to beach front investigations and probably secured the entire of the west bank of India from Veraval to Kanyakumari and the Gulf of Mannar. The NIO had a 10-year program in the Antarctic Ocean for studies on topics such as ; The natural way of life, material science, and various other sciences. By 1990, she had moved out of NIO, following 17 years there, to the National Chemical Laboratory in Pune and went through the following 15 years examining

enzymology of salt-tolerant and salt-loving organisms engaged in the food chain. After completing her studies, Pant decided not to pursue a tenure or postdoctoral research position. Instead, she returned to India to join the National Institute of Oceanography (NIO) in Goa, after being inspired by the founder of the institute, N. K. Panikkar.

In 1990, after 17 years of working with the NIO, Pant moved to Pune to work at the National Chemical Laboratory. Here, she studied the enzymology of salt-tolerant and salt-loving microbes involved in the food chain.

She was also Professor Emeritus for the University of Pune Botany Department 2003 to 2007.

Antarctic Expedition

Between December 1983 and March 1984, Pant embarked on an expedition to one of the most untouched regions on earth, Antarctica. This was the third in a series of expeditions spearheaded by then Prime Minister Indira Gandhi. India's signing of the Antarctic Treaty in 1981 began the Indian Antarctic Program (under the National Centre for Polar and Ocean Research). Along with structural geologist Sudipta Sengupta, Aditi Pant was the first Indian woman to set foot on Antarctica. Pant's expedition was aimed at gathering information related to food chain physics, chemistry, and biology in the Antarctic Ocean. Under the severe and harsh climate conditions Dr. Aditi Pant studied the mainland for four months and turned out with brilliant disclosures. During the course of the mission, the team built Dakshin Gangotri, the first Indian scientific research base station of Antarctica (located 2,500 km from the South Pole). Pant also participated in the fifth expedition to the Antarctic in 1984, carrying out research in oceanography and geology

Recognition & Awards

Pant is the owner of five patents and has over 67 publications in international journals. She was honored with the Antarctica Award by the Government of India for her contributions to the Indian Antarctic programme. She shared the honor with colleagues Sudipta Sengupta, Jaya Naithani, and KanwalVilku. She was a recipient of the SERC award and stipends for her investigations in her field of research.

She is a member of the Maharashtra Society for the Cultivation of Science, General Body of Maharashtra Association for the Cultivation of Science, Biofuel Committee, Department of Biotechnology, CGO Complex, New Delhi. She is also a fellow member of Maharashtra Academy of Science.

Usha Barwale Zehr

She produced India's first genetically modified food, the Bt brinjal. She is the Joint Director of Research at Maharashtra Hybrid Seeds Company Limited in Jalna and one of the most sought-afterresearcher in the field of Botany.

Education

Ms Barwale Zehr graduated with a B.Sc. in 1981 from Wilson College at the University of Bombay, India. After that she was awarded an M.S. and later on a Ph.D. in 1985 in Agronomy at the University of Illinois, USA.

Contribution

Since 1991 she is the Director of the Barwale Foundation, and has worked as a geneticist in sorghum and millet at the Purdue University, Indiana, USA. From 1997 till 2006 she has been a trustee of the M.S. Swaminathan Research Foundation, in Chennai, India. She has occupied and is still occupying many positions of which the most notable are a member of the board at the Donald Danforth Plant Science Centre, member of the board at IRRI and CIMMYT. Since 2000 she is whole-time Director of Maharashtra Hybrid Seeds Co. Ltd., Jalna, India. With advances in plant biotechnology in the recent years, Usha's research interests are in the area of application of these tools to improve agricultural productivity. With use of genetically enhanced crops and genomics, many opportunities are presented for enhancing productivity in a sustainable manner. Use of Molecular tools to enhance breeding activity, use of genomics to gain better understanding about crops, deploying new tools to enhance nutritional value of food grain are just a few of the possibilities. The objective is to look at possible technologies and work to bring appropriate technologies for the farmers.

Priya Davidar

Priya Davidaris an Indian scientific researcher, a conservation biologist, scholar and an author. Currently she is working as a professor at the Pondicherry University and conducts ecological research in different regions of India.She has authored a few books, including Whispers from the Wild, co-authored with E.R.C Davidar and published by Penguin India books. She was elected Fellow of the American Association for the Advancement of Science in 2012. She is actively involved with the conservation of forests and wildlife. She has published about 100 papers in scientific journals.

Education

She completed her B.Sc. in 1973 from Madras University and then moved on to get an M.Sc. in 1975 from the same university. In 1979 she was awarded a Ph.D. from Bombay University and later moved on to acquire a S.M. from Harvard University in 1985.

For her doctoral thesis, she worked on pollination of the hemi-parasitic mistletoes by nectar feeding birds, under the guidance of the naturalist, Salim Ali, who is known as the "bird man of India".

Contribution

As a conservation biologist, her work mostly revolved around forest ecology, pollination biology and endangered species conservation.

She worked for close to three decades in Pondicherry University at the Department of Ecology and Environmental Sciences until she retired. Currently, she is working on a research project where she is "analysing tree distributions at the bio-geographical scale, and the conservation genetics of endangered species such as the Asian elephant and NilgiriTahr"

She is one of the few women who were field biologists in the 1970s. Though scientists who have only carried out research inside of their laboratories do not adjust well to fieldwork, Allison Snow, who was a fellow postdoc in Panama remarked, "Priya was … unfazed by all the practical difficulties."

Awards & Achievements

In 2009, she was the President of the Association for Tropical Biology and Conservation.

In 2012, she was elected Fellow of the American Association for the Advancement of Science (AAAS).

Renee Borges

Renee Maria Borges (born 25 February 1959) is an Indian evolutionary biologist and professor at the Centre for Ecological Sciences, Indian Institute of Science. Her work as a scientist has been profiled on India Today.

Education

Borges studied science at St. Xavier's College, Mumbai, where she obtained her bachelor's degree (with distinction) in Zoology and Microbiology in 1979. She obtained her master's degree in animal physiology from the Institute of Science, University of Bombay in 1982. She received a PhD from the University of Miami, in Coral Gables, Florida, with a thesis entitled "Resource heterogeneity and the foraging ecology of the Malabar Giant Squirrel, Ratufaindica".

Contribution

Her research areas are behavioural and sensory ecology with special reference to plant and animal interactions such as figs and fig-wasps. Other areas of research interest include conservation biology and the history and philosophy of science.

Social impact

Borges has contributed a chapter to the book Battles Over Nature: Science and the Politics of Conservation as well as being cited in the Journal of Moral Theology.

Awards and achievements

Borges' contributions have been recognized in the following ways, of her appointments are:

- Fellow, Indian Academy of Sciences
- J. C Bose National Fellowship (2016)
- Fellow, Indian National Science Academy
- Chairperson of the DST-Program Advisory Committee on Animal Sciences (2016-19)
- Member, Western Ghat Ecology Expert Panel (WGEEP), Government of India, 2010-2011[12]
- Fellow of the Indian Academy of Sciences, Bangalore, 2009.

BHATNAGAR AWARDEES

Asima Chatterjee

.An Indian chemist, Asima Chaterjee is regarded highly for her works in the fields of organic chemistry and phytochemistry (chemicals derived from plants).Her area of interest was natural products with special reference to the medicinal chemistry. Asima Chatterjee was born on 23 September 1917 in Bengal.She was the eldest of the two children of a medical doctor Indra Narayan Mukherjee and his wife, Kamala Devi.

Education

First woman D.Sc. (1944, Calcutta), FASc, FNA, Khaira Professor of Chemistry, Calcutta University, She graduated in chemistry from the Scottish Church College of the University of Calcutta in 1936 and then pursued research.

Contribution

She made significant contributions in the field of medicinal chemistry with special reference to alkaloids, coumarins and terpenoids, analytical chemistry, and mechanistic organic chemistry. She published around 400 papers in national and international journals and more than a score of review articles in reputed serial volumes. Her publications have been extensively cited and much of her work has been included in several textbooks. Chatterjee edited and revised the six-volume Bharatiya Banoushodhi published by the Calcutta University and was also the Chief-Editor of the six-volume series, The Treatise of Indian Medicinal Plants published by CSIR.

Social impact of work

Through her untiring efforts, she established a Regional Research Institute for carrying out research on Indian medicinal plants for the development of Ayurvedic drugs along with an Ayurvedic Hospital for systematic clinical trials through a unique Centre-State collaboration, under the aegis of the Central Council for Research in Ayurveda and Siddha in Salt Lake City, Kolkata. As the Honorary Principal Co-ordinator, she nurtured this Institute till the end of her life on 22 nd november 2006.

Awards and Achievements

Recipient of the Padma Bhushan, The numerous awards she won include the first female recipient S S Bhatnagar award (1961), 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 Rajya Sabha.fromFebruary 1982 to May 1990 .

Archana Sharma

Archana Sharma was a renownedIndian botanist, cytogeneticist, cellbiologistand cyto-toxicologist.Archana Sharma was born on 16 February 1932 in Pune. hHer father N.P. Mookherjee was a Professor of Chemistry at Bikaner. She was married to Arun Kumar Sharma, considered by many as the Father ofIndian Cytology.

Education

She had all her early education in Rajasthan. She completed her B.Sc., from Bikaner and later joined the Department of Botany, University of Calcutta and obtained her M.Sc. degree (1951), followed by her Ph.D. degree (1955). She got her D.Sc. (1960) from the University of Calcutta specializing in Cytogenetics, Human Genetics and Environmental Mutagenesis. She had a brilliant academic career throughout and was the second lady to have secured a D. Sc. degree from the Calcutta University, the second oldest in India. She began her professional career by joining the faculty of the University of Calcutta (1967), later became a Professor of Genetics (1972) in the Centre of the Advanced Studies in Cell and Chromosome Research, and the Head of the Department of Botany (1981- 1983) succeeding Prof. A. K. Sharma.

Contribution

In 1967, Sharma joined the University of Calcutta as faculty, later becoming a Professor of Genetics in 1972 in the Centre of Advanced Studies in Cell and Chromosome Re- search at University of Calcutta. In 1981, she was promoted to Head of the Department of Botany, succeeding Prof. A.K.Sharma until 1983. During her academic career, she supervised over 70 Ph.D. students in the areas of cytogenetics, human genetics, and environmental mutagenesis.

She was a passionate teacher and a dedicated researcher and a pioneer who developed new staining and pre-treatment techniques to study the structure of the chromosomes which are being followed throughout the world even today, and she also deduced the evidences of a new concept of speciation and fixity of chromosome number in obligate vegetatively reproducing plants and the pesticides.

Archana`s pioneering work on the morphology of the chromosomes relating to the changes with evolution, diseases and mutation deserves much appreciation. She has done significant work on the chromosomes of both the plant and human systems, with special reference to the differentiation and mechanisms of evolution.

She has published over 300 research papers and reviews, along with 8 books and edited 15 international reference volumes and special journal issues. Her book, Chromosome Techniques: Theory and Practice, is a classic in its field.

Social impact of work

The new techniques which were developed by her have had a greater

impact in the field of plant and human genetics.

Sharma's research led to breakthroughs in botanical science. Among her notable findings are topics related to speciation in vegetatively reproducing plants, induction of cell division in adult nuclei, the cause of polyteny in differentiated tissues in plants, cytotaxonomy of flowering plants, and the effect of arsenic in water. Her research and findings on chromosomal study on flowering plants led to a new set of perceptions on their classification. Sharma also worked extensively in human genetics, specifically genetic polymorphism in normal human populations.

Awards and achievements

She was the recipient of Shanti Swarup Bhatnagar Prize (1975) by the Council of Scientific and Industrial Research; J. C. Bose Award (1974) by the University Grants Commission, UGC National Lecturer (1980), Eminent Teacher Award (2005), FICCI Award (1983), Birbal Sahni Medal (1984) by the Indian Botanical Society, G. P. Chatterjee Award (1995), Sinha Award (1995), Women Scientist Award, Ashutosh Mukherji Medal (1999) by the Indian Science Congress Association and Padma Bhushan Award (1984) by the Government of India. She also has delivered the Platinum Jubilee Lecture (1989) of the Indian Science Congress Association. She also delivered a plenary lecture at a meeting of the American Association for the Advancement of Science, Chicago, USA, in 1987 on "Environment and genetic polymorphism in Indian populations"

She was a member of organizations such as the University Grants Commission, National Commission for Women, Science and Engineering Research Council, Department of Environment, Overseas Scientific Advisory Committee, among various others. Sharma also served as Chairperson on the Task Force on Integrated Manpower Development of the Department of Biotechnology.

Sharma was actively involved with prominent policy-making bodies, including Science and Engineering Research Council of the Department of Science and Technology, Government of India; Environmental Research Council of the Ministry of Environment and Forests, Government of India; the Panel for Cooperation with UNESCO, the Ministry of Human Resource Development, Government of India; and various technical committees of University Grants Commission, Department of Science and Technology, and the Department of Biotechnology .

Indira Nath

Introduction

Indira Nath (born 14 January 1938) is an Indian immunologist. Prof. Nath's fields of specialisations are Immunology, Pathology, Medical biotechnology and communicable diseases.

Education

Nath received her MBBS from All India Institute of Medical Sciences (AIIMS), New Delhi. She joined AIIMS as MD (pathology) after mandatory hospital training in the UK. During the 1970s, India has the world's largest number of leprosy patients in the world of 4.5 million. In 1970 Nath was in the UK with a Nuffield Fellowship. During this period she came to specialise in immunology. She worked in the area of infectious diseases, particularly leprosy, with Professor John Turk at the Royal College of Surgeons and Dr RJW Reesat the National Institute for Medical Research, London.

Contribution

Her major contribution in medical science deals with mechanisms underlying immune unresponsiveness in man, reactions and nerve damage in leprosy and a search for markers for viability of the Leprosy bacillus.

She saw the importance of getting experience abroad but did not want to add to the brain drain out of India. She and her husband made a pact to return to India after 3 years abroad. She returned to India in the early 1970s.

"Still, it was quite an exciting time to come back because you felt you could really play a role in building up research," she said in an interview published on Nature Medicine in 2002. After coming back to India, she joined Professor Gursaran Talwar's Department of Biochemistry at AIIMS, which had just initiated immunology research in India. Later in 1980 she moved to the Department of Pathology and she founded and established Department Biotechnology (1986) at AIIMS. She retired in 1998 but continued to work at AIIMS as INSA-SN Bose Research Professor.

Social impact

Her research is focused on the cellular immune responses in human leprosy as well as nerve damage in the disease. Her work has also looked for indicators of the leprosy bacillus surviving. She has over 120 publications, invited reviews, opinion/comments on recent developments in international journals. Her discovery and her pioneering work are a significant step towards the development of treatment and vaccines for leprosy.

Awards and Achievements

She received DSc from Pierre and Marie Curie University, Paris in the 2002. She was invited for the post of Dean of AIMST University in Malaysia and also as Director of Blue Peter Research Centre (Lepra Research Centre), Hyderabad. She was one of 100 scientists gathered by Rajiv Gandhi when he became Prime Minister to make suggestions to improve Indian science.

Raman Parimala

Raman Parimala (born 21 November 1948) is an Indian mathematician known for her contributions to algebra. She is the Arts & Sciences Distinguished Professor of mathematics at Emory University. For many years, she was a professor at Tata Institute of Fundamental Research (TIFR), Mumbai. Background.

Education

Parimala was born and raised in Tamil Nadu, India. She studied in SaradhaVidyalaya Girls' High School and Stella Maris College at Chennai. She received her M.Sc. from Madras University (1970) and Ph.D. from the University of Mumbai (1976); her advisor was R. Sridharan from TIFR.

Contribution

Her area of research is algebra with connections to algebraic geometry and number theory. Parimala was an invited speaker at the International Congress of Mathematicians in Zurich in 1994 and gave a talk Study of quadratic forms - some connections with geometry. She gave a plenary address Arithmetic of linear algebraic groups over two dimensional fields at the Congress in Hyderabad in 2010.

Social impact

She is also well-recognized for her solution to the second Serre conjecture.

Awards and achievements

The recipient of several national and international awards, such as Fellow of the Indian Academy of Sciences Fellow of Indian National Science Academy Bhatnagar Award in 1987, Honorary doctorate from the University of Lausanne in 1999, Srinivasa Ramanujan Birth Centenary Award in 2003.TWAS Prize for Mathematics (2005).Fellow of the American athematical Society (2012)and ShantiSwarup Bhatnagar Prize for Science and Technology (1987). In 2010, Parimala received one of the highest global honours in her field when she was selected as the plenary speaker at the International Congress of Mathematicians. The government decided to establish eleven chairs to honour women scientists who have contributed to the field of science. It is also to inspire women and encourage participation of young girls in STEM (Science, Technology, Engineering and Mathematics).

Manju Ray

Manju Ray is an Indian scientist specialising in Molecular Enzymology and Cancer Biochemistry.

Education

Ray graduated from the Calcutta University with degrees in M.Sc. in Physiology in 1969 and Ph.D in Biochemistry in 1975.

Contribution

Ray started her career in the Department of Biochemistry, Indian Association of Cultivation of Science. Since December 2010, she is an Emeritus Scientist at Bose Institute, Kolkata.[2] Ray's research has focused on understanding the biological role of methylglyoxal, a side-product of several metabolic pathways. Over the course of her career, she and her team have isolated, purified and characterized a series of enzymes involved in methylglyoxal anabolism and catabolism. Her work has also focused on studying anticancer properties of methylglyoxal, with positive results observed in the first phase of clinical trials.

Ray has published a large number of scientific papers as lead author in association with others.

Social impact of work

Her research has contributed significantly to the development of anticancer drugs and understanding the differentiation process of cells. Her interests include tumour biochemistry and molecular enzymology.

Awards and Achievements

She was awarded the Shanti Swarup Bhatnagar Prize in the year 1989, being only the second woman to receive this award in the category 'Biological Science, Indian National Science Academy (INSA) Young Scientist Medal in Biological Science, : Dr I.C. Chopra Memorial Award[, Dr. Jnan Chandra Ghosh Memorial Award.

Sudipta Sengupta

Sudipta Sengupta is a professor in structural geology in Jadavpur University, Calcutta, India, and a trained mountaineer. She is one of the first Indian women (along with Aditi Pant) to set foot on Antarctica. She is also popularly known in India for her book Antarctica in Bengali and numerous articles and television interviews on geosciences.

Sengupta was the youngest daughter of three, born to Jyoti RanjanSengupta and Pushpa Sengupta in Calcutta, India. Her father was a meteorologist and their family spent a lot of time in both India and Nepal. She says she "comes from the land of Durga. We worship Durga and as a child I believed that she lived in Kailash. Now, I know that Durga lives in us, in all women."

Education

Sudipta Sengupta graduated from Jadavpur University with top honors in both the B.Sc. and M.Sc. examinations. She obtained her Ph.D. degree from Jadavpur University in 1972 under the supervision of Subir Ghosh. She worked as a geologist in the Geological Survey of India between 1970 and 1973. In 1973, she received the prestigious scholarship of the Royal Commission for the Exhibition of 1851 from U.K. and carried out post-doctoral research work for the next three years at the Imperial College, London. In 1977 she joined the Institute of Geology of Uppsala University, Sweden as a docent for six months and thereafter carried out research as a visiting scientist in connection with the International Geodynamics Project which was supervised by Professor Hans Ramberg. On her return to India in 1979, she joined the Geological Survey of India as a Senior Geologist. In 1982, she joined Jadavpur University as a lecturer and retired as a Professor.

Contribution

Sengupta recounts that "for the first 15 years of my life, there were hardly any woman in the class-in most of the years none." She talks about the fact that the university wasn't prepared to accommodate women during field-trips. Conditions didn't improve until 1996, Sengupta says "In our times, it was terrible. We stayed in dharamshalas and sometimes huts." Sengupta also talks about the fact that in some ways it was better in her days. She went on her PhD studied alone and traveled to remote places with "bad roads and no communication, but never felt unsafe" but that these days she "wouldn't dare to send a girl alone for field work."

Social impact

Sudipta Sengupta is an expert mountaineer and was trained in Advanced Mountaineering by Tenzing Norgay in the Himalayan Mountaineering Institute. Tenzing Norgay was one of the first two men to scale Mt Everest in 1953. She has participated in numerous mountaineering expeditions in India and Europe, including an unnamed virgin peak in the Lahaul Region, which they later named Mount Lalona. Sengupta remembers that her field

work taught her lots of things. She says "people are the same everywhere. They are basically good and helpful" even if "to seen an Indian girl moving around with a hammer was very new for them."

Antarctic expedition and research

In 1983, SudiptaSengupta was selected as a member of the Third Indian Expedition to Antarctica and conducted pioneering geological studies in the Schirmacher Hills of East Antarctica. Sudipta and Dr. Aditi Pant, a Marine Biologist were the first women scientist from India to take part in Antarctic Expedition. In 1989 she visited Antarctica for the second time as a member of the Ninth Indian Expedition to Antarctica. Her work in the Schirmacher Hills is of fundamental importance as it became the basis of further research in that area. In the major part of her research in structural geology, Professor SudiptaSengupta has combined geological field studies with laboratory experiments and theoretical analyses. Apart from doing structural field studies in varied terrain, including the Precambrian structures of Peninsular India, the Scottish Highlands, the Scandinavian Caledonides and East Antarctica.

She talks about her experience in Antarctica and says that the Geology prejudices extended to that land as well. She says "Antarctica was also a male bastion, women scientists weren't allowed there before 1956." She remembers men joking that a women couldn't go without a beauty parlor in Antarctica. In 1982 she applied to join an Indian Expedition to Antarctica but her application was rejected because she was a woman, she was later taken on an expedition on 1982 and 1989.

Both expeditions she traveled on ships taking a month to get there. Once they were on land, the crew had to work during blizzards and a Sun that never set. In the days that she went to Antarctica , India only had one base station- DakshinGangotri, which now is not in function and is fully submerged in ice. The Maitri station was already up and running by then in Schirmacher Oasis in East Antarctica and is still an active research base.

Awards and achievements

Professor Sengupta has published numerous papers in Indian as well as international journals. She has edited a book with contributions by renowned structural geologists and also authored a book on her travels and work in Antarctica which has become a best seller in West Bengal. She was awarded the Bhatnagar Award for excellence in science by the Government of India. She is a Fellow of the Indian National Science Academy. Professor Sengupta also received the National Mineral Award and the Antarctica Award from the Government of India, along with numerous other awards like the Profession and Career Award of the Lady Study Group.

Professor Sengupta was part of a forum titled 'Women in Science and Technology' at the India International Centre in New Delhi. It was acknowledged that Sengupta was a geologist during the 80s, a time when women were discouraged from taking part in any field work. Sengupta was a guest speaker during the event and began by quoting Eleanor Roosevelt: "The future belongs to those who believe in the beauty of their dreams."

Shashi Wadhwa

Shashi Wadhwa is the dean of All India Institute of Medical Sciences, New Delhi. Her major research interests are developmental neurobiology, quantitative morphology and electron microscopy. Her laboratory mainly focussed on the developing human brain

Education

Dr Shashi Wadhwa received her graduate degree from Jabalpur Medical College (Madhya Pradesh) in 1970 and subsequently joined the Department of Anatomy at AIIMS for postgraduate studies leading to MS and PhD. She has published extensively on the developing human brain in both national and international journals. Her work on the developing human retina has been well cited. She is a fellow of the Indian Academy of Science, Indian Academy of Neuroscience, National Academy of Medical Science and National Academy of Science as well as member of IBRO, New York Academy of Science and Society for Neuroscience, USA amongst

CONTRIBUTION

Shashi worked till her retirement as Professor and eventually the Dean of the Department of Anatomy. She has taught and trained undergraduates and postgraduates of MSc, MS and PhD since 1972 at AIIMS. She has 67 international and 37 National Research Publications, 27 Chapters in books and has edited/co-edited 13 books and monographs.

Her major research interests are: Developmental neurobiology, Quantitative morphology and

Electron microscopy

Her laboratory has mainly focused on the developing human brain. The human spinal cord, visual pathway, cerebellar nuclei and the autonomic innervations of human urinary bladder have been studied to highlight the critical time periods during which these regions are susceptible to alterations in the micro-environment of the fetus that could result in related developmental abnormalities. The studies provided baseline data for comparison with pathological material and animal experiments as well as helped in better understanding of processes involved in the development of these regions at the molecular level.

Achievements:

Shashi, an elected fellow of the National Academy of Medical Sciences, has been recognized for her work with many awards and honors. She won the Shanti Swarup Bhatnagar Prize of CSIR in 1990 and the BK Bachhawat Lifetime Achievement Award in 2013.

She holds life memberships with: International Brain Research Organization, Indian Group of International Society for Stereology, Indian Academy of Neurosciences, Electron microscopic Society of India, Delhi Association of Morphological Sciences, She has been a member of the , Indian Cancer Society since 1999, Padma Shri Award in 2010.

Vijayalakshmi Ravindranath

Vijayalakshmi Ravindranath (born 18 October 1953) is an Indian neuroscientist. She is currently Professor, Centre for Neuroscience, Indian Institute of Science, Bangalore. She was the Founder Director of the National Brain Research Centre, Gurgaon (2000-9) and founder Chair of the Centre for Neuroscience at Indian Institute of Science.

Education

Ravindranath earned her B.Sc. and M.Sc. degrees from Andhra University and received her Ph.D. (Biochemistry) in 1981 from Mysore University and worked at the National Cancer Institute, USA as a Postdoctoral Fellow. She joined the National Institute of Mental Health and Neurosciences, Bangalore, where she studied the metabolizing capacity of the human brain, focusing especially on psychoactive drugs and environ- mental toxins.

Contribution

Her main area of interest is the study of brain related disorders including neurodegenerative diseases such as Alzheimer's and Parkinson's

Social impact

In 1999, she helped Department of Biotechnology (DBT), Government of India to establish National Brain Research Centre (NBRC), an autonomous institution of DBT to co-ordinate and network neuroscience research groups in India.

Awards and achievements

Ravindranath is an elected fellow of several Indian academies: Indian Academy of Sciences, National Academy of Sciences, Indian National Science Academy and National Academy of Medical Sciences, Indian Academy of Neurosciences and Third World Academy of SciencesShanti Swarup Bhatnagar Prize for Science and Technology for Medical Sci- ences in 1996, KP Bhargava Medal of Indian National Science Academy Om Prakash Bhasin Award for Science & Technology in 2001, J.C. Bose Fellowship (2006), S.S. Bhatnagar Award of Indian National Science Academy (2016) Padma Shri Award in 2010.

Sujatha Ramdorai

Sujatha Ramdorai (born 1962) is an algebraic number theorist known for her work on Iwasawa theory. She is a professor of mathematics and Canada Research Chair at University of British Colum- bia, Canada. She was previously a professor at Tata Institute of Fundamental Research.

Education

She completed her B.Sc in 1982 at St. Joseph's college, Bangalore and then got her M.Sc. through correspondence from Annamalai University in 1985. After that she went for PhD at Tata Institute of Fundamental Research and was awarded her PhD under supervision of Raman Parimala in 1992. Her dissertation was "Witt Groups of Real Surfaces and Real Geometry".

Contribution

Dr. Ramdorai initially worked in the areas of algebraic theory of quadratic forms and arithmetic geometry of elliptic curves. Together with Coates, Fukaya, Kato, and Venjakob she formulated a non-commutative version of the main conjecture of Iwasawa theory, on which much foundation of this important subject is based. Iwasawa theory has its origins in the work of a great Japanese math- ematician, KenkichiIwasawa.

Social impact

Working with her husband Srinivasan Ramdorai and Indian mathematics writer V.S. Sastry, Sujatha Ramdorai conceived of and partially funded the Ramanujan Math Park in Chittoor, Andhra Pradesh, which was inaugurated at the end of 2017. The park is dedicated to mathematics education and honors the great Indian mathematician Srinivasa Ramanujan (1887-1920).

Awards and achievements

ICTP Ramanujan Prize (2006) Shanti Swarup Bhatnagar Award (2004) Alexander von Humboldt Fellow (1997-1998) Scientific careerFields Mathematics Institutions TIFR University of British ColumbiaDoctoral advisor Raman Parimala. She is a member of the Scientific Committee of several international research agencies such as the Indo-French Centre for Promotion of Advanced Research, Banff International Research Station, International Centre for Pure and Applied Mathematics. She was a member of the National Knowl- edge Commission from 2007 to 2009. She is at present a member of the Prime Minister's Scientific Advisory Council from 2009 onwards and also a member of the National Innovation Council. She is also on the advisory board of GonitSora. She also holds editorship of various journals.

Rama Govindarajan

Rama Govindarajan is an Indian scientist specialized in the field of Fluid Dynamics. She was formerly working at the Engineering Mechanics Unit of the Jawaharlal Nehru Centre for Advanced Scientific Research from 1998-2012 and as a professor at the TIFR Hyderabad from 2012-2016Centre for Interdisciplinary Sciences and presently she is working as professor at International Centre for Theoretical Sciences (ICTS) Bengaluru.

Education

She did her undergraduate degree (B.Tech.) in Chemical engineering from IIT Delhi, in 1984. She got her master's degree (M.S.) in Chemical Engineering, from Drexel University, Philadelphia, United States, in 1986. Her doctoral degree (Ph.D) thesis is on the subject of Aerospace Engineering from the Indian Institute of Science Bangalore, in 1994. She worked in Post-Doctoral Research, in Dept. of Aeronautics, Caltech during 1994.

Contribution

She started her career as scientist in the Computational and Theoretical fluid dynamics divi- sion of National Aerospace Laboratories, Bangalore, and worked there for a decade from 1988 to1998. She became a faculty member at the Jawaharlal Nehru Center for Advanced Scientific Research and worked in that position between 1998 and 2012. Since 2012, she is a professor at the TIFR Centre for Interdisciplinary Sciences. She has published a large number of technical papers in her field of specialization of fluid physics and has also published a few books. Her main research interests relate to instability and transition to turbulence of shear flows, physics of interfacial flows.

Awards

Of the many awards that she has received so far, the most notable is the Shanti Swarup Bhatnagar Award for the year 2007 for her "original contributions to the understanding of instabilities in shear and non-parallel flows, flow entrainment, turbulent transition and small-scale hydraulic jumps". She was also awarded with the Young Scientist award of 1987 and Outstanding scientist award of 1996 given by the National aerospace laboratories. She received the CNR Rao Oration award of 2004 at JNCASR Bangalore.

Charusita Chakravarty

Charusita Chakravarty was an Indian academic and scientist. She was a professor of chemistry at the Indian Institute of Technology, Delhi since 1999.Chakravarty was born in Cambridge, Massachusetts, USA on 5 May 1964 as the only daughter of Sukhamoy and Lalita Chakravarty. She was raised in Delhi, India and chose to give up her American Citizenship in her twenties.

Education

Chakravarty was selected as the National Science Talent Scholar and went on to clear the Joint Entrance Exam (JEE) of the Indian Institutes of Technology (IIT) She did her BSc. Chemistry program from St. Stephen's College, University of Delhi with a gold medal, she went on to do the Natural Science Tripos from Cambridge University, UK. Doctorate of Philosophy program at Cambridge under the guidance of David Cleary, Her thesis was on the spectra and dynamics of Ar-OH, an open shell system that involved a lot of nuances. Post Doctoral Scholar at the University of California at Santa Barbara, under Professor Horia Metiu. After a brief visit to India, she returned to Cambridge as a Gulbenkian junior research fellow in an independent post-Doctoral position.

Contribution

Soon after joining IIT Delhi, she submitted a research proposal to the Department of Science and Technoogy and having received funding easily, carried on with her research.

Her fields of interest also included theoretical chemistry and chemical physics, the structure and dynamics of Liquids, water and hydration, nucleation and self-assembly. International and national journals have published her articles and she was widely known for her single-author papers, published extensively over the course of her career. A few of her famous co-written works include, 'Multiple Time-scale Behaviour of the Hydrogen Bond Network in Water' (2004), 'Estimating the entropy of liquids from atom-atom radial distribution functions: silica, beryllium fluoride and water (2008), and 'Excess entropy scaling of transport properties in network-forming ionic melts (2011).

Social impact of work

Her initial work was related to atomic and molecular clusters and over the course of her career, she became famous for her specialised application of path integral Monte Carlo simulation to unravel quantum mechanical effects in the properties of atomic and molecular clusters.

Awards and Achievements

She was a referee and on editorial board for several scientific journals. She was awarded the Young Scientist Medal of the Indian National Science Academy (INSA), New Delhi in 1996, and selected as Young Associate of the Indian Academy of Sciences (IAS), Bengaluru. She was made an Associate Member of the Abdus Salam International Centre for Theoretical Physics, Trieste, Italy (1996-2003). She received the B. M. Birla Science Prize in 1999 and the Swarnajayanti Fellowship in 2003. In 2009 she was conferred Shanti Swarup Bhatnagar Prize for Science and Technology in the field of chemical science. She was elected Fellow of IAS, Bengaluru in 2006 and INSA, New Delhi in 2015.

Mitali Mukherjee

Mitali Mukerji is a Chief Scientist at the CSIR Institute of Genomics and Integrative Biology with notable achievement in the field of human genomics and per sonalized medicine. She is best known for initiating the field of "Ayurgenomics" in partner with her colleague Dr BhavanaPrasher (MD Ayurveda) under the mentorship of Prof. Samir K. Brahmachari. Ayurgenomics is an innovative study, blending the principles of Ayurveda- the traditional Indian system of medicine- with genomics.

Education

Post Graduate from Indian Agricultural Research Institute. Master's Thesis was on Agrobacterium tumefaciens mediated transformation of chick pea. Gold Medalist PhD (1997) from Indian Institute of Science Bangalore from Developmental Biology and Genetics laboratory (now MRDG). Elucidated the molecular mechanism of activation of cryptic bgl operon of E.coli.

Senior Principal Scientist at the CSIR-Institute of Genomics and Integrative Biology and Programme Director of CSIR's Ayurgenomics Unit TRISUTRA @IGIB.

Contribution

Mukerji was a contributor on, "linking the genetic ancestry of the Siddi people from the Western region of India to Bantu-speaking East African tribes, to different skin phenotypes for populations living in different climates changes within this area of skin-related genes and the role it plays in adaptations in response to environmental stimuli, establishing a clear genetic correlation is difficult, making clinical screening difficult as well" the underlying genetic mechanisms that cause ataxias and develop a clinical screening to be able to check disease susceptibility of healthy patients method is being used at the All India Institute of Medical Sciences and helps reduce economical and medical stresses on families." Identified genes of a PCDHG cluster and pinpointed specific chromosomal locations of polymorphisms that contribute to the disorder heritable neural disorder, dyslexia" study of cytokine serum levels between patients with active tuberculosis and healthy individuals identified five cytokine gene polymorphisms correlating to immunity against tuberculosis.

"Correlations between polymorphisms in the APOBEC3B gene and malaria susceptibility." "Ayurgenomics", integrating the phenotyping Ayurveda principles of Indian medical system with "objective parameters of modern medicine for identifying molecular endophenotypes populations, and agree with the distinguishing of different Prakriti's, giving a molecular basis for the ancient medical practice led to the inference that the genomics-based treatments of pharmacogenetics, also encompassing Ayurvedic practices, are possible.

Social impact

At IGIB, she has been instrumental in the setting up the genomics initiative and has made important contributions in the area of population genomics, hereditary ataxias and role of repetitive sequence in genome organization and function. All her projects primarily aim at identifying informative and predictive markers for disease predisposition. Her group has provided insights into the mechanism and origin of triplet repeat expansion in hereditary ataxias and identified founders for different ataxias like SCA1, SCA2, SCA3 and SCA12 in the Indian population. Her group has also carried out extensive genome wide informatics analysis of primate specific Alu repeats in human and have demonstrated how these elements could create novel regulatory networks in human. She has been the convener of the Indian Genome Variation (IGV), a CSIR consortium initiative which has recently completed the development of an Indian Genome Variation database which houses variability information in over 1000 genes from diverse Indian populations. She has also demonstrated how this basal data can be used for dissecting disease genes, identifying signatures of selection, tracing mutational histories and also for pharmacogenomics studies. Presently, she has concerted her efforts at integrating genomics with principles of Ayurveda, an ancient system of predictive and personalized medicine and initiated a new field of Ayurgenomics.

Awards and achievements

Mukerji has received several prestigious awards. On September 24, 2001, she was awarded the CSIR Young Scientist Award. She then was nominated to be a member of HUGO, the Human Genome Organization, in 2006. She received the National Young Woman Bioscientists Award in 2008 and the prestigious Shanti Swarup Bhatnagar Award in 2010. In 2014, Mukerji became an elected fellow of the Indian Academy of Sciences and in 2016, was awarded the VASVIK award for Women Scientists. Most recently, in 2017, MitaliMukerji was awarded the PushpalataRanade National Woman Award.

Shubha Tole

Shubha Tole is an Indian neuroscientist, Professor and Principal Investigator at the Tata Institute of Fundamental Research in Mumbai, India. Her research involves investigating the development and evolution of the mammalian brain, and she has won many accolades for her work. She is famous for having discovered a gene that is crucial to the proper formation of the hippocampus, amygdala, and cortex of the brain, winning the Infosys Prize in the Life Sciences category in 2014.

Education

After her basic education, Tole decided to go on to study life sciences and biochemistry at St. Xavier's College, in Mumbai instead of pursuing medical school. For her MS and PhD degrees, Tole went to the US to complete them at the California Institute of Technology. After successfully completing her degrees, Tole then decided to do post-doctoral research at the University of Chicago.In 1999, after spending more than a decade on her education in the US, Tole moved back to India and began work at the Tata Institute of Fundamental Research. Her work involves the investigation of how the developing brain comes to be and she has published many a paper and written many blogs targeted at a younger audience.

Contribution

Her research involves investigating the development and evolution of the mammalian brain, After earning her PhD, Tole sought out a post-doc position, finding a position studying the development of the mammalian brain at the University of Chicago.

While she was doing work that interested her, she and her husband both had a similar want to bring their type of work to their mother country, India. Tole wished to bring her research in developmental neuroscience to India, where should would be one of very few in her line of work. She believed that by taking her work there, she could provide students in India the option to engage in a research area that was not available to them before.

When she got an offer to set up a lab and work as a part of Tata Institute of Fundamental Research, she and her husband decided to make the move. After moving back to India with her husband in 1999, Tole took the next few years to set up her lab.

As she was setting up her lab in India, she began to face many problems. Though the cost of equipment and materials was pricey, Tole's research was well-funded by the prestigious Wellcome Trust Senior International Fellowship. However, there were other troubles since the long travel time it took to get materials to Mumbai meant that sometimes there wasn't enough dry ice to keep perishable items frozen, and thawing of materials could potentially ruin these materials before they had even arrived at her lab.

However, these obstacles were met and overcome, and Tole had her lab's first publication in 2000.

Many publications followed in the years to come, and she currently has over 40 publications today.

Social impact

Tole's work is in developmental neuroscience, and for the last few decades, she has been working to elucidate the mechanisms behind the development and diseases of certain brain structures. Her most significant contribution to the scientific world was her discovery of the regulatory gene, Lhx2, that controls some aspects of how the amygdala, cortex, and the hippocampus form during early development.

While Tole is primarily a neuroscientist, she is also an active member of a community of scientist who reach out to students to guide them in their respective field and help to foster love of their subjects. She posts articles on www.indiabioscience.org that are aimed at a younger audience, and has many pre and post-doctoral candidates that she is mentoring.

Achievements:

In addition to researching and mentoring, Tole is also holds a membership with academic groups such as the International Affairs Committee of the American Society for Cell Biology. She is also a Fellow of the National Academy of Sciences, India and the Indian Academy of Sciences. Shantiswaroop Bhatnagar Award 2010, Biological Sciences.

Yamuna Krishnan

Yamuna Krishnan (Born: 25 May 1974) is a professor at the Department of Chemistry, University of Chicago, where she has worked since August 2014.She was born to P.T. Krishnan and Mini in Parappanangadi, in the Malappuram district of Kerala

Education

Bachelor's in chemistry from the University of Madras, Women's Christian College, Chennai in 1994. MS in chemical sciences in 1997 and PhD in organic chemistry in 2002, from Indian Institute of Science, Bangalore

As a postdoctoral research (2001-2005) at the Department of Chemistry at the University of Cambridge, UK.National Centre for Biological Sciences, Bangalore, Fellow 2005-2009; Reader 2009-2013.

Contribution

Her current research interests are in the areas related to structure and dynamics of nucleic acids, nucleic acid nanotechnology, cellular and subcellular technologies. Her lab tries to understand the functions from DNA beyond that of its traditional role as the genetic material and tries to develop quantitative imaging technology that uses DNA nanodevices as fluorescent reporters to map second messengers in real time in cells and in vivo.

Society impact

Development of versatile, functional imaging technology using self-assembled DNA nanostructures to quantitatively image second messengers in real time, in living cells and genetic model organisms

Awards and Achievements

She is the youngest woman recipient of the Shanti Swarup Bhatnagar Prize for science and technology, the highest science award in India, which she won in the year 2013 in chemical science category.Infosys Prize for Physical Sciences 2017. Cell's 40 under 40 2014.Council Member, Chemistry Biology Interface, Royal Society of Chemistry 2014. AVRA Young Scientist Award 2014.

- Faculty of 1000 Prime, Chemical Biology 2014
- Associate Editor, Nanoscale, RSC Journals 2013
- Editorial Advisory Board, Bioconjugate Chemistry, ACS 2013
- Fellowship in 2010, the Indian National Science Academy Young Scientist Medal in 2007, Innovative Young Biotechnologist Award from the Dept. of Biotechnology, Govt. of India, in 2006, and the Infosys Prize 2017 in the Physical Sciences category. She was a recipient of the Wellcome Trust - DBT Alliance Senior Research.

Vidita Ashok Vaidya

Vidita Vaidya is an Indian neuroscientist and Professor at Tata Institute of Fundamental Research, Mumbai. She was a former Senior Research Fellow of the Wellcome Trust and a former associate of the Indian Academy of Sciences. Her primary areas of research are neuroscience and molecular psychiatry. Viditas parents, who are clinician scientists and her uncle (a Malaria Parasitologist) were a big motivation for her to pursue neuroscience. Her father is a clinical pharmacologist, and her mother is an endocrinologist. She was also deeply influenced by Dian Fossey and Jane Goodall, during her teenage years.

Education

Vidita received her undergraduate degree from St. Xavier's College, Mumbai in Life Sciences and Biochemistry. She obtained her doctoral degree in Neuroscience at Yale University in. Her postdoctoral work was done at the Karolinska Institute in Sweden and at the University of Oxford in UK, which she completed in March, 2000. Doctoral advisor: Professor Ronald Duman at Yale University Specialization: Medical Sciences

Contribution

She joined the Department of Biological Sciences, TIFR at the age of 29, in March, 2000, as a Principal Investigator. She has been a Wellcome Trust Overseas Senior Research Fellow and an Associate of the Indian Academy of Sciences from 2000-2005. Vidita studies the neurocircuits that regulate emotion and how these mechanisms are influenced by life experiences, and antidepressants. She also investigates how changes in brain circuits form the basis of psychiatric disorders like depression and how early life experiences contribute to persistent alterations in behaviour. Vidita's research has also been centered around the role of serotonin in shaping neurocircuits of emotion during critical periods of postnatal development and on the mechanism of action of fast acting antidepressant treatments. Her lab work is conducted on lab rats and mice. Vidita's particular field of interest lies in understanding how individuals develop vulnerability or resilience to stress-associated psychopathology

Awards and Achievements

Her work has garnered the 2015 Shanti Swarup Bhatnagar Prize for Science and Technology for Medical Sciences. She is also a recipient of the National Bioscience Award for Career Development in 2012. She received the Nature Award for Mentorship in Science, 2019, in the mid-career category Vidita has been featured in Lilavathi's Daughters, a compilation of biographical essays on Indian women scientists, and on "The Life in Science" blog. In 2015, she gave a TEDx talk at St. Xavier's College, Mumbai in which she spoke about how stress can change our neurological makeup. She has also been featured in TIFRs "Chai and Why".

Aditi Sen De

Aditi Sen De is an Indian scientist, an associate professor in quantum information and computation group at the Harish-Chandra Research Institute, Allahabad. She is known for her research on quantum information and computation, quantum communication, quantum cryptography and many- body physics.

Education

Aditi Sen De was born (on 1October 1974 in Kolkata, India) to Lakshmi Dey, a school teacher and Ajit Kumar Dey, a state-government employee.She is married to fellow physicist Ujjwal Sen, who is also a Professor of Physics at Harish-Chandra Research Institute in Allahabad, India.

She did her schooling at SaradaAshramaBalika Bidyalaya, Kolkata, and completed her higher secondary from Sakhawat Memorial Govt. Girls High School, Kolkata in 1992. With a strong passion and high proficiency for mathematics, she joined Bethune College, University of Calcutta to obtain a Bachelor of Science with honours in Mathematics. Subsequently, she joined the prominent Applied Mathematics department of the University of Calcutta, where she pursued her interests in quantum and statistical physics. She received her Master's degree in1997, and after a short period of research work in India, moved to Gdansk, Poland to work with Marek Zukowski at the University of Gdansk, where she received her PhD in January 2004. Following her doctoral studies she moved to Hannover, Germany as a Humboldt Research Fellow to work with Maciej Lewenstein at the Leibniz University. Thereafter, she joined ICFO - The Institute of Photonic Sciences at Barcelona, Spain to continue her research on quantum information theory, condensed matter and statistical physics. Upon returning to India in 2008, she briefly joined the School of Physical Sciences at Jawaharlal Nehru University as an Assistant Professor in Physics, before moving to Harish-Chandra Research Institute, Allahabad in 2009, where she is currently a Professor in Physics. Aditi De has published more than 100 research articles in eminent peer-reviewed journals, and has also collaborated with several world-renowned physicists.

Contribution

De started her research in the field of quantum information theory during her postgraduate studies in Kolkata, and went on obtain her doctorate in 2004 at the University of Gdansk. In collaboration with her supervisor Marek Zukowski, and other eminent physicists such as RyszardHorodecki, Pawel Horodecki, Michal Horodecki and her husband, Ujjwal Sen, she worked on some fundamental problems on entanglement theory, quantum cryptography and quantum communication. After her stint in Gdansk, she joined the group of MaciejLewenstein in

Hannover, Germany and later in ICFO - The Institute of Photonic Sciences in Castelldefels near Barcelona, Spain, where she spend a considerable period of her early research career. During this period, De consolidated her research on quantum information, while contributing heavily to new research direc- tions that were opening in the interface of quantum information and many-body quantum physics. In particular, her research focused on the study of quantum phase transitions using entanglement as a key figure of merit. After a brief stint as a faculty member in Jawaharlal Nehru University, De moved to Harish-Chandra Research Institute in Allahabad, where along with physicists Ujjwal Sen and Arun Kumar Pati, she started the Quantum Information and Computation group in 2009, under the Physics Division at the institute. Over the last few years, several young researchers have completed their doctoral as well as postdoctoral research at the group, resulting in more than 50 publications in well-known journals in physics. The group has also hosted several conferences and workshops, with participants and speakers from all around the world..

Social impact

In recent years, De has contributed significantly to the understanding of quantum information and communication, in particular the formulation of a computable entanglement measure and a novel density-matrix recursion method.Her work also involves understanding the theory of quantum channels, the security of quantum cryptography and quantification of quantum correlations.

Awards and achievements

The Council of Scientific and Industrial Research awarded her the Shanti Swarup Bhatnagar Prize, one of the highest Indian science awards in 2018. She is the first women recipient of this Prize in the Physical Science category. In 2012, she won the biennial Buti Foundation Award, given by the Indian Physics Association to young scientists who have made outstanding contributions in the area of Theoretical Physics, Astrophysics or Biophysics. She has also been a recipient of the prestigious Ramón y Cajal fellowship in Spain and the Humboldt Research Fellowship, given by theAlexander von Humboldt Foundation in Germany.

Neena Gupta

Neena Gupta (1982) is an Associate Professor at the Statistics and Mathematics Unit of the Indian Statistical Institute (ISI), Kolkata. Her primary fields of interest are commutative algebra and affine algebraic geometry. Gupta was previously a visiting scientist at the ISI and a visiting fellow at the Tata Institute of Fundamental Research (TIFR).

Education

Gupta graduated with honours in Mathematics from Bethune College in 2006. She earned her Post Graduation in Mathematics from the ISI in 2008 and subsequently, her Ph.D. degree in 2011 with algebraic geometry as her specialization, under the guidance of Professor Amartya Kumar Dutta.Gupta's Ph.D. dissertation was "Some Results on Laurent Polynomial Fibrations and Quasi A* Algebras"

Contribution

In recent years, Dr Gupta has provided solutions to two open problems in mathematics - one, posed by Oscar Zariski (1899-1986), one of the founders of modern Algebraic Geometry. Gupta describes these open mathematical conjectures as problems which can be easily explained to mathematicians but are very difficult to solve, in an interview with Research Matters. The 'Zariski Cancellation Problem', which has earned Gupta the SSB prize, has intrigued mathematicians around the globe ever since a version of it was proposed by O Zariski in 1949.

By the early 21st century, several eminent mathematicians had tried their hand at a solve for the Zariski Cancellation Problem, which remained open for about 70 years before Gupta's complete solution came along in 2014.

Social impact

The solutions provided by Dr Gupta have given both insights and inspiration to young researchers as they can initiate research into other associated conjectures, which remain open.

Awards and achievements

She has won ShantiSwarup Bhatnagar award (2019) in the category of mathematical sciences, the highest honour in India in the field of science and technology.B.M. Birla Science Prize in Mathematics (2017), The Swarna Jayanti Fellowship Award, Department of Science and Technology (India) (2015), The inaugural Professor A. K. Agarwal Award for best research publication by the Indian Mathematical Society (2014), The INSA Young Scientist Award (2014), The Ramanujan Prize from the University of Madras (2014) Associateship of the Indian Academy of Sciences (2013), The SaraswathiCowsik Medal by the TIFR Alumni Association for her work on the Zariski Cancella- tion Problem in positive characteristic (2013), INSPIRE Faculty Fellowship Award (2012), Shyama Prasad Mukherjee fellowship, the Council of Scientific and Industrial Research (2008), PC Panesar Gold Medal for Outstanding Performance in the Masters program in Mathematics, ISI (2008).

Sanghamitra Bandyopadhyay

Sanghamitra Bandyopadhyay is an Indian computer scientist specializing in computational biology. A professor at the Indian Statistical Institute, Kolkata, Since 1 August 2015, she has been the Director of the Indian Statistical Institute, and she would oversee the functioning of all five centres of Indian Statistical Institute located at Kolkata, Bangalore, Delhi, Chennai, and Tezpur besides several other Statistical Quality Control & Operation Research Units spread across India.

Education

Sanghamitra Bandyopadhyay obtained a bachelor of science in physics from Presidency College, Kolkata before obtaining another bachelor's degree (of technology) in Computer Science in 1992 from Rajabazar Science College. She then obtained a master's degree in computer science from the Indian Institute of Technology, Kharagpur before pursuing a Ph. D. at the Indian Statistical Institute, obtaining it in 1998.

Contribution

Sanghamitra Bandyopadhyay is an Indian computer scientist specializing in computational biology. A professor at the Indian Statistical Institute, Kolkata, Her research is mainly in the areas of evolutionary computation, pattern recognition, machine learning and bioinformatics.

Social impact

She is the first woman Director of the Indian Statistical Institute. Currently she is on the Prime Ministers' Science, Technology and Innovation Advisory Council.

Achievements

Swarnajayanti Fellowship, Humboldt Fellowship from Germany, Shanti Swarup Bhatnagar Prize in Engineering Science 2010. J. C. Bose Fellowship, IEEE Fellow, 2016, Infosys Prize 2017 in Engineering and Computer Science , TWAS Prize for Engineering Sciences, by TWAS, The World Academy of Sciences 2018.

Bushra Ateeq

Birth Year: 1976, Early life and Education:, B. Sc- 1995 Aligadh Muslim University, M.Sc- 1997 AMU, Ph D -2003 AMU

Post Doctoral Studies: Genentech Post Doc Award, San Francisco, USA

2011- American association of cancer research.

2013- Welcome trust DBT India alliance

Career- Since 2014 working at Department of Biological Science and Biological Engineering at IIT Kanpur, as Associate Professor.

You have received several National and International awards, which is a receipt of your accomplishments. Prestigious CSIR-Central Drug Research Institute Award (2020) Fellowship award from Wellcome Trust/DBT India Alliance, AACR Women in Cancer Research Scholar Award (2011) by the American Association of Cancer Research, Young Investigator Award (2009) from Expedition Inspiration Fund for Breast Cancer Research, Genentech Postdoctoral Award (2009) from the Genentech Foundation, South San Francisco, and Strategic training Award (2005) from the Canadian Institutes of Health Research for Skeletal Health Research, depict your triumph and success. The prestigious Shanti Swarup Bhatnagar Prize for Science and Technology for 2020 in Medical Sciences, which is one of the highest Indian science awards, conferred upon you is highly commendable. Your contribution to the scientific society as a member of the Programme Advisory Committee-Interdisciplinary Biological Sciences, and Empowerment and Equity Opportunities for Excellence in Science (EMEQ) of the Science and Engineering Research Board (SERB), Department of Science and Technology establishes your urge to serve the society to make it a better place for all researchers who are struggling to excel. You have also conserved your hobbies of Painting, Photography, and Bird-watching, in spite of your extremely demanding career profile.

Area of Research: Breast, colon and Prostrate cancer. Molecular oncology, therapeutics, cancer biomarkers.

Publications : She has 92 international Journal publications and extremely high Google citation index of 6799 which is an indicative of her high quality research.

Jyotirmayee Dash

Birthdate: 7 July 1976, Birthplace: JagatsinghpurDistrict , Odisha, Education and early life:

Her career is a reflection of nurturing and disciplined family environment offered her your parents, who have been school teachers. They have offered her a liberal and supportive backbone for your studies which has made her a person of such a great academic stature.

M.Sc: Revenshaw University Cuttack.

Ph D: IIT Kanpur

Post Doctoral studies: Alexander Von Humboldt Fellow- FreieUniversitat Berlin Germany 2004-2006, Marie Curie fellow, ESPCI Paris 2006-07, University of Bristol UK 2010,

Career: IISER Kolkata, 2009-2012, 2012- 2014 Assistant Professor IASC Kolkata, 2014-2019- Associate Professor, 2019- Professor of Organic Chemistry at IACS Kolkata.

Publications: 82 Publications in journals of high impact factor with a citation index of 2773.

Areas of research : Chemical Biology, Nucleic acid chemistry, nanomaterials, catalyst, sensors,

Personal life: She has hobbies like classic music, painting and spending time with her parents.

Awards and fellowships: She has made outstanding contributions in developing new strategies for nucleic acid therapeutics, artificial ion channels and other biomedical applications, which has high impact at social level, especially in health. Structure and function of nucleic acids for applications in therapeutics and nanotechnology has been your areas of strength and expertise. Development of ion channels and hydrogels for programming antimicrobial agents, drug-delivery systems, cancer therapeutics and sensors, depict the extreme social connect and relevance of your research to human health issues. You additionally serve the society, at large, by delivering lectures at International platforms and working as a reviewer in peer reviewed journals of high repute.

VatsalaThirumalai

Birth Year: 1976, Education: B Tech-Anna University,

M S and PhD : Brandeis University Waltham,

MA Post Doctoral Studies: Neuro Science, Cold Spring harbor Laboratory, NY, National Insritute of Health , Bethesda, MD.

Career: Head Neural Circuits and development laboratory, Associate Professor at National centre for Biological Sciences, Bengaluru.

Family background: Born as 4 th child and 3 rd daughter of the family in a conservative Tamil family, she was fortunate to have parents who supported her with all the resources they had. She was first Doctorate of the family. She lives in Bengaluru with her husband and daughter who support and appreciate her work immencely.

Research :

For most animal species, survival depends critically on the ability to move-be it for feeding, escaping predators or selecting a suitable mate. To generate movement, skeletal muscles need to be contracted in precisely coordinated patterns. Neural circuits control the spatial and temporal pattern of skeletal muscle contractions. Our lab is interested in understanding the hierarchy, mechanisms and development of neural circuits that generate movement.

In vertebrates, the circuits that control movement are found in the spinal cord and in the brain. The spinal circuits controlling the generation of locomotion are referred to as 'central pattern generators' as the output from these circuits is patterned and rhythmic electrical activity sent to the muscles. These central pattern generators are in turn controlled by sensory drive and by commands from the locomotory centers of the brain. My lab focuses on the development of central pattern generators and the development of descending motor control from the brain. We also seek to understand the mechanisms by which brain locomotor circuits control movement in mature organisms.

We use zebrafish, a small fresh water tropical fish endemic to the Ganges, as our model system. The embryonic and larval stages of these fish are transparent allowing for direct visual observation of developing internal organs including the brain. We employ a suite of techniques to tease out the circuitry responsible for generating swimming in developing and more mature zebrafish. We record electrical activity from individual spinal and brain neurons using extracellular and whole-cell patch clamp techniques. We record activity from populations of neurons simultaneously using calcium imaging. We generate transgenic zebrafish to express proteins of interest in particular neurons. This allows us to selectively ablate and also to electrically activate/inactivate specific populations at will. Using these cutting edge tools and technologies, we hope to throw light on the development of neural circuits

and the neural basis of locomotion.

Publications: She has 38 Publications in highly reputed journals and has a citation index of 1138.

Awards and Scholarships:

The prestigious Shanti Swarup Bhatnagar Prize for Science and Technology for 2020 in Biological Sciences is indeed a recognition for your efforts and accomplishments. The Fellowship by the Wellcome Trust/DBT India Alliance also is a receipt of your intellect and hard work. You have inspired the younger generations, typically the school children, through your writings and lecturing on popular science. The contributions in Amar Chitra Katha, Tibetan Central School Tibetan Science Conclave and Jawaharlal Nehru Centre for Advanced Scientific Research.

SHAKTI MEMBERS IN THE FIELD OF SCIENCE

Sudha Tiwari

I have been engaged in doing basic research since last twenty five years.My subject is Botany. Working as Consutant Scientist in MGIRI Wardha (MS),my work is as follows

Standardisation of Herbal drugs 5 Monographs in Ayurvedic Pharmacopeia of India Proposed range for standardisation of cow urine after analysis of 400samples of 35 varieties indigenous cow Innovated 15 products prepared using Panchagavya and herbs(Herbal face pack, Shampoos, Transparent soaps, HandWash, Turmeric based kumkum,Hairoil,Mosquito coil, Dhoopdatti, Agarbatti)

(All the above products without hazardous chemicals.) Prepared a low cost simple On the field testing Biomanure and Soil testing kits. Given training to unemployed People of the innovated products through my institute.

MahatmaGandhi Institute of Rural Industrialisation(under ministry for MSME) MGIRI Motivated nearly300 Enterpreuners throughout India.

Published papers in national and international Journals DIC is a project given by MHRD new delhi. In all over india Only 18 DIC centre are selected and all are IIT, NIT and other famous Universities Like BHU and JNU etc.

My work-

I am working in DIC last three years and Workin on some innovative ideas but among all of them the Bioplastic become super Famous. Also appreciated by Anandiben Patel ex governer of MP. The main concept of making this prototype is to solve the problem related to pollution. Because the polyethe is made up of synthetic chemical which are non degradable for thousand of years so we make a plastic that is bio degradable and it is made up of Biopolymer like starch

We use starch in this plastic so it is easily degradable and non harmful for any animal, it is also safe for Animal as well as human.

Kusum Arunachalam

Dr. Kusum Arunachalam, a tropical soil ecologist graduated from the School of Ecology at North-Eastern Hill University, India.

She is all through first class starting from High School till M.Sc in Botany. She did her Masters and Ph.D from North Eastern Hill University, Shillong in 1992 and 1997 respectively. Her academic mentor was Professor R.S.Tripathi. Dr. Arunachalam started her research carrier in the year 1992 and since then she has been actively involved in various aspects of ecology and environmental research. Soon as she completed her Ph.D. she got CSIR-Independent Research Associateship in Horticulture/Forestry during 1997, followed by DST-Young Scientist Scheme in 1998.

She joined North-Eastern Regional Institute of Science and Technology (NERIST) as a Lecturer in Forestry during 1998, where in addition to teaching, she has been carrying out several sponsored research Forest Soil Productivity and Wetland Ecosystems. She has also been involved in various other research programmes on shifting agriculture and agroforestry systems. At present she is heading the school of Environment and Natural Resources at Doon University.

Within a relatively shorter span of professional experience, Dr. Arunachalam has made notable contributions to soil ecology, ecosystem ecology, shifting agriculture and land use dynamics in the north- eastern India. Her doctoral research on the role of microbial biomass in soil nutrient restoration in regrowing forests has led to significant conclusions about the least studied belowground components including fine roots. These components have a greater nutrient immobilization potential and rapid biomass turnover and thus contribute significantly to the organic matter and nutrient dynamics in the degraded and/or regenerating forest ecosystems. Her further research demonstrated that such processes vary with different scales of disturbance, and ecosystems across seasons and soil depth. This work is of both basic and applied importance in restoration ecology. Recently, she is working on community driven climate resilient agriculture in hill agroecosystems of western Himalaya.

In 1998, she was awarded the Young Scientist Scheme by the Department of Science and Technology (DST), Government of India. She was awarded the prestigious BOYSCAST fellowship in Plant-Microbe Interaction (DST: 2002-2003) to work at University of Freiberg, Germany. She is fellow of International society of Tropical Ecology, Nation Environmental Science academ,y, Academy of Forest & Environmental sciences and National Institute of Ecology. For her achievements, Dr. Kusum Arunachalam was awarded the National Young Woman Bioscientist Award 2005 by the Department of Biotechnology, Govt. of India. She was also awarded Commonwealth Silver award for popular-

ization of Environmental issues.

She juried Doon University in 2009 as Assistant Professor in school of Environmental Sciences and became Professor in 2013. She was Dean School of Environment & Natural Resources, Dean Academics at Don University from 2014 till 2019. She also served as actng vice chancellor Doon University from August 2017 till January 2018. Beside teaching Environment Science at Doon University she is researching on documenting the traditional knowledge of the communities and its scientific validation, valuation of ecosystem services, biodiversity conservation, and understanding the structural and functional dynamics of various ecosystems in Uttarakhand Himalayas. To date she has published more than 90 research papers in reputed national and international journals and more than 10 in edited volumes. Dr. Arunachalam is a life member of Indian Science Congress Association, Indian Society of Tree Scientists, Indian Association of Soil and Water Conservationists, Indian Society of Soil Biology and Ecology, Bamboo Society of India and Arunachal Pradesh Society of Land & Water Management. She is widely travelled and visited Germany, Austria, France and Switzerland in connection with her research.

Snehasikta Swarnakar

Snehasikta Swarnakar is an Indian Chemical Biologist. Her work is focused on the role of matrix metalloproteinases (MMPs) in gastropathy and endometriosis and those are highly cited.

Education

She studied B.Sc. Chemistry honors in Krishnagar Govt. College under Calcutta University and did Masters in Biochemistry with specialization in advance microbiology from Calcutta University in the year 1986 followed by Ph.D. in lectin chemistry from Jadavpur University. She went to University of California, Davis, US for post doctoral work on protease biology with Peter B. Armstrong and James P. Quigleyin 1994.

Dr.Swarnakar was also research associates in the Marine Biological laboratory, Woods Hole, Boston. After returned to India in the year 2002 she joined as scientist in CSIR-Indian Institute of Chemical Biology, Kolkata, a primer biomedical research institute in India. She has been successful to be project leader of several DBT, DRDO, ICMR, CSIR funded projects. She made remarkable progress in the area of gastric ulcer, gastric cancer, endometriosis and the involvement of metalloprotease thereon.

Contribution

Dr.Swarnakar's seminal contribution on protease biology in the context of inflammation and gastric cancer is new understanding of MMP-9 upregulation during gastric ulcer development for which she has been awarded National Bioscience award 2008 from DBT, Govt. of India and several other National accolades from ICMR, CSIR, IABS, SBC.

Dr Swarnakar is elected fellow of NASI, India and WAST, West Bengal. She is also life member of several scientific bodies of India and abroad. She has credential in publishing more than 100 research articles, 15 book chapters, several popular article in the field of inflammation.

Social impact

She discovered MMP9 dependent pathway as an alternative mechanism for non virulent H. pylori infection. Her work demonstrated for the first time that curcumin (an active constituent of turmeric), nanoquercetin and melatonin (N-Acetyl-5-hydroxy tryptamine) protect gastric ulcer via MMP9-dependent pathway.Recently she found one new anti-gastric ulcer compound (tamarexitin) from neem leaf as future drug for gastric ulcer. Her phenomenal work highlighted the action of melatonin and curcumin in modulating MMP9 activity by increasing tissue inhibitor of metaloprotease (TIMP1) protein during endometriosis regression and; MMP9 : TIMP1 ratio as diagnostic marker for endometriosis. She documented the association between MMP7-181A/G, MMP9 -1562C/T polymor-

phisms and gastric cancer risk in eastern Indian population and; detrimental effect of tobacco thereon. She has been engaged in collaborative work with NIMS, Japan for understanding the regulation of cellular proliferation by applying electromagnetic resonance and nanorobot treatment. While she was Fulbright Fellow in Emory University in 2014 since then she initiated collaborative research on cross-talk between MMPs and claudins in alcohol-induced lung injury.

Achievements

She served as adjunct professor in Environmental Science department of Calcutta University, NIPER-Kolkata and AcSIR for many years. She is heading Infectious Disease and Immunology Division and Publication & Information Division at CSIR-IICB and involved as member representative as well as chairperson in various responsible committees of differentresearch institutions and govt. organizations.. She has mentored more than 50 students for completing M.Sc. thesis and Ph.D. thesis work and reviewed many research grant proposal of National and International status. She also engaged in reviewing Ph.D. thesis of various institutes and universities. She is actively involved in various outreach programsfor social benefit and very much enthusiastic to nurture science awareness among school children through delivering speech. She organized several International conferences and proves her credibility of leadership power in various activities. She is bearing torch for young women at UG and PG level around her to inspire and support for scientific knowledge development and self-empowerment via coordinator events like science festival, Mega -fest and so on.

Sangeeta Kale

Dr. Sangeeta Kale
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Sangeeta Kale, graduated from University of Pune, India and did her Masters in Electronic-Science and Doctoral studies in Material Science from same university in 1996. She did her post-doctoral studies from University of Maryland, College Park, U.S.A. from 2000 to 2002. She has been working at Defence Institute of Advanced Technology, as Professor and Dean of this University. Additionally, she has been a visiting Scientist at International Centre for Theoretical Physics, since 2006, till date, at Trieste, Italy.

She worked as Officiating Vice Chancellor (2014-15) of DIAT and Dean (Academics) (2013-15), Dean (Student Affairs) (2017-18) of DIAT. She is a Full Professor in Physics.

At the research front, she works on nanomaterials for their sensing and bio-medical applications, typically pertaining to Defence research. Her work includes Nanotechnology and its applications in the domain of CBW sensors, electromagnetic shielding for Radars, optical sensors for field detections, metamaterials for smart detections and drug delivery using nano-materials. She implemented a huge project grant from ER-IPR, DRDO, where, she, along with her team of 7 other Co-Investigators worked on development of various prototypes of products useful to DRDO and Tri-Services (Army-Navy-Air Force), using nanomaterials. She has successfully executed projects funded nationally from DST, DBT, UGC, DAE, ISRO and DRDO. She has also internationally implemented projects Indo-French and Indo-German, along with her overseas collaborators.

She has guided more than 17 PhD students for their PhD (completed and ongoing) and more than 50 Masters projects for their dissertations. She has more than 115 International research publications to her credit along with 8 Book Chapters and 4 Books. She has written a invited-chapter in a book entitled "Lilavati's Daughters" published by Indian Academy of Sciences, which is a short biography of Indian Women Scientists. She has flair of writing scientific articles for science popularization among the masses and is a frequent writer in newspapers science columns, and gives talks on television and All-India-Radio in the area of nanotechnology. Her research work has been frequently by Radio Mirchi, Pune. She is a Blogger with articles written in the domain of Science, sports and interdisciplinary topics.

She has been actively involved in establishing International collaborations of mutual research and training. She has

been actively involved in setting up MoUs with Universities in Israel (Tel-Aviv and Technion), Singapore (NUS), Australia (Daikin), USA (Naval Postgraduate School) and so on.

Medals and Honors:

1. Recipient of Indian National Science Academy (INSA) Teachers award for 2016, in the subject : Physics.
2. Recipient of Materials Research Society of India (MRSI) Medal for her outstanding work in the area of Materials Science, by MRS-India.
3. Recipient of DRDO Science Oration award (2014) for her contributions to Defence Research and Development Organization, through her research on nanotechnology-based-sensors.

Salient Achievements:

1. Developed indigenous product "ANANYA" as a solution to combat microbial infections under these Covid19 times. The Technology has been transferred to Kinetic Engineering Pvt. Ltd. For upscaling.
2. President of India nominated Court Member on the Board of Banaras Hindu University (BHU), India (2017 - 2020).
3. Senior Visiting Scientist with International Center for Theoretical Physics (ICTP), Trieste, Italy.
4. Board Member of the High Level Committee on Scientific and Technological Cooperation between India and Russia, Government of India, Ministry of Defence.
5. Elected Fellow of Maharashtra Academy of Sciences, Pune International Center, India and President - Sharada Shakti (Maharashtra) (Women's wing of Vijnana Bharati).

Swarnlata Saraf

is a Professor of Pharmaceutical Sciences. Currently, She is Director (2nd Tenure) University Institute of Pharmacy, Pt. Ravishankar Shukla University Raipur, Chhattisgarh, India. She graduated (B.Pharm) from IIT, BHU with the highest merit for admission in the class in competitive examination through CPMT Uttar Pradesh. She received a junior research fellowship of UGC for qualifying the GATE conducted by IIT Kanpur in 1988 and CSIR Senior research fellowship for her PG & Ph.D. Program.

She gained industrial experience during her industrial training program at smith Staini Street a Government Pharmaceutical industry in Kolkata and as an analyst in Swastik Pharmaceuticals at Varanasi. She served at all positions in the University as Chairperson-Board of studies, member, Board of governing body of the various affiliating colleges to the university, Dean - faculty of Technology, Member- academic council and member-executive council of the University. During her administrative and academic tenure and time to time in the university, her iconic contributions in the University are as key members to draft intellectual property rights regulation 181, Reforms in examination pattern, Prepared electives subject scheme and syllabus for PG Programs eg.intellectual property right (credit 04) and cosmetic technology (04 credits), PH. D regulation reforms, Continuous addition of contemporary topics as per the need in B. Pharm and M. Pharm Programs.

Her field of research is Pharmaceutics specially worked in the formulation development of herbals, Phyt-constituents, quality control Parameters of cosmetics, cosmetic technology, and standard of the drug. The research work is well cited by national and international laboratories & institutions as per Google Scholar (citation-7526, H-index-76, i-10 index 104) and SCOPUS (H-index-28). She received funding from national agencies - worth rupees around 11 core as an individual, Departmental and University Projects from CG-COST, UGC, AICTE, and DST, New Delhi till date. As she has good research contribution and academic experiences, MHRD and now "Shiksha Mantralaya" selected her for the Leadership program "LEAP" organized by BHU in collaboration with NTU, Singapore.

State Contribution: She served in different organizations of the state as an expert/chairperson of the committee like CG-COST, Public Service Commission, and different Chhattisgarh universities.

Other states: She served as Ph. D. examination experts in more than 25 central and state universities, member university teacher's selection committee, the board of studies, and state-level competition.

National Contribution: She served in almost all national agencies of education in the country concerned with the pharmacy profession. She served as a member

Pharmacy council of India, New Delhi nominated by University Grant Commission from 2008-2013. She participated to draft the national education regulation of B.Pharm and M.Pharm regulation 2014 and member, syllabus committee to date. She also conceptualized the continuing education program in the education sector of the pharmacy profession and played a key role in the framework of CEP. She worked in NAAC, Bangalore to draft the health sciences manual as a member of a Small working group., assessor as chairperson and member coordinator of visiting committees of academic institutions.

She served UGG, ICMR, and DST new Delhi As an expert in project screening, evaluation, and interface meeting committees.

International Contribution: She contributed through her research expertise in foreign universities, research agencies, and governing bodies. She served the Israel science foundation for project screening, Kings college London for collaborative publications, and Accreditation council of Pharmaceutical Education-USA as an observer for international academic framework meeting. She visited several organizations related to the pharmacy profession to study their management and skills like Pfizer laboratory, Boost Pharmacy, Royal Society of London, Royal Hospital, and London School of Pharmacy and US university.

She Visited Numbers of foreign countries for her official trips as USA, Singapore, UK, Switzerland, UAE, and many more.

She also feels her social responsibility to contribute to nation-building by participating in activities like women empowerment through science and technology, Capacity building, leadership, and skill development via serving to NGO (Shakti VigyanBharati) and Mahamana Malviya Mission and Mathur Vaishya Society. Looking to the youngest kid among 8 brothers and sisters of her middle school-educated parents with excellent wisdom, she feels proud to serve the society with modern thoughts of herself and cultured thoughts of parents.

Kinkini Dasgupta

Kinkini Dasgupta Misra has been actively involved in the field of Science and Technology Communication with special expertise on Digital Publishing & Communication, Gender and Technology issues, large scale media productions, to name a few. With her postgraduation in Physics from Delhi University, and subsequent training in Management, she brings into her works a perfect blending of complex scientific issues narrated in simple popular style, which has been the hallmark of her projects presented both in National and International platforms. She has been published widely in national and international journals, popular magazines, e-portals etc. on India's S&T communication efforts through her works.

Presently working as a Senior Scientist in Vigyan Prasar (VP), an autonomous body of national repute under the Department of Science and Technology, Govt. of India, Kinkini is engaged in designing and developing original science content for popularizing science at national level through print, digital, social and electronic media. Her long research experience in handling diverse issues with a Pan-Indian perspective has been extremely helpful in implementation of several national initiatives on S&T communication by VP and DST. She always focusses on using new, innovative technologies for creating effective communication resources for all types of stakeholders across the country.

Another area that deserves special mention is her pioneering contribution to the development of gender sensitive science communication programmes in reaching out to women in the rural and tribal areas of the country. She has led and spearheaded many national projects and campaigns of taking science to the masses. Some of the notable ones are Internet based 24X7 Science Channel, a Web Portal reflecting one stop source of information on science in India, Awareness campaign on women's health and nutrition, and drudgery reduction aligning with national mission of the country towards sustainable development. She was invited to China, Mexico, Kuwait and some other global Conferences to showcase her works with gender sensitivity and emancipation through technology. Her guidance and support to innumerable organizations in India has been a strong factor of all States and NGOs developing their projects on the lines of S&T for women, sustainable development, and of course digital communication.

Manisha Khaladkar

Dr. (Smt.)Manisha Khaladkar, Associate Professor Chemistry College of Engineering Pune, Pune, Maharashtra.

Dr. Manisha (Bhide) Khaladkar was born on 19 April 1969. She was blessed to have MrBhalchandraBhide and Mrs. Padmashree as parents. Her parents had a sound scientific knowledge, great love for art, music and culture, they gave complete freedom and developed her into well balanced all round person. Dr. Manisha married to a longtime friend Yogesh Khaladkar who always supports and encourages her to excel in her chosen field.

Dr. Manisha B.Sc.(Chemistry) in 1990, M.Sc.(Analytical Chemistry)in1992 and Ph. D. in Chemistry in 1997(On Scholarship of Department of Atomic Energy).After completing Ph. D. she was selected as Lecturer in Government Engineering College Karad through Maharashtra Public Service Commission selection. In year 1999, At the age of 29 she successfully shouldered the responsibility of being Head of Applied Sciences Department and Continued till 2012. In 2001 she joined College of Engineering Pune, actively worked in teaching, administration and research. And till date completed 6 research projects worth 1.2 Cr, 33 research papers, successfully guided 4 Ph. D. students and filed 2 patents. Her areas of research are Electronic materials, Superconducting ceramics, functional ceramics like Substituted Zirconia, Energy Generation from Waste Thermoplastics and automation of Thermo-Analytical Instruments.

Her major contribution however comes from successfully leading COEP Satellite Initiative CSAT, In 2008 the club was initiated under her able leadership and in 2016 COEP's First satellite SWAYAM (India's first passively stabilized student satellite) was launched into Space on board PSLV C 34. It was first end to success, student satellite which completed its mission life of 1 year before killing it successfully by the team. The work continued further and soon 2 more payloads will fly into space under her leadership. Her most significant contribution is; she instated on documentation of student's research logs, participated in the process of new student's induction, maintained continuity in the long term research project, conducted periodic reviews of each subsystem, developed and nurtured the culture of multidisciplinary undergraduate research among the team members of team CSAT. Over the years more than 200 students have worked in CSAT team, they have presented more than 35 research papers in various national and International Astronomic al Congress events and International Journals. She has been the catalyst which inspired more than 50 students to pursue Master's degree and doctoral degree from USA, EU and higher learning institutes in India, and the tradition continues year after year.

She has organized 4 National Conferences in the capacity of Organizing secretary, participated in more than 20 National and International Conferences and Presented papers, Chaired sessions, given Keynote addresses. She has organized more than 25 Faculty development programs since 2006 in various areas of Technical and managerial skills development, Softskills development, Interpersonal skills etc. She has been a constant member of women cell, Internal complaints committee, vigilance committee She has been active member of Sharda Shakti Pune since 2008 and through Sharda Shakti organized various events for Women, Students in the area of awareness programs on Pollution, conservation of resources, Energy generation, Electricity conservation, Carbon footprint, water footprint etc. She has delivered several talks, conducted seminars and workshops on collaborative, participative, long termteam research.

She has been awarded by many organizations like CEDA(Centre for Education Development Administration), CII, FICCI, ACMA, VigyanBharati and Marathi VigyanParishad Pune, GYTI (Gandhiyan Young Technology Innovation counsel), Vedh Pune, Pune Municipal Corporation, DRDO, SantEeshwarSevaSamman from SantEshwar Foundation, Companies like L&T John Deer, Tech Mahindra, Infosys, TCS foundation.

Manasi Deshpande

Professor & HOD, Dravyaguna Vigyan [Medicinal plants] Bharati Vidyapeeth, Deemed to be University, College of Ayurved, Pune

Prof. Dr. Manasi Deshpande is currently serving as Professor and Head of Department of DravyagunaVigyan, Bharati Vidyapeeth Deemed to be University, College of Ayurved, Pune, Maharashtra, India. She was born on 8th August 1965. She completed B.A.M.S. in 1987 from Gulabkunvarba Ayurved Mahavidyalaya, Jamnagar, and M.D. Dravyaguna in 1991 from Post Graduate Teaching and Research Institute, Gujarat Ayurved University, Jamnagar. She obtained her Ph. D. in 1999 from University of Poona, Pune.

After completing her M.D course she was selected for the post of assistant professor and she started her teaching career in higher education in the year 1ST August 1991.She has a teaching experience of 29 yrs of Ph. D. P.G and U.G. classes.

She has worked on critical review of various plant products to provide and hypothesize how drugs act giving a general as well as specialized relevance to areas such as liver diseases, and various classifications of Charak&Sushrut. As a Ph. D. coordinator, she has developed syllabus and ethic related regulations for research scholars. 34 PG and 04 Ph.D. research scholars have completed various research works through multi-disciplinary approaches in the areas of literary, fundamental and survey study under her guidance.

A strong proponent of integrating knowledge base with teaching, research and translational approaches she has published 04 books, and several papers in national and international journals. Two major and two minor research projects have also been completed by her. She has represented Ayurveda at several national and international delegations and served as an organizing secretory to various committee members.

She was nominated as Dean, BOS, faculty, and an academic council member to BVDU and has also served as an expert for committees of several other organizations. She is presently a coordinator of Internal Quality Assurance Cell and NAAC.

Her academic efforts have been recognized by several awards such as Best teacher Award in Literary Research Teaching in the field of Ayurved by Central Council for Research in Ayurvedic Sciences, Acharya award from Central Council of Indian Medicine, New Delhi, the Best Researcher Award from BVDU, Pune, Rula Innovative Researcher in Ayurved, the Life time achievement by Sheth brothers, Bhavanagar.

As a social responsibility, she is participating in various activities conducted by Vigyan Bharati, Sharada Shakti, and the Rotary club. Currently she is serving as a Joint Secretory of Sharada Shakti and a Secretary General for IASTAM India.

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ASHA GUPTA

D.Sc. from Moscow University, U.S.S.R, Environmental Scientist .Worked on Carbon Sequestration in Forests, Climate change vulnerability and adaptation. Organised International Workshop on Matrix models at Florence, Italy.Organized International Conference on Natural resources management. Editorof thirteen books.Borne on 12 May 1952, in a middle class family of school teacher atMandla,Madhya Pradesh.Dr Asha Gupta, M.Sc, M.Ed., Ph.D., D.Sc. (Moscow University)Retired Prof Centre of Advanced Study in Life Sciences, Deptt of Life Sciences Manipur University, Imphal is a prolific writer with publications in journals of repute.

Education

Graduated from Hislop College,Nagpur and completed her Master's Degree in Botany with specialization in Forest Ecology withFirst Division from Saugor University,Sagar. She obtained her Doctoral degree from Nagpur University in 1981 for which she did her research work at Deptt.of Botany,Institute of Science, Nagpur.All India Radio,Nagpur Station recognised her talents and broadcasted regularly plays and short stories written by her. Shestarted her first job at Nehru Memorial Model Junior College at Sitabuldi Nagpur as a Biology teacher in1979.

Contribution

She was recipient of prestigious USSR Higher Education fellowship Award from Ministry of Higher Education, USSR (1986-1990) and was selected by Ministry of Higher Education,Govt of India for post doctoral studies on the Subject Systems Ecology with the topic Modelling in Ecosystems. She worked at Moscow University and with dual specialization in Natural Resource Management and Ecology,obtained her D.Sc. Degree in1990.At Moscow University she was deeply involved in activities of Indian Scholars Association and publication of Research Journal.She has visited ,Finland and France, as a post doctoral scholar for presentation of papers representing the Deptt of Ecology ,Moscow University, USSR.

After her return to India , she joined as Assistant Professorin Manipur Universityat Department of Life Sciences,on 5th September 1995and retired in 2017 as Professor.She was in Charge of the Special Assistance Programme in Centre of Advanced Study in Life Sciences on Carbon Sequestrationin Forests and headed Ecology Section.She is connected in various capacities to Universities of NE India ,besides a number of Central,South Indian and North Indian Universities for M.Sc. and Ph.D.programmes.Also,recognised as examiner for NET examination in Environmental Sciences. She supervised twenty Ph.D. scholars and trained batches of students and oriented them towards environmental journalism.

Social impact of work

As President of Manipur University Working Women's Association launched a newsletter dealing with working women's

issues, laws related to women,awareness about social issues etc. and organised important programmes and awareness events on health,academic excellence,yoga and climate change vulnerability and adaptation etc. Also, collaborated with community members, media personnel, young scholars , bureaucrats and leaders about the local and global environmental issues.Ashawas invited in a number of countries on academic visitslike Japan, Thailand, Singapore, Belgium, Polland, Germany, Netherlands, Italy,Australia and Bangladesh.She was organizer of many National seminars,workshops,conferences on environmental issues,biodiversity conservation and sustainable development, global climate change ,Advances in Life Sciences ,Carbon sequestration in terrestrial and aquatic systems. She conducted UGC sponsored refresher and orientation courses on environmental education, biodiversity conservation ,Natural Resources and Sustainable Development, Global Climate change , Intellectual Property Rights, Disaster Management, etc.

She organized International workshop on Matrix models in Ecology at Florence ,Italy(1998) at the International Congress of Ecology(INTECOL) with its Proceedings got published from Netherlands. .Besides she organized International Conference on Natural Resources Management and Technology Trends (ICNRM,2017) at Manipur University . .She is editor of thirteen books viz.Advancing frontiers of ecological researches in India , Biodiversity conservation and legal aspects and Ecorestoration and Biodiversity Conservation, Biodiversity Utilization and Conservation, Ecoplanning, Biodiversity and Climate Change, Perspectives in Science , Perspectives in Culture, Integrated Farm Management , Global warming ,climate change ,Indigenous Knowledge and Plant Utilization ,Water Pollution,Biodiversity appraisal ,conservation and management , Medicinal plants-Exploration and Evaluation and author of a monograph on Lemanea in Lotic Environment of Manipur,North East India published from Germany.

Awards and Achievements

She is Life Member of Indian Science Congress Association,a premier Scientific Organisation of the country and executive member of ISCA-ImphalChapter, Life member of International Society of Natural Scientists, Life member of International Society of Ecology and Environment etc. She is thereviewer and expert for publication in Academic Press and Springer journals .

She was awarded BirbalSavitriSahani Plaque and gold medal for enhancing the Science of biodiversity conservation. Her name is notified in the gazetteer of India as an expert in State Environmental Appraisal Committee (SEAC) from Manipur for the second term. She worked as PrincipleInvestigator for Projects sponsored by DST.DBT.CSIR.Forest Deptt,Govt of Manipur,National Bamboo Mission,Indo-Canadian Facility and Loktak Development Authority,WWF-India,Manipur Biodiversity Board etc. She is elected as fellow of Asiatic Society,Kolkata , a premier organization of India in 2018 in Science.

Aarti Ashok Saoji

Dr. (Mrs) AartiSaoji former Director of Institute of Science, Nagpur is an eminent environmental Scientist still actively engaged in research work, for the betterment of mankind. Pioneer in establishing subjects Palynology and Aerobiology in R.T.M. Nagpur University at PG and research level. Recipient of UGC and Senior C.S.I.R. fellowship, she supervised 23 research students for their Ph.D. and published 81 research papers in national and international journals, contributed a lot to the field of aerobiology so that her name is included in the "galaxy of aerobiologist" by Dr. S.T. Tilak, father of Indian Aerobiology in his book, 'Genesis of Indian Aerobiology'.

Education

Aarti did her B.Sc. in 1966 from Wardha and M.Sc. in 1968 with distinction at Institute of Science, Nagpur andlater Ph.D. in 1973 under Dr.Mrs.ShyamalaChitale, Scientist of international repute, who resided in USA after her retirement for 35 years. Dr.AartiSaoji completed electron microscopic course in England and worked with Prof. H.E. Street on Electron Microscopy (EM) of Atropabelladona pollen in tissue culture at Leister (UK) in 1972-73. She is fellow of Indian Aerobiological Society and fellow of Linnean Society, London.

Selected through M.P.S.C. she jointed Institute of Science, Nagpur as Lecturer in 1974 then became reader in 1986 and Professor in 1998. She retired from service as HOD, Botany and Director of Institute of Science, Nagpur in 2005. She joined Department of Botany R.T.M. Nagpur University Campus in 2006 as visiting professor and still engaging PG classes in Botany and Molecular Biology. She visited various countries abroad as U.S.A., England, France, Germany, Rome, Italy, Belgium, Singapore, Malaysia, Switzerland and Netherlands.

Contribution

Mrs.Saoji carried out research activities constantly during the span of her service period. She is Principal Investigator of research project from M.O.E.F., New Delhi for preservation of rare and endemic species in botanical garden and another research project from U.G.C. on Penicillium:- Detailed study of intramural and extramural environment of Nagpur. Acted as expert for D.S.T., C.S.I.R. Projects, evaluated Ph.D. Thesis from various universities of India including Kolkata, Bangalore, Kolhapur, Pune, Nanded, Aurangabad, Mumbai etc.

Social impact of work

Being active member of "Pratibha Shakti" working since the inception of the Nagpur Shakti Branch delivered no.of lectures , editor of souvenir "WESAT" national conference on Women Entrepreneurship through science and technology, Nagpur (2012). She was also convenor of National Conference on occupational health hazards and its holistic management (2018) at NCOH Nagpur.

Aarti is a president of SRII organisation established by her guide Dr. S.D. Chitaley and also chief editor of UGC sponsored scientific journal "The Botanique" since 1998. Published 21 volumes of the journal.

She deliveredno.of lectures in conferences, radio talks at refresher / orientation courses on various topics such as electron microscopy, mushroom cultivation, allergy, tissue culture, women power, biodiversity, science and peace.

Under awareness program she delivered 22 lectures on various aspects of global warming at different colleges in Nagpur and vicinity, in conferences, at Indian Science Congress, Jammu, and also in famous lecture series "Dnyan-yoddha" where she also delivered lecture on evolution of plant also. Special lecture of mass awareness was conducted on global warming, its impact and remedies in front of 1500 people on open ground at Karanja (Lad) Dist. Washim, in 55 years old lecture series "SharadVyakhyanmala".

Aarti developed her interest in Homeopathy and studied it thoroughly and help needy people. She passed yoga pravesh exam with distinction, attended two RamdeobabaShibir and started free yoga class in her colony since 15 years and taught yoga to nearly 300 persons.

Awards and Achievements

"Best presentation of Maharashtra team award" at the conference on 'Impact of Health culture' organised by Shakti, Raipur in July 2018.

Aarti was invited as a lead panellist in Environment Session alongwith two foreign delegates at "Utkarsh" international conference organized by PUSA Institute, New Delhi in 2018.

Recipient of BirbalSavitriSahni Medal and a plaque as a life time achievement award by BirbalSavitriSahni Foundation, Luckhnow in 2008.

Life time achievement award conferred upon Dr.Aarti for outstanding contribution in subject Botany at 1st International conference on Science, Engineering and Technology for academicians I.C.S.E.T. - 2015, at Birla Institute of Technology, Dubai (U.A.E.).

She was Honoured by offering Sreeramloo Oration at 21stNational Conference on Aerobiology atVisva-Bharti Shanti Niketan, West Bengal 2019.

Jayashree Pendharkar

She is immensely involved in spreading the importance of health and food. She strongly believesthat from hair to nail everything is related to food you eat. Diseases appears due to nutritional deficiencies for long period of time, due to processed foods, fast foods, refined foods, pollution irregular life style, etc

Education

After that she did B.Sc. Science from Govt. Science College, Nagpur ,post graduation in Biochemistry from Post Graduate, Dept. of Biochemistry, Nagpur University. She got 5th position amongst 12 students.

She was a part-time lecturer in Biochemistry in Govt. Ayurved College, Nagpur for one year in 1966. During that period she was the Manager of Nagpur University Women Kho-Kho team.

Contribution

She has taught in schools at Bagdogra, Mumbai, Delhi for around 7 years, all most all subjects mainly Science, Maths. She used to help her students to prepare projects especially on Nutrition. With allthis she has collected interesting experiences of life, people, nature, culture etc. During Bagdogra stay she got an opportunity to carry out 5 days Nutrition Education Programmes in Tata Tea Gardens for the wives of the managerial staff of Tata Tea Gardents - in Rungamatti and Hatikuli. It was an unique experience of observing the life of Tea Garden people, the poverty, illeteracy. She says there is extremeprotein mal-nutrition.

Social Impact of Work

During all this she used to visit Slums, Anganwadies, Schools on invitation by NGOS & many institutions etc. She has attended variety of health camps in and around Nagpur. Elsewhere also she has been doing demonstrations, slide presentations etc. She has made a Health Pyramid out of iron rods. In which she depicts the right foods and balance food. Her targets for nutrition education are young girls, school children, women especially working women, pregnant womens.

She prepared 35-40 hand made diet charts all by herself. She used to display them during lectures, seminars, workshops. Many a times, fresh diets used to be displayed even sweets for Diabetics. Now she has converted them to flex charts. She has so far delivered, more than 1500-1600 lecture, presentations, demonstrations - from slums to scientific workshops, seminars in and around Nagpur in very many cities. She is working in Central India Institute of Medical Sciences, Bajaj Nagar. Nagpur. Since 28 years as Diet Consultant and now has specialised in Ryle's tube feeds for comatous patients. They are prepared from natural grains, washed, sprouted, dried, roasted and powdered. She is getting good response even after the discharge of patients. So far 6 such formutation have been prepared with her assistant. The formula feeds available in the market are not natural and are devoid of fibre and roughage which is an essential non nutri-

ent. The feeds made by madam has all the nutrients and enough roughage.

Achievements

She has been regularly writting about health and nutrition and other topics also in English, Hindi, Marathi News Papers, Magazines, journals etc. So also giving interviews on Doordarshan about foodand nutrition. So far she has written and published 12 books and booklets in Marathi and Hindi on health and diet.

She is publishing "Yograj" magazine in Marathi for last 20 years. about Sanskar Culture Yoga health and another magazine "Matrusewa" for last 8 years of MatruSewa Sangh, a100 years old NGO - about mother and child's health, and about courageous extraordinary ladies. She is Vice President of MatruSewa Sangh, Nagpur and other organisations too. Executive Member of other NGOS. She was also the member of Independant Ethical Committee, Mishel Foundation, Nagpur. She was on syllabus forming Committees of Medical University, Nashik and Kavi Kulguru Kalidas Sanskrit Vidyapeeth, Ramtek, Nagpur and proposed Diploma courses in Dietetics and for Pune University MSc. in Public Health Nutrition.

She has received four awards (1) Sakhi Gaurav, Lokmat, Nagpur in 2010 (2) Stri Shakti Samman in Raipur M.P. in 2009 (3) DeerghayuStri Shakti Samman, Pune (M.S.) (4) Ahilyabai Holkar Puraskar, Maharashtra in 2015.

Suneeta Patra

Dr. Suneeta (Das) Patra was born on 08 August 1966. She was blessed to have Dr. J.N. Das as a very disciplined, devoted and dedicated father. He was a reynold physicist and retired from Govt. N.P.G college of science Raipur, Chhattisgarh as principal. She was married to Dr Pradeep kumar Patra (M.D.) at present Dean CIIMS Bilaspur C.G.

Dr. (Smt.) Suneeta Patra did H.S.S.C. in 1983 , B.Sc. in 1986, M.Sc. in1988 with 2nd position in merit list with Specialization in Biotechnology and M. Phil in 1989 with first position in merit list . While perusing M. Phil she got IInd Prize in poster presentation in National Science day, Sponsored by (MAP-COST), 28 April 1989, Pt. R.S.U. Raipur. She qualified NET in 1989 (Joint CSIR/UGC test for eligibility for Lectureship in Life science) She was awarded Ph.D. in field of plant breeding and genetics in 20.11.2006. She also did diploma in French in1989 and diploma in sericulture in 1990. After completing her M. Phil course she was selected for the post of assistant professor and she started her teaching career in higher education in the year 30-12-1989.She has a teaching experience of 30yrs of P.G and U.G. classes. She successfully completed two research projects as principal investigator of CGCOST. One of her research projects was on "Screening of anti-sickling property of some plants used for the treatment of sickle cell anaemia. Sickle cell anaemia is very prevalent in Chhattisgarh state ,keeping this in mind she selected this topic for her project work which is directly related to the community suffering from this genetic disorder.

Under her supervision/co supervision 08 students successfully completed their research work and were awarded Ph.D.

She has published 48 research papers in various national and international journals. She had visited Australia for presentation of her research work in 14th Australasian plant breeding conference (APBC) & 11th Congress of the Society for Advancement in Breeding Research in Asia & Oceania Conference (APB & SABRAO 2009) 10-14 August 2009, Cairns, Australia and Kingdom of Bahrain for International Conference on Sickle cell Disease-Management and prevention in Feb 4- 7 2013, Besides this she has participated in various national and international workshops, conferences/ seminars and presented her research papers. She has been honoured as Fellow Indian Botanical Society (FBS) for her contribution in the field of Biotechnology. She is a life Members of SCDIO (Sickle cell Disease International Organization) which serves for people suffering from sickle cell anaemia world wide. She also has life Membership of ADNAT (Association for promotion of DNA finger printing and other DNA technologies). She is life Membership of Indian Botanical Society (IBS) and Indian Chronobiological Society. She has been invited as Guest Speaker and as a chair person in the seminars /conferences.Her areas of interest are Biotechnology, Molecular Biology, Microbiology, Cytology & Genetics.

Rupinder (Arora) Diwan

Dr. (Mrs.) Rupinder (Arora) Diwan was born on 09th of June, 1959 in Patiala (Punjab). She was blessed to have a very educated and industrious family.

Her father late Shri Balwant Singh Arora settled in Raipur (Chhattisgarh). Her two brothers servd in central government jobs. One of her brother late Shri Tejinder was a well known Hindi writer and novelist retired as Deputy Director General, Doordarshan from Raipur in 2010. Her husband Shri Samir Diwan is in the field of journalism, a novelist and writer in Hindi & English as well.

Dr (Mrs.) Rupinder Diwan did her M.Sc. in Botany in 1981 with 9th position in order of merit with specialisation in Plant Pathology. She was awarded Ph.D. on 02.04.1985 in Bioscience from Pt. Ravishankar Shukla University, Raipur. She reported 14 new host pathogen relationships in leafy vegetable crops while doing her research work. She also did one year diploma course in German Language in 1984 from Pt. Ravishankar Shukla University, Raipur where she stood first in the order of merit.

Dr (Mrs.) Rupinder Diwan was selected as Assistant Professor (Adhoc) in Botany by Higher Education, Bhopal (M.P.) and joined Govt. Job on 19.09.1985, where she was upgraded as senior scale and selection grade in the years 1992 and 1998 respectively. She was promoted as Professor in August 2006. She has a teaching experience of more than 34 years.

Dr (Mrs.) Rupinder Diwan is actively engaged in research work for over more than 35 years in the fields of Plant Pathology, Microbiology and Seed pathology. Besides she has covered other areas of research like agricultural Science and Mushroom production & cultivation.

Under her supervision 09 students successfully completed their research work and were awarded Ph. D. Degree. She has published 45 research papers in various national and international journals of which several papers have been presented in different conferences & Seminar. She has participated in various national and international symposia/ workshop/ Seminars and conferences. She has been invited as a Guest speaker and as a chairperson in seminars and conferences.

Dr. R. Diwan has also written 05 books in Botany Theory and Practical for undergraduate classes and 01 book in Biology of Higher secondary level. She has been honoured as Fellow of Indian Botanical Society (FBS) for her contribution in the field of Botany. Besides she also been engaged in several social activities as well, National Literacy Mission being one of them during 1988-1989.

Anjali Oudhia

Dr Anjali Oudhia is born and brought up in Chhattisgarh. She has a vision to contribute to higher education and research through academic leadership by grooming youth to realize their full potential, to develop a firm value system and execution of social responsibility. As an educator, her motto is to develop processes of a continuous professional development process for the academic fraternity, and achieve academic excellence for the society as a whole.

Education

She is the Physics topper in PSC (AP) 1993, and was appointed as Asstt. Professor at Govt college, Balod (CG), a gold medalist in M. Sc. Physics and silver medalist in graduation, received university merit scholarships throughout her academic career. She completed her PhD with a UGC Teacher Fellowship in 2009

Contribution

Her 30 Years of teaching experience has earned her excellent communication skills through teaching courses like quantum mechanics and materials science, which have enhanced critical thinking skills and has given an ability to thrive in a challenging environment.she has above 50 publication in high impact journals, and has published two books till now. Drive and determination to work on own initiatives resulted in successful completion of major/ minor projects funded by UGC and CCOST and many more inhouse projects. She was appointed as referee in Elsevier journals eg. She has been working towards creating an ecosystem within her institute for Skill Development and deep learning.

Social impact

Currently, apart from research, she has been engaged in a self driven project on linking science with philosophy. She has been creating you tube videos on fundamental scientific concepts and trying to bridging the knowledge gap, in order to develop an insight into the scientific principles in the light of ancient wisdom and finding a balance between the two of them. This will not only create a paradigm shift in the fundamental understanding of science, but also generate a new set of pedagogical tools to teach science in right perspective.

Sampa Das

Sampa Das is a renowned Indian plant molecular biologist, and an expert on public sector agricultural biotechnology. She is a fellow of the Indian National Science Academy (FNA), The National Academy of Sciences, India (FNASc) and West Bengal Academy of Science and Technology. Currently, she is an INSA Senior Scientist at Division of Plant Biology, Bose Institute in Kolkata, which is a multi-disciplinary research institution focused on science and technology.

After her post graduation in Botany she joined Bose Institute for pursuing Ph.D. Dr. Das received her doctorate degree in 1981 working under the supervision of famous Plant Biotechnologist, Prof. S.K.Sen. Das has worked with national and international individuals studying the mechanisms of plant defence responses against pests and pathogens, with an aim to combat their stress. She did her post-doctoral training at the Friedrich Miescher Institute in Switzerland, where she became interested in applying plant transformation technology in rice, mustard, and tomatoes.

Thereafter, Dr Das became a faculty member of Bose Institute. She expanded her research on plant genetic engineering in rice, mustard, chickpea and pigeonpea to improve their quality and quantity of the produce. In an aim to do so she started isolating, characterising and monitoring the functionality of insecticidal, plant defence response related and other useful genes from various plant sources and finally expressed them in target crop plants. After some success in this direction with the help from Department of Biotechnology, Govt of India, she developed licence agreement of her technology with renowned seed industries.

She has worked on development of insect resistant transgenic rice, chickpea and mustard plants free of antibiotic resistant selection marker gene through the expression of mannose binding monocot plant lectins and different Bt toxin genes. She has studied the molecular interaction between receptor proteins identified from target insects and insecticidal lectins as well as different Bt proteins.

Das has also worked on developing understanding of the mechanism of defence response in plants when challenged by various fungal and bacterial pathogens. Isolation and characterization of differentially expressed defence response related genes, proteins from chickpea and rice plants detected at early stage of infection by Fusarium oxysporum f.sp.ciceris and Xanthomonas oryzae, respectively are her significant achievements.

Apart from her own research activity Das also worked for other academic and administrative responsibilities. She served as Head of the Department at Bose Institute for nine long years and during her tenure she introduced an integrated M.Sc.-Ph.D. Programme in Plant Molecular Biology and Biotechnology for the first

time at Bose Institute in collaboration with Calcutta University which was further expanded in due course.

In 2009, she became a fellow of the Indian National Science Academy and in the same year she also became a fellow of the National Academy of Sciences, India. She is also a Fellow of West Bengal Academy of Science and Technology.

As of now she has published more than eighty research articles in reputed international and National Journals. Twenty four researchers got Ph.D. degree under her supervision who are well placed in academic or industrial organisations across India and abroad.

Pritha Bhattacharjee

Dr. Pritha Bhattacharjee, Assistant Professor, Department of Environmental Science, Calcutta University. She is teaching here for last 8 years. She did her MSc in Zoology, 2002, awarded CSIR-NET in the same year and joined CSIR-IICB for PhD in Human Molecular Genetics, where she developed her passion for studying Environmental Health at cellular and molecular level. She was dedicated to her research and received series of fellowship from CSIR- Extended SRF, Research Associate fellowship and Pool scientist positions during her a decade experience in CSIR-IICB. CSIR-IICB environment and encouragement developed her skill and transformed her an independent faculty. She joined Calcutta University again and now as a faculty in Dept of Environmental Science. She makes a balance in teaching and research. Major focus of her research lies with environmental epigenetics, Occupational health, Lifestyle disorders and in silico based prediction analysis. Dr Bhattacharjee has authored/co-authored in 55 International journal publications with 1584 total citations and h-index 19. She wrote several book chapters and contributed a text book for undergraduate students in vernacular language on Environmental Studies.Dr. Prithaserve as editorial board member and reviewer of a number of International journals. One candidate awarded PhD, three candidates submitted their thesis, two completed pre-thesis and others are working under her guidance.

Swapna Mukherjee

Swapna Mukherjee was born in Howrah, West Bengal on January 11, 1944. Her foremost interest is to study the basic problems with data systematics and apply analytical techniques and largescale data handling for useful purpose.

Education

After completing her school education in Howrah joined Scottish Church College, Kolkata, and received the honours in physics in 1963 with Rajani Kanta De award and subsequently completed her M. Sc in Physics in 1965 from Presidency College, Calcutta University. She was deeply interested in pursuing higher education and joined Saha Institute of Nuclear Physics, Kolkata for her Ph. D in Nuclear Physics and got her Ph D degree in 1972. The post-doctoral work in Europe with a prestigious fellowship of International Atomic Energy, exposed her in the applied field of handling different analytical data.

Contribution

Subsequently her research work was applied towards both industrial and academic fields e.g. marine geology, cement, bauxite and various other directions which has been reported through published papers in international journals, symposia, conference proceedings and lectures. She was attached to the geological Survey of India for more than 30 years and retired as a senior director. As a member of the advisory board of the University Science I& Instrumentation center of Gauhati University she helped to develop the centre for a long period of time. Subsequently she devoted her time in delivering lectures at different national universities particularly in Kolkata and north eastern region along with writing books on mineralogy and clay science for the benefit of students and research workers and published already three books with one more in process. She had a keen interest in developing schemes for the upliftment of scientific awareness among students of different levels in general.

Social impact

She applied the neutron activation technique to characterize geological samples with success which was well appreciated in international Scientific community. Subsequent to her return, she joined Geological Survey of India as a Mineralogist in the Mineral physics division and devoted her work on identification and characterization of minerals, both off shore and on shore of geological samples using several analytical techniques.

Shyamali Ghosh

Date of Birth: 24.10.1951, Kolkata, School: St. John's Diocesan Girls' Higher Secondary School, Kolkata, 1968.

B.Sc in Chemistry Honours from Presidency College, Kolkata, 1971

M.Sc in Bio-Chemistry, university of Calcutta, 1973.P.hD in Biochemistry from Bose Institute, Kolkata, 1983.

Reader in Chemistry, Jogmaya Devi College, Kolkata till 1998.

Senior Scientist in deCode Genetics Inc. in Reykjavik, Iceland till 2008

Project Manager in Icelandic Red Cross till 2016.

List of last few publications are below:

1. **A common inversion under selection in Europeans.**

Stefansson H, Helgason A, Thorleifsson G, Steinthorsdottir V, Masson G, Barnard J, Baker A, Jonasdottir A, Ingason A, Gudnadottir VG, Desnica N, Hicks A, Gylfason A, Gudbjartsson DF, Jonsdottir GM, Sainz J, Agnarsson K, Birgisdottir B, Ghosh S, Olafsdottir A, Cazier JB, Kristjansson K, Frigge ML, Thorgeirsson TE, Gulcher JR, Kong A, Stefansson K. Nat Genet. 2005 Feb;37(2):129-37. doi: 10.1038/ng1508. Epub 2005 Jan 16.

PMID: 15654335

2. **Neuregulin 1 and susceptibility to schizophrenia.**

Stefansson H, Sigurdsson E, Steinthorsdottir V, Bjornsdottir S, Sigmundsson T, Ghosh S, Brynjolfsson J, Gunnarsdottir S, Ivarsson O, Chou TT, Hjaltason O, Birgisdottir B, Jonsson H, Gudnadottir VG, Gudmundsdottir E, Bjornsson A, Ingvarsson B, Ingason A, Sigfusson S, Hardardottir H, Harvey RP, Lai D, Zhou M, Brunner D, Mutel V, Gonzalo A, Lemke G, Sainz J, Johannesson G, Andresson T, Gudbjartsson D, Manolescu A, Frigge ML, Gurney ME, Kong A, Gulcher JR, Petursson H, Stefansson K.

Am J Hum Genet. 2002 Oct; 71 (4): 877-92. doi: 10.1086/342734. Epub 2002 Jul 23.

PMID: 12145742 Free PMC article.

3. **Multiple novel transcription initiation sites for NRG1.**

Steinthorsdottir V, Stefansson H, Ghosh S, Birgisdottir B, Bjornsdottir S, Fasquel AC, Olafsson O, Stefansson K, Gulcher JR.

Gene. 2004 Nov 10;342(1):97-105. doi: 10.1016/j.gene.2004.07.029.

PMID: 15527969

4. **Common sequence variants on 2p15 and Xp11.22 confer susceptibility to prostate cancer.**

Gudmundsson J, Sulem P, Rafnar T, Bergthorsson JT, Manolescu A, Gudbjartsson D, Agnarsson BA, Sigurdsson A, Benediktsdottir KR, Blondal T, Jakobsdottir M, Stacey SN, Kostic J, Kristinsson KT, Birgisdottir B, Ghosh S, Magnusdottir DN, Thorlacius S, Thorleifsson G, Zheng SL, Sun J, Chang BL, Elmore JB, Breyer JP, McReynolds KM, Bradley KM, Yaspan BL, Wiklund

F, Stattin P, Lindström S, Adami HO, McDonnell SK, Schaid DJ, Cunningham JM, Wang L, Cerhan JR, St Sauver JL, Isaacs SD, Wiley KE, Partin AW, Walsh PC, Polo S, Ruiz-Echarri M, Navarrete S, Fuertes F, Saez B, Godino J, Weijerman PC, Swinkels DW, Aben KK, Witjes JA, Suarez BK, Helfand BT, Frigge ML, Kristjansson K, Ober C, Jonsson E, Einarsson GV, Xu J, Gronberg H, Smith JR, Thibodeau SN, Isaacs WB, Catalona WJ, Mayordomo JI, Kiemeney LA, Barkardottir RB, Gulcher JR, Thorsteinsdottir U, Kong A, Stefansson K.

Nat Genet. 2008 Mar;40(3):281-3. doi: 10.1038/ng.89. Epub 2008 Feb 10.

PMID: 18264098 Free PMC article.

5. A variant in CDKAL1 influences insulin response and risk of type 2 diabetes.

Steinthorsdottir V, Thorleifsson G, Reynisdottir I, Benediktsson R, Jonsdottir T, Walters GB, Styrkarsdottir U, Gretarsdottir S, Emilsson V, Ghosh S, Baker A, Snorradottir S, Bjarnason H, Ng MC, Hansen T, Bagger Y, Wilensky RL, Reilly MP, Adeyemo A, Chen Y, Zhou J, Gudnason V, Chen G, Huang H, Lashley K, Doumatey A, So WY, Ma RC, Andersen G, Borch-Johnsen K, Jorgensen T, van Vliet-Ostaptchouk JV, Hofker MH, Wijmenga C, Christiansen C, Rader DJ, Rotimi C, Gurney M, Chan JC, Pedersen O, Sigurdsson G, Gulcher JR, Thorsteinsdottir U, Kong A, Stefansson K.

Nat Genet. 2007 Jun;39(6):770-5. doi: 10.1038/ng2043. Epub 2007 Apr 26.

PMID: 17460697 Clinical Trial.

6. Two variants on chromosome 17 confer prostate cancer risk, and the one in TCF2 protects against type 2 diabetes.

Gudmundsson J, Sulem P, Steinthorsdottir V, Bergthorsson JT, Thorleifsson G, Manolescu A, Rafnar T, Gudbjartsson D, Agnarsson BA, Baker A, Sigurdsson A, Benediktsdottir KR, Jakobsdottir M, Blondal T, Stacey SN, Helgason A, Gunnarsdottir S, Olafsdottir A, Kristinsson KT, Birgisdottir B, Ghosh S, Thorlacius S, Magnusdottir D, Stefansdottir G, Kristjansson K, Bagger Y, Wilensky RL, Reilly MP, Morris AD, Kimber CH, Adeyemo A, Chen Y, Zhou J, So WY, Tong PC, Ng MC, Hansen T, Andersen G, Borch-Johnsen K, Jorgensen T, Tres A, Fuertes F, Ruiz-Echarri M, Asin L, Saez B, van Boven E, Klaver S, Swinkels DW, Aben KK, Graif T, Cashy J, Suarez BK, van Vierssen Trip O, Frigge ML, Ober C, Hofker MH, Wijmenga C, Christiansen C, Rader DJ, Palmer CN, Rotimi C, Chan JC, Pedersen O, Sigurdsson G, Benediktsson R, Jonsson E, Einarsson GV, Mayordomo JI, Catalona WJ, Kiemeney LA, Barkardottir RB, Gulcher JR, Thorsteinsdottir U, Kong A, Stefansson K.

Nat Genet. 2007 Aug;39(8):977-83. doi: 10.1038/ng2062. Epub 2007 Jul 1.

PMID: 17603485

7. Genome-wide association study identifies a second prostate cancer susceptibility variant at 8q24.

Gudmundsson J, Sulem P, Manolescu A, Amundadottir LT, Gudbjartsson D, Helgason A, Rafnar T, Bergthorsson JT, Agnarsson BA, Baker A, Sigurdsson A, Benediktsdottir KR, Jakobsdottir M, Xu J, Blondal T, Kostic J, Sun J, Ghosh S, Stacey SN, Mouy M, Saemundsdottir J, Backman VM, Kristjansson K, Tres A,

Partin AW, Albers-Akkers MT, Godino-Ivan Marcos J, Walsh PC, Swinkels DW, Navarrete S, Isaacs SD, Aben KK, Graif T, Cashy J, Ruiz-Echarri M, Wiley KE, Suarez BK, Witjes JA, Frigge M, Ober C, Jonsson E, Einarsson GV, Mayordomo JI, Kiemeney LA, Isaacs WB, Catalona WJ, Barkardottir RB, Gulcher JR, Thorsteinsdottir U, Kong A, Stefansson K.

Nat Genet. 2007 May;39(5):631-7. doi: 10.1038/ng1999. Epub 2007 Apr 1.

PMID: 17401366

8. **A common variant associated with prostate cancer in European and African populations.**

Amundadottir LT, Sulem P, Gudmundsson J, Helgason A, Baker A, Agnarsson BA, Sigurdsson A, Benediktsdottir KR, Cazier JB, Sainz J, Jakobsdottir M, Kostic J, Magnusdottir DN, Ghosh S, Agnarsson K, Birgisdottir B, Le Roux L, Olafsdottir A, Blondal T, Andresdottir M, Gretarsdottir OS, Bergthorsson JT, Gudbjartsson D, Gylfason A, Thorleifsson G, Manolescu A, Kristjansson K, Geirsson G, Isaksson H, Douglas J, Johansson JE, Bälter K, Wiklund F, Montie JE, Yu X, Suarez BK, Ober C, Cooney KA, Gronberg H, Catalona WJ, Einarsson GV, Barkardottir RB, Gulcher JR, Kong A, Thorsteinsdottir U, Stefansson K.

Nat Genet. 2006 Jun;38(6):652-8. doi: 10.1038/ng1808. Epub 2006 May 7.

PMID: 16682969

9. **Sequences from first settlers reveal rapid evolution in Icelandic mtDNA pool.**

Helgason A, Lalueza-Fox C, Ghosh S, Sigurethardóttir S, Sampietro ML, Gigli E, Baker A, Bertranpetit J, Arnadóttir L, Thornorsteinsdottir U, Stefánsson K.

PLoS Genet. 2009 Jan;5(1):e1000343. doi: 10.1371/journal.pgen.1000343. Epub 2009 Jan 16.

PMID: 19148284 Free PMC article.

10. **A statistical approach to identify ancient template DNA.**

Helgason A, Pálsson S, Lalueza-Fox C, Ghosh S, Sigurdardóttir S, Baker A, Hrafnkelsson B, Arnadóttir L, Thorsteinsdóttir U, Stefánsson K.

J MolEvol. 2007 Jul;65(1):92-102. doi: 10.1007/s00239-006-0259-8. Epub 2007 Jun 25.

PMID: 17593420

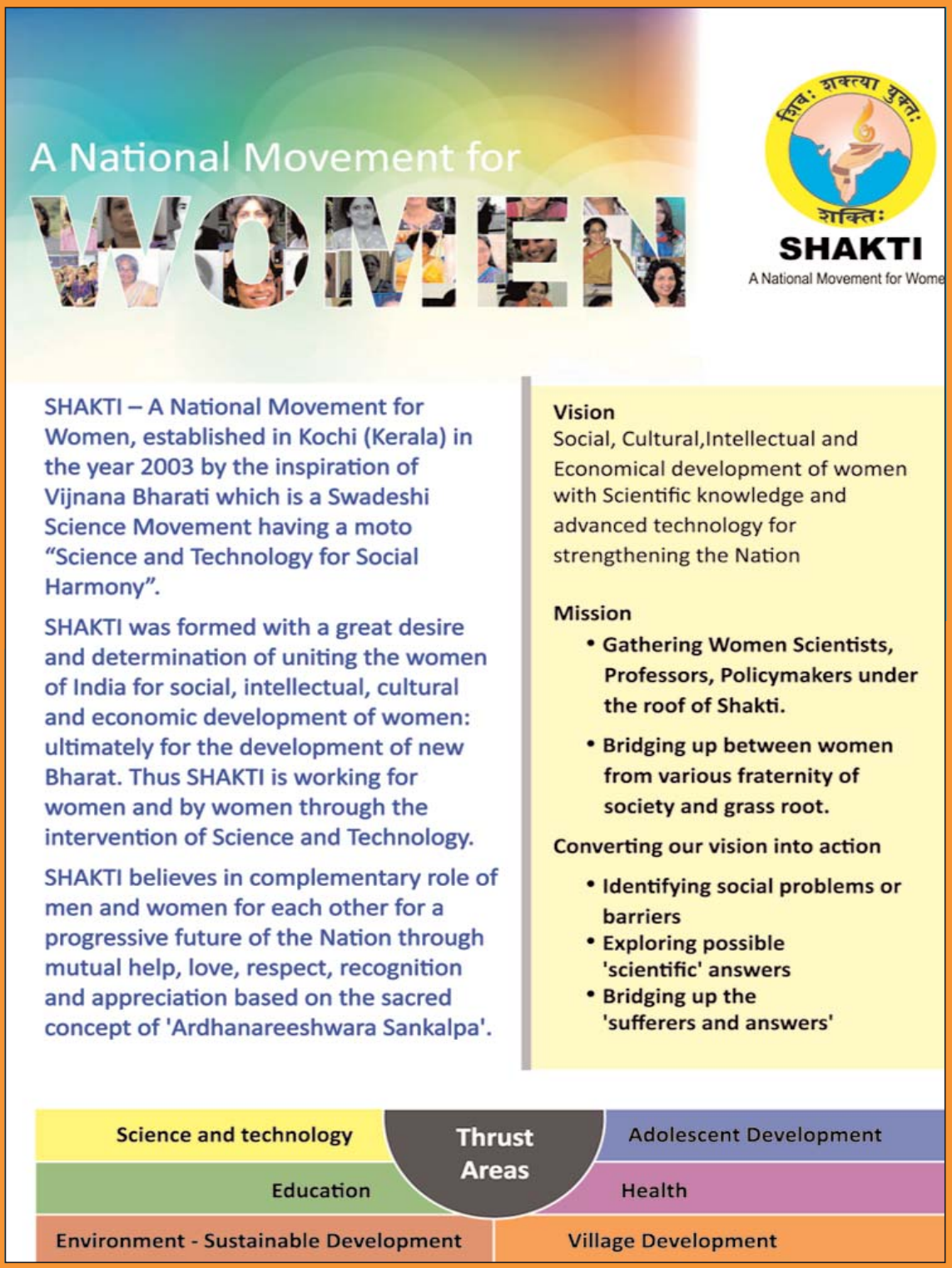
शक्तिगीत

विधातुं निजं राष्ट्रनिर्माणकार्यं
तथा चाबलां दोर्बलां तां विधातुम् ।
लसत्स्नेह सौहार्दरूपप्रतीकं
शिवं चार्धनारीशसंकल्परूपम् ॥१॥

जगत्यां चकास्ते नवं केन्द्रमेकं
यदत्राभवच्छक्तिनाम्ना प्रसिद्धम् ।
परिच्छिद्य पाश्चात्यतर्कं नवीनं
स्त्रियं जागृतां कर्तुमेतत प्रवृत्तम् ॥२॥

समाजं प्रकृष्टं विधातुं क्षमा या
नवं भारतं चित्रितुं च क्षमा या ।
भविष्यं समर्थं प्रकर्तुं क्षमा या
विकासार्थमस्याश्च शक्ते : प्रयत्न : ॥३॥

स्त्रियं शिक्षितां कर्तुमेतत् प्रवृत्तं
स्त्रियं प्रेममूर्तिं विधातुं प्रवृत्तम् ।
स्त्रियं चोन्नतं प्रापणार्थं प्रवृत्तं
चिरायुश्च भूयान्नवं केन्द्रमेतत् ॥४॥



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OBJECTIVES OF SHAKTI:

- To motivate women to realise their inner potential and utilise their capacities to serve for the society.
- To generate a strong motivation for the social, intellectual, economic and cultural upliftment of women.
- To create awareness about scientific knowledge and technological development by organizing training programs, seminars, workshops, orientation programs based on the recent developments in Science and Technology.
- To design and develop awareness activities about education, science, technology for sustainable development, environment, energy conservation, water conservation, health, hygiene, nutrition.
- To conduct surveys, studies and research addressing the impact of changing social scenario and the effect of technology on the financial, mental, social and health status of women.
- To undertake research and development project for sustainable development.
- To collaborate with like-minded voluntary organisations and institutions for spreading our vision on a large scale.
- To conduct training programs, seminars, workshops, orientation programs based on the recent developments in Science and Technology.
- To organise science fairs, exhibitions and competitions for educating and motivating the masses, particularly the younger generation.
- To publish newsletter, books and periodicals for women.
- To confer honours to women in Science and Technology for their social and National contribution.
- To help girls from underprivileged class for pursuing science for their higher studies1.

1) National Conference: Women Health- Challenges and Solutions 2015

2) SHAKTI -Rashtreeya AbhyasVarga2019

3) National Conference: WE MEET 2010

4) 1st State Conference of Shakti at Kochi Kerala 2004

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4

NATIONAL PROGRAMS of SHAKTI

Rashtriya Abhyas Varg-Orientation Program for state executive team conducted once in 2 years.

National Seminar and Workshop – Every two years.

Celebration of Some Special Days –

28 February: National Science Day is being celebrated by performing science activities such as science fairs, innovation competitions, deliberations, discussions and dialogue with women scientists.

22nd March : Shakti Sthapana Divas - all units are celebrating this foundation day with Eminent women personalities, representatives from NGO's. Their Shakti members congregate and deliberate their role in society. This day is being celebrated by ● Conferring **'SHAKTI Prerana Samman'** to a woman Scientist for her social contribution, ii)Conferring **'Swa-SHAKTI Sahayog'** award to an under privilege talented girl student who is interested in Science and innovations.

28 October : Samarpan Divas is being celebrated in the memories of Bhagini Nivedita, the disciple of Swami Vivekanand to ignite & spread feel of **'Service to Society'**. Initially, the 150th Birth Anniversary of Bhagini Nivedita was celebrated by all the units throughout the year from 2016 to 2017. The inauguration was done in Kolkata at **Indian Association for the Cultivation of Science** on 28 October 2016, and closing ceremony was at Mumbai in collaboration with SNDT University Mumbai on 28th and 29th Oct 2017 by organising A National Workshop on *Role of Women to Strengthen the Nation – In Perspective of Sister Nivedita.*

Vigyan Samvad : This is a platform of SHAKTI where stalwarts from various disciplines informally interact with ordinary people. It is a monthly activity of SHAKTI. The program aims at expanding the horizons of scientific knowledge to housewives, students and also to all who are all the way far away from this knowledge.

Yuva Shakti Abhiyaan– This program is specially designed for 8th -12th standard students for creating awareness about the. Another execution plan is to include a 7-day workshop for creating an overall awareness among young girls regarding studies, vocation, grooming, etiquettes, values and career. Individual sessions have been designed to address the career opportunities for their bright future.

E-learning program –SHAKTI conduct this programme to create digital awareness among self-help groups, homemakers and women at grass root level.

Women Health Activities – SHAKTI is taking care of physical and mental health of the women in our society. Two National Conferences have been conducted addressing physical, mental, social, nutritional and spiritual health issues of women. The women health issues like occupational health hazards, female foeticide, infertility, anaemia, adolescent heath addressed during these conferences have been undertaken by different units of Shakti to work on as pursual of the conferences.

National surveys - National surveys will be conducted to study the impact of technology on the social and economical status of women working in various professions.

Publication – 'PRAMA' is an Annual National Magazine based on social science which is continuing from the year 2011.