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Celebrating Centenarians 2022

VIGYAN PRASAR

Contents

Celebrating the Centenarians

Nakul Parashar

The year 2023 will coincidentally be the year of 23 centenarian Indian scientists par excellence. Come, let us celebrate their birth centenaries and tell our present and the next generation about them. Incidentally, our Hon'ble Prime Minister in his speech on September 12 at the national meeting of scientists & science ministers from all over the country at Ahmedabad emphasised the need to remember our scientists and tell about them to all in the country through effective means of SCoPE (Science & Technology Communication Popularisation & its Extension).

These 23 scientists are C. Ambasankaran, R.R. Daniel, E.H. Daruwalla, M.K. Dasgupta, Harish-Chandra, J.N., Kapur, C.R. Krishna Murty, R.N. Lakhanpal, Shankar Lal, A. Ramachandran, Alladi Ramakrishnan, M.R.N. Prasad, S. Ramaseshan, G.S. Ramaswamy, A.K. Raychaudhuri, T.K. Roy, S. Roy Chowdhury, M. Santappa, S.N. Ghosal, C. SivaRaman, B.C. Subba Rao, S. Swaminathan, and T.A. Davis. Besides being centenarians in common, these scientists are members of the Indian Academy of Sciences, Bengaluru. Although a brief about them is available on the IASc's website, we at Vigyan Prasar have planned to take these notable centenarians to the masses through all possible media types – print, electronic, digital and social. We plan to populate our OTT channel, IndiaScience with short films on each of them.

In fact, like last year, this year-long celebrations would commence on December 22, 2022, the National Mathematics Day. Vigyan Prasar, with its local partners across the nation, would also organise a national school-level quiz contest about the life & works of these centenarians.

Besides, as we come to the year-end, a recap of milestones is ceremonious. Vigyan Prasar ran past the 4,000 mark of producing popular science films of various sizes, now easily available at the IndiaScience OTT Channel. Just wondering if you have downloaded the free app on your mobile handsets; if not, please do to explore the wonderful world of interesting stories of S&T success. This year, IndiaScience productions also won two coveted Red Ink prizes for the year 2021. At Vigyan Vaibhav (the India Science & Technology Innovation) web portal, we achieved the record of aggregating more than 100,000 pages of relevant content for the masses, which again is freely available. On the print side, we produced more than 300 titles of popular science books at low-cost. India Science Wire, Indian S&T News syndicate for all media continued to produce more than 15 stories on an average every week. Amongst notable events that Vigyan Prasar organised nationwide were *Vigyan Sarvatra Pujyate* and *Swachh Sagar Surakshit Sagar*. Interestingly, both these events coincided with the 75th year of Indian independence celebrations – *Azadi ka Amrit Mahotsav*. Received amazingly well by the masses, these two programmes catapulted the organisation's position as the nation's nodal neutral agency for science & technology communication popularization and its extension, popularly known as SCoPE. Much more and thus, the list of milestones achieved by Vigyan Prasar in the year 2022 is long to be confined within a page, and I suggest our readers to visit our website.

Wishing you and your loved ones a very happy new year 2023.

Continue to think scientifically and act scientifically. •

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Cadamby Ambasankaran

Building a Life in Vacuum

Kollegala Sharma

All nation builders need not be the founders of elite institutions or huge firms. People who meticulously nurture a much needed field do also contribute tremendously to the progress of the nation. One such personality is Cadamby Ambasankaran, who nurtured new fields of engineering that were unheard of in pre-independent India and yet is hidden from limelight. Popularly known as Cadamby, Ambasankaran was an engineer who built foundations of disciplines such as vacuum engineering, cryogenics and other areas that were in high demand in the free India.

Cadamby Ambasankaran was born in 1923. He did his graduation from Christian College in Madras (now Chennai) and spent some time in India teaching physics. He then moved to Manchester, the then industrial hub in United Kingdom to join the research division of Associated Electrical Industries. During the three years he was in Manchester, Ambasankaran learned the ropes of designing Linear accelerators and Synchrotrons, the essential tools then for understanding the constitution of atoms and matter.

He returned to India in 1957, a time when his expertise was much needed here. It was just three years since the establishment of the Atomic Energy Division established by Homi J. Bhabha. Work on developing nuclear reactors were in full swing, and his experience in accelerators and synchrotron was utilised. Joining India's fledgling nuclear programme, Ambasankaran not only helped build the first reactor but also contributed to development of a host of other related technologies.

One of the technologies that has etched his name in Indian industry is the Vacuum technology. In the fields of vacuum and ultra-high vacuum technologies, he led the development of a wide range of components and devices, such as diffusion pumps, ion pumps, absorption pumps, thermal conductivity gauges, ionization and discharge gauges, leak detectors, vacuum control valves, and vacuum fluids making India self-sufficient in the field of vacuum technology. This led to advances in related fields such as the manufacture of vacuum flasks, TV tubes, and pharmaceuticals. In fact, realising the potential of the field, he brought together industry and researchers to form the Indian Vacuum Society. The society organised training courses in design, development, operation and maintenance of a variety of vacuum systems for different applications. No wonder, the Society's annual award to an individual for significant contribution in the field is named after Ambasankaran.

Ambasankaran also promoted development of cryogenics and night-vision technologies. These are inevitable for military uses. Cryogenics uses vacuum technology to cool liquids and gases to very low temperatures.

Cadamby Ambasankaran contributed to development of Vacuum Technology in India in a way that India could pride itself as self-sufficient in the technology. He received several awards for his achievement. He was also the fellow of the prestigious Indian Academy of Sciences. Ambasankaran died on 20 August 1990. •

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Ranjan Roy Daniel

A Dedicated Space Physicist

Sudhakar Agarkar

Prof. Ranjan Roy Daniel was a cosmic ray physicist who had an opportunity to work with Prof. Homi J. Bhabha for about two decades. Daniel joined Tata Institute of Fundamental Research (TIFR) in 1947 as a young researcher. Those were the formative days for the institute. Basic research issues were to be identified and a research culture had to be established. He moulded himself in a short time and provided the leadership that the institute needed. He is one of the most respected members of the TIFR Alumni Association.

Ranjan Roy Daniel was born on 11 August 1923 at Nagarcoil, Tamil Nadu. He had his school education in the Scott Christian Secondary School there. Later he moved to Chennai and joined Loyola College. He obtained his BSc from University of Madras with good scores. For his post-graduation he went to the Banaras Hindu University. He was awarded MSc in physics in 1946.

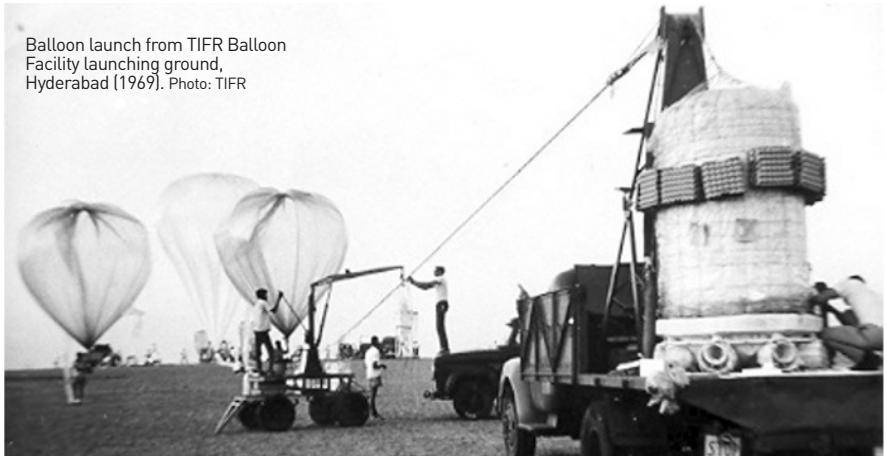
Soon after independence the Government of India had created

funds to support young researchers to pursue their research abroad. Daniel was chosen for this scholarship. He joined the laboratory of Nobel Prize Winner scientist Prof. C.G. Powel at Bristol in United Kingdom. He conducted studies on cosmic particles and submitted his thesis under the guidance of Prof. Donald Hill Perkins. He was awarded the PhD in 1953 by the University of Bristol for his pioneering work in cosmic ray physics.

He published a large number of articles in peer-reviewed international journals that made him well revered as a Space Physicist. His colleagues were very much impressed by his methodical work and learnt a lot from him. He trained young graduates to become good researcher and guided a large number of students for their doctoral work.

Prof. Daniel played a leading role in setting up new areas of research in the institute. He initiated Balloon Research Facility to conduct research in the upper atmosphere. He was felicitated by Padma Bhushan in 1992. He was elected as a fellow of National Academy of Sciences and Maharashtra Academic Science. He also received the Vainu Bappu award. He worked as scientific advisor to the Prime Minister of India during the 1970s.

Prof. Daniel formally retired in 1988. But he remained active and provided guidance to young researchers. He succumbed to a long illness on 27 March 2005. Not only the community of Space physics, but people from other fields also remembered him as a soft-spoken fine gentleman. He always tried to create a band of young research workers in the country. As an advisor to the newly established Homi Bhabha Centre for Science Education he shared his ideas of effective teaching of science in schools and colleges. I was fortunate to interact with him in the campus of TIFR on many occasions. •



Balloon launch from TIFR Balloon Facility launching ground, Hyderabad (1969). Photo: TIFR

Dr Sudhakar Agarkar is a Retired Professor of TIFR, Mumbai. He is currently working as Professor and Dean at the VPM's Academy of International Education and Research, Thane.

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Erach Hormasji Daruwalla

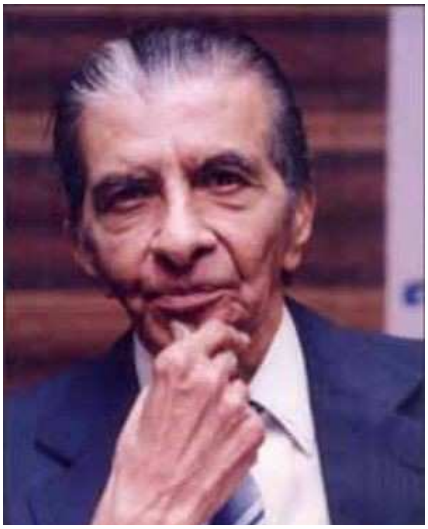
The Doyen of Textile Chemistry

T.V. Venkateswaran

Prof. Erach Hormasji Daruwalla (born 1923) was an internationally renowned textile chemist who was the Director of the Institute of Chemical Technology (ICT), then known as University Department of Chemical Technology (UDCT) during 1971-83. After his retirement he served as Research Advisor to Bombay Textile Research Association (BTRA). For his outstanding contribution to the science of colouration, he was awarded the Gold Medal by the Society of Dyers and Colourists (UK).

He studied BSc (Tech) and MSc (Tech) from UDCT and went to do his PhD from the University of Manchester. He returned to India and joined the Alma Mater as faculty and undertook pioneering research in the area of textile chemistry, in particular the Science of Coloration. He provided technical consultancy to then fledging textile and chemical companies and contributed immensely to the nation building and hence is rightly considered the 'Father of Textile Industry' in India.

The state of dyes in solution was a crucial question in the then booming textile industry in the mid-20th century. Along with other chemists, Daruwalla studied the chemistry of dye by employing solubility, mixed melting point, conductivity, and chromatographic measurements and found that interaction between disperse dyes takes place influencing the uptake of



these dyes by synthetic fibres when they are applied as binary mixtures. His research demonstrated that over an appreciable range of dye concentration in different cellulosic fibre substances and in polyvinyl alcohol fibre, values of heats of dyeing remain constant. Determining the values of accessible surfaces in different substrates and also to assess whether all the sites on surfaces have equal activity or whether there are present in the fibre sites of differential energy was another question he and his team investigated. They found the values of the surface available for dyeing in cotton, viscose, Cuprammonium rayon, and polyvinyl alcohol fibres depending on the size and shape of the dye molecules adsorbed, and assuming dye molecules lying flat with the aromatic rings on top of monomer units in the polymer chain molecules. His work showed that the alignment of direct dye molecules on cellulose chain can vary depending on the state of the hydrated surface of the fibre.

During the 1950s to 1990s, textile sector was a major source of employment in India and a significant contributor to the crucial foreign exchange. His research had both far reaching implication for the science of colouration and also assisted the nation during the curial period in history. For example, Sodium Hydrosulfite is a crucial reducing agent used in textile dyeing and as a non-aggressive alternative to bleach to remove stains and whitening dyed fabrics. The chemical, a vital element for the textile industry, is largely imported. Prof. Daruwalla and his team embarked on pioneering research at BTRA on its substitution which helped the textile industry to advance. He breathed his last on 17 March 2012. •

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Mrinal Kumar Dasgupta

Radio Astronomer of International Repute

Bhupati Chakrabarti

Mrinal Kumar Dasgupta (MKDG to his students and others) was a pioneer in the radio astronomy research in India. He as a young researcher made some very significant and internationally acknowledged contributions in the field. In 1953 he was doing his PhD at Manchester University, UK, under the supervision of famous astronomer Prof. Hanbury Brown. Here Dasgupta and his fellow researcher Roger Jennison could build up suitable detectors to detect the radio wave signals emanating from the distant constellations. Those were good enough to detect radio signals from the two strongest sources known as Cygnus A and Cassiopeia. The signal from Cassiopeia was in the expected line but the other source, Cygnus A, showed two maxima in its spectra indicating double radio sources. This observation could actually be interpreted as some special behaviour of the source, and later on, this could be related with what we call a black hole now. He is acknowledged as the co-discoverer of double radio galaxy, Cygnus A.

Mrinal was born on 1 September 1923 at Barishal (now in Bangladesh) and had his schooling at St Gregory's School at Dhaka (then Dacca). Here when he was in class X, Prof. Sisir Kumar Mitra from Kolkata (then Calcutta) came to deliver a lecture in his school that drew Mrinal to physics. He completed his M.Sc in physics in 1946 from Dhaka University, which was unfortunately not the best time for a young dreamer. The partition of India made him and his family to get shifted to Kolkata and he was put to hardship. However, he got assistantship under Prof. Mitra who quickly identified his talent and suggested him to try for a Fellowship for pursuing his PhD in England.

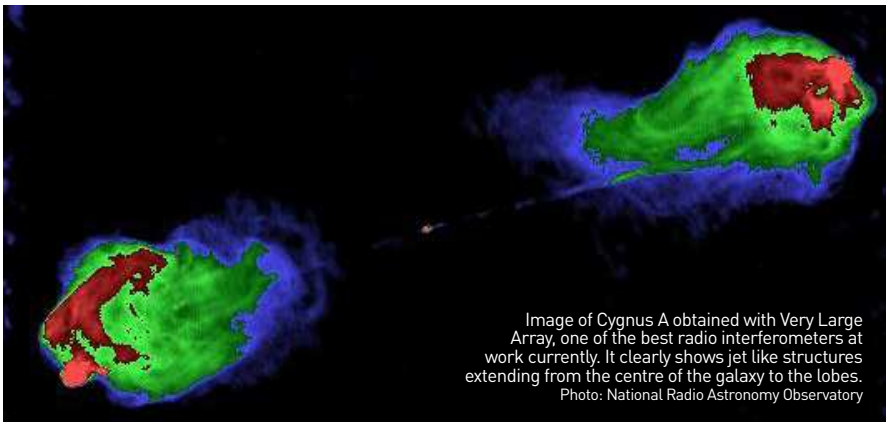

Image of Cygnus A obtained with Very Large Array, one of the best radio interferometers at work currently. It clearly shows jet like structures extending from the centre of the galaxy to the lobes.
Photo: National Radio Astronomy Observatory

On his return to India in 1954, Dasgupta became a faculty in the Institute of radio Physics and Electronics (INRAPHEL) under the leadership of Prof. Mitra. Dasgupta gave the shape of the Institute into a centre of national and international repute. He guided a good number of PhD students in the field of radio astronomy and a section of them went on to provide leadership in different countries worldwide for developing the facilities carrying out research in the field. He had the special inclination for science communication and had written number of articles in Bangla and did quite a few radio programmes on science. He remained active till his demise on 28 November 2005. •

Dr Bhupati Chakrabarti has retired from the Department of Physics, City College, Kolkata. He is the former General Secretary of Indian Association of Physics Teachers.

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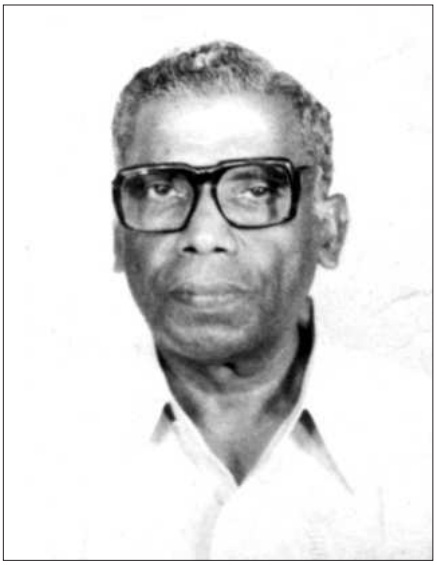
Trupapur Antony Davis

The Palm Man of India

Rayies Altaf

Trupapur Antony Davis was born on 9 February 1923 in Nagercoil, Tamil Nadu. He did his graduation from Madras University in 1944 and then went on to pursue higher studies in crop physiology from Madras Agricultural Research Institute, Coimbatore. After passing out from the Institute, he joined the then Sugarcane Research Station at Karnal, Punjab as a research scientist. Thereafter, Antony joined the newly established Coconut Research Station at Kyangulum Kerala, as a coconut physiologist. Most of his research life was spent on understanding coconut palms.

In 1960, Antony joined the Indian Statistical Institute (ISI), Calcutta (now Kolkata) as a faculty in the Crop Science Division. It is from here that he did his PhD in biometry in 1972. At Crop Studies Division of ISI, he created a separate school of Palm Studies. This initiative lead to creation of more avenues for palm research in India and also encouraged other young botanists to take up this area of study. This way he mainstreamed the science and research of palms in India. Dr Antony joined the Food and Agriculture Organization (FAO) at Coconut Research Institute, Manado-Indonesia as a coconut specialist. In 1982 he established Haldane Research Centre at Nagercoil, as a tribute to his friend and mentor J.B.S. Haldane. Renowned naturalist, mathematician, and philosopher Haldane had tremendous influence on life and work of Trupapur Antony Davis.



A naturalist, a zealous botanist and an over-zealous palm coconut specialist, Prof. Davis was a true son of the soil. He felt that a lifetime was too short to marvel about and unravel the perplexing diversity of the living world.

Davis studied the number of floral organs in different groups of plants and also the number of spirals of sporophylls in the cones of gymnosperms, and demonstrated the preponderance of the Fibonacci numbers. He played key role in establishing Palm Society of India based out of Calcutta. The idea behind this was to promote national and international collaborations in Palm Research in the country. He also served as a member of the Board of Directors of the International Palm Society. He was elected into the fellowship of Indian Academy of Sciences, Bengaluru in 1979 under the Plant Sciences section.

A true naturalist, a zealous botanist and an over-zealous palm coconut specialist, Prof. Trupapur Antony Davis was a true son of the soil, who not only contributed immensely to the science of palm coconut but also helped India in growing healthy and plentiful coconuts. He felt that a lifetime was too short to marvel about and unravel the perplexing diversity of the living world.

Prof. Trupapur Antony Davis breathed his last on 10 November 1989. •

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Samarendra Nath Ghoshal

At Home with Nuclear Physics

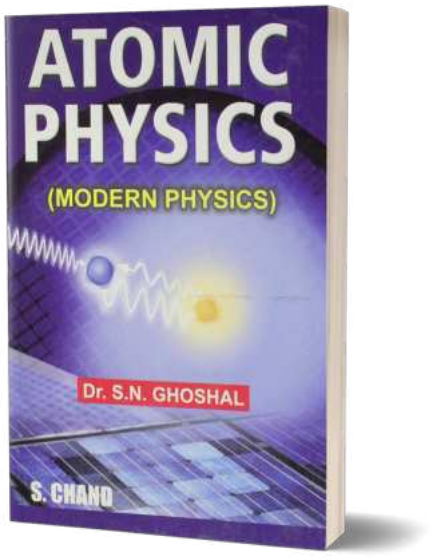
Bhupati Chakrabarti

For a large number of students of physics, even those who are now at the UG or PG stages, the name of Prof. Samarendra Nath Ghoshal, better known as S.N. Ghoshal, is a familiar one. As the author of a few classic text books of nuclear physics and atomic physics, this outstanding physicist also excelled as a teacher and an academic administrator. He also penned down books on quantum mechanics and other areas of physics.

Samarendra was born in Kolkata in 1923. He did his MSc from Calcutta University and went to USA for his PhD. He joined the University of California, Berkley under the supervision of Prof. Emilio Segre. His field of work was experimental nuclear physics, a very promising and challenging field at that time. Here in 1950, young Ghoshal did an experiment to establish the veracity of the theory of the formation of compound nucleus as proposed by Niels Bohr. In this experiment he bombarded two different nuclei with two different projectile particles to arrive at the same compound nucleus. By measuring the cross sections of various nuclear reactions, he could obtain experimental support for the theory proposed by Bohr. Interestingly, at that time his PhD supervisor Prof Segre was not

at Berkley but was visiting some other place. Ghoshal planned and executed the entire experiment by himself and the 1950 Physical Review paper that reported these findings was a single author paper. Emilio Segre went on to share the 1959 Physics Nobel prize with Owen Chamberlin for their discovery of antiproton. It shows that Ghoshal, even while working under a future Nobel Laureate, could show his ability to work independently.

Writing about nuclear physics was Prof. Ghoshal's real passion. He has written several outstanding books for the UG & PG students not only in English but also in Bangla.



After coming back to India, Prof. Ghoshal taught physics at different times in Lucknow University, Saha Institute of Nuclear Physics, Presidency College, and University of Calcutta. At Presidency he taught during the golden age of the College and its physics department. He was an excellent teacher and he had Prof. A.K. Raychaudhuri as one of his colleagues. Later Prof. Ghoshal got more involved in academic administration and became the Principal of Presidency College. He also took up other responsibilities like that of DPI. But writing about nuclear physics was his real passion and he has written several outstanding books in this area not only in English but also in Bangla for the UG & PG students. He passed away in 2007 after remaining ill for some time. •

Dr Bhupati Chakrabarti has retired from the Department of Physics, City College, Kolkata. He is the former General Secretary of Indian Association of Physics Teachers.

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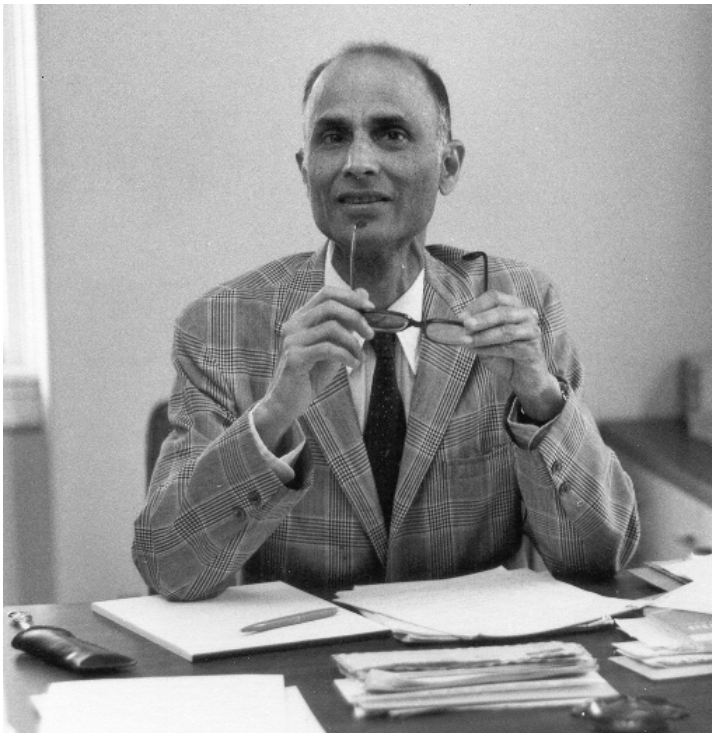
Harish-Chandra

Distinguished Mathematician



B. Srikumar

Professor Harish Chandra began his work in theory of elementary particles before switching from physics to mathematics in 1949. His main interest was the study of infinite-dimensional representations and he created a theory with implications for many domains -- from geometry to number theory.

Harish-Chandra was born on 11 October 1923 at Kanpur in Uttar Pradesh to Satyagati Seth and Chandra Kishore, a civil engineer. He attended school in Kanpur, then graduated from the University of Allahabad and secured a Master's degree in 1943.

Later, he studied at The Indian Institute of Science at Bangalore and worked there as a postgraduate research fellow on problems in theoretical physics under physicist Homi J. Bhabha.

Chandra began publishing papers on theoretical physics while at Bangalore (now Bengaluru) and also published a couple of joint papers with Bhabha extending some of Dirac's results.

Bhabha and Chandra's teacher K.S. Krishnan at the Allahabad University, recommended him to Dirac for research work at Cambridge. Chandra went to Cambridge and studied for his PhD under Dirac's supervision.

During this time in Cambridge, he began to move away from physics to mathematics and started attending the lecture courses of John Edensor Littlewood (British Mathematician) and Marshall Hall (American Mathematician).

Once, he attended a lecture by Wolfgang Pauli and pointed out a mistake in his work. The two later became lifelong friends.

Chandra obtained his degree in 1947 for his thesis 'Infinite Irreducible Representations of The Lorentz group' before travelling to the US the same year.

Dirac visited Princeton in New Jersey during 1947-48 and Chandra accompanied him and worked as his assistant during the time. He also spent time at Harvard during 1949-50.

During 1950 to 1963, he was at Columbia University, New York and worked on representations of semi-simple Lie groups.

Chandra married Lalitha Kale when he was at the Tata Institute in Bombay (now Mumbai) during 1952-53 and the couple had two daughters.

Harish-Chandra won the Cole prize from the American Mathematical Society in 1954 for his papers on representations of semi-simple Lie algebras and groups.

He also worked at the Institute of Advanced Study at Princeton from 1963 and received many awards during his career.

He won the Cole prize from the American Mathematical Society in 1954 for his papers on representations of semi-simple Lie algebras and groups. In 1974, he received the Srinivasa Ramanujan medal from the Indian National Science Academy. He was awarded honorary degrees by Delhi University in 1973 and Yale University in 1981.

Chandra became a Fellow of the London's Royal Society in 1973, Fellow of the National Academy of Sciences of the United States in the year 1981, and Fellow of the Indian Academy of Sciences and the Indian National Science Academy in 1975.

He died of a heart attack at the end of a week-long conference in Princeton at the age of 60. •

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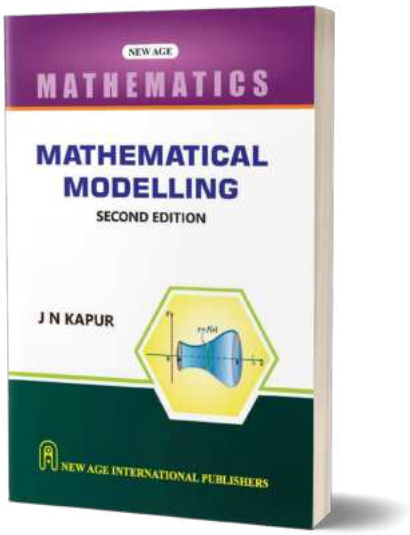
Jagat Narain Kapur

The Mathematician and the Educator



Sudhakar Agarkar

Jagat Narain Kapur was a multifaceted and multi-talented person. Born on 7 September 1923 in Delhi, he displayed his intelligence from school days. He had special interest in mathematics. He was an exceptional student and passed his BSc with first class first. Moreover, he broke the earlier record by obtaining the highest score in graduation as well as post-graduation examinations.

Kapur completed his PhD in 1957 from University of Delhi. He then joined the Indian Institute of Technology at Kanpur to teach advanced mathematics. Prof. Kapur developed mathematical models for a variety of physical and social aspects that we encounter in our daily life. Some of the models that he designed were model for measure of financial development, measurement of time, environmental degradation, etc. He published large number of articles and soon was considered one of the leading experts in the field.

Apart from his research, he concentrated on improving teaching of mathematics in schools and colleges. He took lead in organising in-service teacher training courses for practicing mathematics teachers. Similarly, he used to arrange Summer Camps for the talented students. This work was applauded both by the society and by the authorities in education

department of the country.

Prof. Kapur loved teaching. Apart from the IIT, Kanpur he taught at various other institutions and universities like Delhi University, Jawaharlal Nehru University, Waterloo University, etc. He was invited to be a visiting professor at various universities in many countries like Australia, UK, USA, Canada, etc. He became the vice chancellor of the University of Meerut for a few years and provided strong leadership to the University. He was also appointed as INSA Senior Scientist for two years (1985-87).

Kapoor was associated with various social and educational organisations. He gave shape to the Mathematics Teacher Association of India. He also edited journals on mathematics and science education and guided young writers. He also edited books brought out by National Council of Educational Research and Training and National Institute of Open Schooling. He continued to do this work till he breathed his last on 4 September 2002.

He has written more than 50 books on various subjects that include mathematics modelling, history of mathematics, effective teaching techniques, etc. He was the recipient of GP Chatterjee Award of Indian Science Congress (1988); Distinguished Service Award of Mathematical Association of India (1985); Education Minister Gold Medal and National Academy of Sciences Distinguished Research Award. He was a Fellow of the Indian Academy of Sciences, Bangalore; National Academy of Sciences (India), Allahabad and Institute of Mathematics and its Applications (UK). He was the President of Indian Mathematical Society and Calcutta Mathematical Society. •

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Coimbatore Ramadurai Krishnamurti

Quiet Flew His Life

Kollegala Sharma

Ganga Action Plan, the plan to clean Ganga, is a daunting exercise. Nor is it today's idea! 2023 is the year of hundredth birthday of one of the stalwarts that spearheaded scientific evaluation of the mighty river. Dr Coimbatore Ramadurai Krishnamurti, whose book 'The Ganga - A Scientific Study' is a handbook for those trying to clean up Ganga, was born 100 years ago, on 3 March 1923.

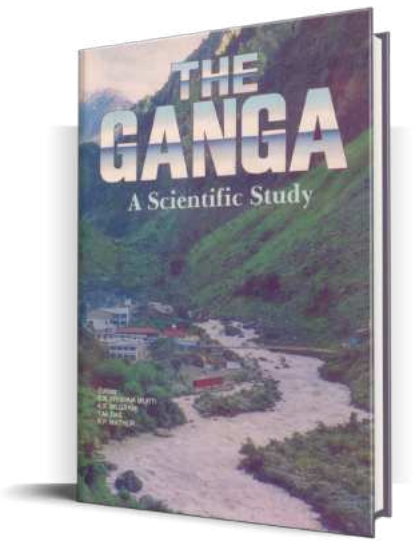
Murti did his PhD in Biochemistry from the University of Bombay in 1948. In 1950 he joined the newly formed Central Drug Research Institute, Lucknow. There he worked on some of the urgent problems that India faced at that time like using antibiotics in Cholera treatment. His earliest work was on the problem of curdling. He found that the milk of anjeer (Ficus carica) could be useful in preparation of traditional paneer. The enzyme he extracted then is used even now.

Later Murti moved to the Indian Institute of Toxicological Research. He rose to be the post of Director of the Institute and led it till his retirement in 1983.

His concern with environmental issues is reflected in his research on pesticide residue. His team's work exposed how the unjust use of DDT helped deadly chemical stay back in soil, water bodies, and fish and to further get into other animals. His team found pesticide residues in birds, fish, cattle, and even human flesh. His work also revealed how

mother's milk passed on the poison to the new born babies or yet-to-be born babies through mother's umbilical cord. The findings have shaped much of the pesticide use policies in present India.

Murti's life and career were closely associated with factors that affect our life. Two significant contributions of Murti were about the jaundice that affects the newly born and the role of lipid peroxidation during poisoning or inflammation.



Toxicity and poisoning by environmental chemicals and hygiene were central to his researches. 'The Ganga, a scientific study' was an initiative he undertook as the Director of IITR. The enormous study is the basis for all the present biodiversity or river rejuvenation programmes.

Be it pesticides, cholera toxin, heavy metal contamination by industries or industrial tragedies like the infamous Bhopal gas leak, Krishna Murti was associated. In the aftermath of the Bhopal gas tragedy, when avoiding such tragedies in future was on everyone's thought, it was Murti to whom the nation looked for advice.

His passion for environmental hygiene received several accolades. He received Basanti Devi Amirchand Award of ICMR (1973), Sunder Lal Hora Medal of INSA (1981), and Pitamber Pant National Environmental Fellowship (1983). He was a Fellow of Indian Academy of Sciences, Bangalore and National Academy of Medical Sciences (India). He was a Member of the Society of Biological Chemists (India).

Murti believed that science should reach masses, and science communication was the only way. In this direction, he founded the Madras Science Forum that is still active. He breathed his last on 30 June 1990. •

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Rajendra Nath Lakhanpal

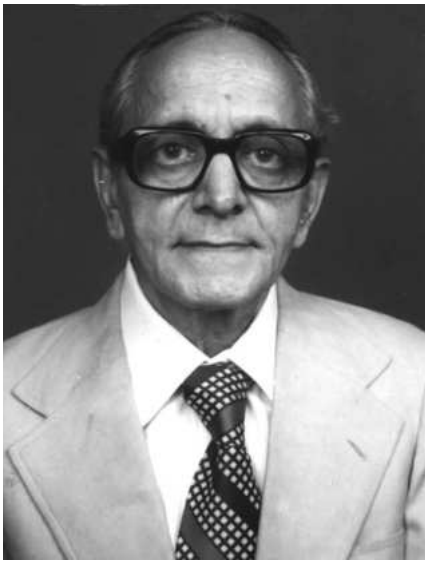
A Palaeobotanist Par Excellence

B.K. Tyagi & Vyoma Bhalla

Over the centuries, many distinguished scientists have not only revealed scientific truths but have also added dignity and lustre to the science they practised. Professor Rajendra Nath Lakhanpal was one of them who followed the footsteps of his supervisor, Birbal Sahni, a world-renowned palaeobotanist. Lakhanpal was an expert in palaeoecology and plant identification using pollen microfossils.

Lakhanpal was born on 5 August 1923. In 1944, he earned a master's degree in botany from the University of Lucknow. Later, he joined Prof. Birbal Sahni as a Research Fellow to conduct palynology research at Lucknow University. In 1947, he was hired as a Senior Research Assistant in the CSIR-sponsored project for Measuring Geological Time. When the Institute of Palaeobotany was founded in 1949, he joined it to focus on tertiary plant fossils and microfossils from the Salt Range. In 1952, he got a PhD from Lucknow University, under Prof. Sahni and then moved on to a UNESCO fellowship to work with R.W. Chaney at the University of California, Berkeley, where he studied Upper Oligocene fossils from Oregon.

After his visit abroad to various centres of palaeobotanical studies in the USA, France, UK, Belgium



and The Netherlands, he returned to the Birbal Sahni Institute of Palaeobotany to resume his work. During his fruitful career as a scientist, he performed outstanding work in three areas: palaeoecology, palaeobotany, and palynology. His finding of Nipa sahnii from the Assam Tertiary revealed that the Bay of Bengal extended much farther north in the Miocene. He described several Tertiary plants from the Deccan Intertrappean Series, the Cuddalore Series, atmospheric pollen, and Quaternary and Recent Palynology.

Lakhanpal examined Tertiary Indian floras and addressed their implications for the past geology of Southeast Asia and Northern Africa. He surmised his studies as "water was the main factor influencing plant distribution in the tropics''. His study on palaeoecology was based on palynology, and he proposed that the temperate Himalayan flora appeared in the Miocene Epoch. He authored The Antiquity of Angiosperms (1979) and co-authored the Catalogue of Indian Fossil Plants (1975). Other honours which came to him were Assistant Director, Deputy Director, President of the Palaeobotanical Society (1983), Distinguished Scientist (1984), and Emeritus Scientist (1984-88), all at the Birbal Sahni Institute of Palaeobotany. He was also the recipient of the XII International Botanical Congress Medallion (1975), J Sen Memorial Lecture (1983); and Birbal Sahni Medal of the Indian Botanical Society (1991).

He had a curiosity for the unknown and a love of adventure and led the Indian team in the Indo-Japanese Expedition to Eastern Himalayas in 1960. He founded the Society for Scientific Values to promote integrity, objectivity, and ethical values.

A philanthropist, who probed to uncover hidden mysteries, will be remembered for his humanism and significant contribution to the advancement of knowledge not only in botany and palaeobotany but also in other closely related disciplines. •

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Shankar Lal

A Stalwart in Engineering Education

Sumita Mukherjee

Mechanical engineers play a vital role in any nation's growth. To innovate and invent new goods, the nation needs creative engineers with mechanical backgrounds. Prof. Shankar Lal was one such talented and creative professional who also worked on developing resource material to teach young students. Born on 24 June 1923, Lal did his Bachelor of Engineering in Aerodynamics from BHU in 1944 and M.S. from London University in 1949. He did his PhD from California Institute of Technology (Caltech) in 1955. His research interest was on solid mechanics and elasticity.

In 1959 he joined the Mechanical Engineering Department of University of Roorkee (now IIT Roorkee) as Associate Professor. He chaired the position of Head of the Mechanical Engineering department during 1964-67 and again during 1972-78. During his tenure, the Department of Industrial Engineering and BTech in Production Industrial Engineering were also started.

He joined IIT Kharagpur as Director in February 1978. With his charming personality and excellent oratory skills he made a good impact on the students, faculty, and staff. Both in Roorkee and Kharagpur students used to enjoy his classes. He was a linguist par excellence. He spoke Bangla fluently along with Sanskrit, Hindi, English, Punjabi, Urdu, French, and Spanish.

He took charge of IIT Kharagpur at a very crucial juncture and overhauled the functioning of the Institute. He modernised the curricula and syllabi of UG and PG courses and introduced computers in several departments. Prof. Lal motivated faculty members on writing books on their subject of expertise, and for this he entered into a contract with Oxford University Press to start an IIT Kharagpur-Oxford University Press series.

After completion of his tenure at Kharagpur, Prof. Lal rejoined the Mechanical and Industrial Engineering Department of Roorkee University in 1978 and retired from the University in 1983. Prof. Lal extended his support to his students and colleagues. He received the 'Best teacher award' several times in University of Roorkee and in the USA also. One of his former colleagues fondly remembered how he moderated and edited his grant proposal before it was to be submitted.

Prof. Lal was a linguist par excellence. He spoke Bangla, Sanskrit, Hindi, English, Punjabi, Urdu, French, and Spanish.

He was elected the Vice President for the Society for Heat and Mass Transfer (1976-78); President of Institute of Engineers (1982-83); President of Indian Society of Theoretical and Applied Mechanics (1981-82); Fellow of National Academy of Sciences India and Indian Academy of Sciences; Fellow of Royal Aeronautical Society, London; and Fellow of Institute of Mechanical Engineers, London. He was part of several committees responsible for framing national policies on Science and Engineering like the CSIR-SERC, UGC, etc. He took keen interest on educational administration and was a Member of the Board of Governors, Motilal Nehru National Institute of Technology Allahabad, and REC Srinagar. IIT Roorkee has recently initiated a memorial lecture in his remembrance. He breathed his last on 25 September 1991 in USA. •

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Malur Ramaswamy-Iyengar Narasimha Prasad

Shedding New Light on Animal Physiology

Nimish Kapoor

Malur Ramaswamy-Iyengar Narasimha Prasad (born 5 January 1923) was an eminent Endocrinologist and Professor and well known for his research in reproductive physiology and regulation of fertility. He completed his PhD from University of Wisconsin, USA.

In 1945, Prasad began his career as a Lecturer in Zoology at the Central College, Bangalore. During 1959-1977, he was a Professor of Zoology at the University of Delhi, where he established a research group in the Department of Zoology that was recognised internationally in reproductive physiology. He wrote several insightful research paper on 'Reproductive cycle of the female five-striped Indian palm squirrel', 'Effect of Clomiphene on Blastocysts during delayed implantation in the Rat', 'Is there a role for antiestrogens (estrogen antagonists) in the regulation of fertility' etc. He also worked as a Scientist for a Special Programme in Human Reproduction in World Health Organization (WHO) headquarters in Geneva till 1983. He was also the Chairman of Biology Research Division, Central Family Planning Institute, Delhi.

Prasad contributed to a wide field in the Physiology of Reproduction that included hormonal control of implantation, reproductive biology of rodents, pituitary gonadotropins in mammals, reproductive physiology in lizards, foetal membrane physiology, and physiology of the saccus vasculosus (SV) in fishes. His research in epididymal physiology and male reproduction led to the discovery of a method of regulation of male fertility. Based on this finding multicentre clinical trials were carried out by the WHO. He also worked on the mechanism of estrogen-anti-estrogen interaction and comparative endocrinology.

Dr Prasad also served as the member of the International Planned Parenthood Federation, International Society of Andrology and Society for the Study of Fertility. He also was an editor for the INSA publications during 1971-1974. He worked closely with the Indian Council of Medical Research and the Ministry of Health, Government of India in research on human reproduction and family planning programmes in the country.

Prof. Prasad was the recipient of FICCI 1972 Award. He also received Sir Jagdish Chandra Bose Award in 1976 and Dr. (Mrs.) Shantha Rao Oration Award in 1983. He was elected the Fellow of the Indian Academy of Sciences, Bangalore. He also served as the Vice President of the International Society for Research in Biology of Reproduction and Vice President, INSA (1975-76). Additionally, the Indian National Science Academy (INSA) instituted the "Professor M R N Prasad Memorial Lecture Award" in his honour. Objective of the lecture series is to encourage contribution in the field of animal physiology.

Dr M.R.N. Prasad breathed his last on 7 October 1987. •

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Arcot Ramachandran

Architect of India's Science & Technology Plan

Rintu Nath

Dr Arcot Ramachandran (6 April 1923–17 May 2018) was a scientist renowned for his work on Thermal Engineering and his social commitment to the cause of sustainable development. He was the first Secretary of the Department of Science and Technology (DST), Government of India. He served as the Under Secretary General at the UN Centre for Human Settlements. It was during his tenure, UN launched the Sustainable Cities Programme in 12 cities, in 1990. Ramachandran has made social, educational, and research contributions during his academic and administrative careers. The Government of India honoured him in 2003, with the Padma Bhushan, for his services to the fields of Science and Engineering.

Dr Ramachandran was born in Karnataka. He graduated from the Madras University and went to the Purdue University, USA, from where he obtained MS degree in Engineering. He continued at the University for his doctoral research and obtained his PhD. In 1950 he returned to India and started his career at the Indian Institute of Science (IISc), Bangalore. At IISc he worked as a faculty member of the Department of Power Engineering, in 1950, and later he became an Assistant Professor. In 1954 he went to Scotland to work as research engineer at Babcock & Wilcox Research and Development

Centre. However, the next year, in 1955, he started his post-doctoral studies at the Purdue University, US and later at Columbia University.

Ramachandran came back to India in 1957 and joined as head of the Department of Mechanical Engineering, IISc. In 1967, he became the Director of IIT Madras. During his tenure, he gave a major thrust to research by initiating and encouraging both basic and applied research in many fields of science and engineering.

In 1973 he was invited to be Secretary to Government of India in the newly established Department of Science and Technology (DST). The first Science and Technology Plan, prepared by NCST was published and it was he who implemented the Plan. His notable accomplishments were the setting up of the National Remote Sensing Agency in Hyderabad, transferred to Department of Space; Ocean Science and Technology Agency (OSTA), which later became the Department of Ocean Development; Science and Engineering Research Council (SERC); Environmental Planning, Coordination and Research (now Ministry of Environment, Forests and Climate Change); New and Non-Conventional sources of Energy (now Ministry of New and Renewable Energy); National Information System for Science and Technology; and the UN Asia-Pacific Centre for Transfer of Technology (UN-APCTI) in Bangalore in 1977 (now relocated in Delhi).

Ramachandran was the first Secretary of DST. He was honoured with Padma Bhushan, for his services to the fields of Science and Engineering.

He is recognised as the Architect of the National Programme for Research and Development in Renewable Sources of Energy. He was elected Chairman of the Preparatory Committee of the UN Conference on Science and Technology in 1977. In October 1978 he was appointed Under Secretary General and Executive Director of the newly established United Nations Centre for Human Settlements. •

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Alladi Ramakrishnan

Man of Matscience

Nakul Parashar

The lawyer turned scientist Alladi Ramakrishnan, one of India's finest physicists and mathematicians, founded the famous Institute of Mathematical Sciences in Chennai in 1962.

It was an incident in the year 1943 which motivated Ramakrishnan to take a career in science.

He heard a magnificent lecture on Meson Theory at The Presidency College, Chennai (then Madras) by none other than Prof. Homi J. Bhabha who had just returned to India from England as one of the youngest Fellows of the Royal Society. After listening to his lecture, Ramakrishnan decided to quit his legal career and take up science as his profession.

Ramakrishnan, who was born on 9 August 1923, studied at Pennathur Subramanian High school in Chennai. His father Alladi Krishnaswamy Iyer was a lawyer and played a crucial role in drafting the Constitution of India.

Right from his school days he demonstrated his originality both in mathematics and physics. Later, when he studied in Loyola College he was a brilliant student in classical geometry.

His father had a great influence on him; he enrolled himself to study law, passed the exams with flying colours and secured a gold medal in Hindu Law.

Ramakrishnan was one of the first members of the Tata Institute of Fundamental Research in Mumbai and worked closely with Dr Bhabha who introduced him to Cascade Theory and the Fluctuation Problem of Cosmic Radiation.

Alladi Ramakrishnan with Nobel Laureate Niels Bohr at Bohr's home in Copenhagen (1960). Photo: Alladi Krishnaswami

The young Ramakrishnan worked on this theory and he gave the new name to Correlation Densities as Product Densities. In August 1949 he completed his PhD in The University of Manchester under Prof. M.S. Bartlett. His PhD work on Product Densities appeared in the proceedings of the Cambridge Philosophical Society in 1950. The same year he worked on the problem of the Fluctuating Density Field that came up in studies of the Milky Way by the great Indian astrophysicist Subrahmanyan Chandrasekhar.

In the year 1956 Ramakrishnan also presented a paper to the Indian Academy of Sciences on Inverse Probability in Stochastic processes. During the year 1957-58, he was deeply inspired after a visit to The Institute for Advance Study in Princeton at the invitation of its director.

In 1960, Nobel laureate professor Niels Bohr visited India and he was impressed by Ramakrishnan's enthusiasm and recommended him to Prime Minister Jawaharlal Nehru, which led to the creation of Matscience - The Institute of Mathematical Sciences in 1962. He served as a Director of Matscience for 21 years until his retirement in 1983.

Over a period of a quarter century (1958 to 83) Ramakrishnan produced about 30 PhD students and provided opportunities for all of them to go abroad and participate in international conferences.

Even after his retirement he continuously inspired research students until his last breath. He died on 8 June 2008 at his son Alladi Krishnaswami's home in Florida in the US. •

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Sivaraj Ramaseshan

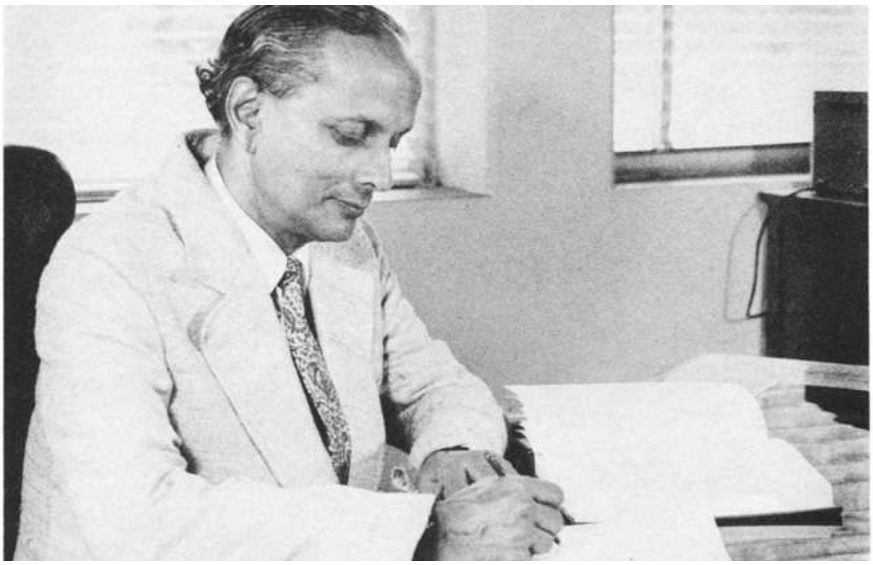
A Passionate Physicist

Rayies Altaf

Sivaraj Ramaseshan was born on 10 October 1923 in Calcutta (now Kolkata). His mother was younger sister of Sir C.V. Raman. He had his early education in Nagpur and graduated in 1943 with a BSc (Honours) degree from the Science College, University of Nagpur with first class first and a gold medal.

Ramaseshan has been one of the most outstanding scientists and visionary of independent India. He began his research career under his uncle Sir C.V. Raman. He did his PhD in Physics and joined the Indian Institute of Science Bangalore as a lecturer. At IISc he played a pioneering role in starting research initiatives in the area of X-ray crystallography in the 1950s. He later became the director of IISc (1981-1984). He is credited with the establishment of Physics department at IIT-Madras, which he headed during 1962-1966, and the material science laboratory at National Aeronautical Laboratory-Bangalore. This laboratory played a key role in development and growth of material science research in India.

He established the first high-pressure laboratory as well as first material science laboratory in the country. The material science programme initiated by him at NAL played a critical role in the development of India's capabilities in aerospace research. He is also credited with designing and fabricating the first nutation damper for India's first satellite Aryabhata. His research played key role in development of heart valves, blood bags, and other crucial components with aerospace applications.



The material science programme initiated by Ramaseshan at the NAL played a critical role in development of India's capabilities in aerospace research.

Prof. Ramaseshan did pioneering research in the areas of optics, crystallography, and high-pressure physics. He received Shanti Swarup Bhatnagar Award in 1962, Vasvik Award in Materials Science in 1980, Aryabhata Medal (1985), and Padma Bhushan (1986). Ramaseshan was one of the founders and first chairman of the Governing Board of Astra Research Centre in Bangalore. In 1971, Ramaseshan was elected as the vice-president of the Indian Academy of Sciences. Besides being an incredible researcher and science leader, he was also a good science communicator. He was instrumental in starting a new physics journal, Pramana, and also became its founding editor. In 1977, he was appointed as the first editor of publications for the Indian Academy of Sciences. He also took the journal Current Science to new heights and expanded its readership, when he became its editor in 1989.

To his friends and colleagues, he was a great teacher and an outstanding conversationalist. He is also the co-author of an illustrated biography of his Nobel Laureate uncle Sir C.V. Raman.

Prof Sivaraj Ramaseshan breathed his last in Bangalore on 29 December 2003 at the age of 80. •

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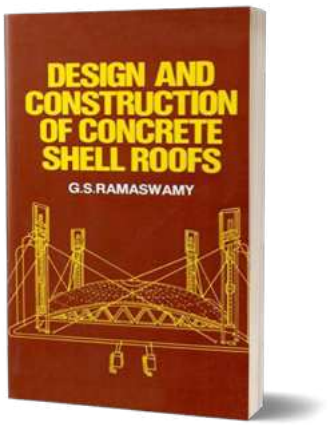
Guruvayur Subramanian Ramaswamy

Designer of High-rise Monuments



A. Ramachandraiah

Guruvayur Subramanian Ramaswamy was born on 3 October 1923. He served as the Founder Director of the CSIR-SERC (CSIR-Structural Engineering Research Institute), Chennai. He had his early education in Trichur and then got his BE Degree from the College of Engineering, Guindy, Chennai, followed by MS and CE degrees from the California Institute of Technology, USA, in 1948.

After some short stints at Annamalai University, Chidambaram joined the Central Building Research Institute, Roorkee, as a Professor and then went to become the Head of the Structures Division. He became the Founder Director of the CSIR-SERC (CSIR-Structural Engineering Research Institute) in 1965 in Roorkee. The institute has been later shifted to Chennai in 1974.

During his academic and professional career he has developed many novel structural engineering schematics. Use of concrete funicular shells and twisted concrete-reinforcing steel bars in construction of thousands of buildings in India and abroad have earned him name and international acclaim. As the Director of SERC, he was instrumental in promoting pioneering research in structural engineering. He has assisted in the installation of the Tower Testing Station at Pallavaram.

He chaired many high-level expert committees in the visualisation and structural designing of several post-independent monuments and institutional high-rise buildings. He served as the United Nations' Chief Technical Advisor to ministries of Trinidad, Iraq, Saudi Arabia, etc. and as a Visiting Professor for the University of West Indies, Jamaica, and Arizona State University, Phoenix, USA.

Use of concrete funicular shells and twisted concrete-reinforcing steel bars in construction of buildings in India and abroad have earned Ramaswamy international acclaim.

He authored several books which have become popular Reference material. 'Analysis, Design and Construction of Steel Space Frames', 'Pre-stressed Concrete Design', 'Design and Construction of Concrete Shell Roofs', etc. are some of his most well-known books, recommended in Structural Engineering Academics.

He had immense interest in literature and fine arts. He was a prolific writer and a great orator. Prof. Ramaswamy received the Indian Merchant's Chamber Diamond Jubilee Award, Invention Promotion Board Award, Invention Promotion Shield, and Gammon Award by the Institution of Engineers (India). He was an elected Fellow of the Indian Academy of Sciences, Bangalore.

He breathed his last on 9 March 2002. In his memory and as mark of respect and honour, the CSIR-SERC has instituted a national-level 'Prof. GS Ramaswamy Summer Internship' programme and recently organised a series commemorative Centenary Seminars. •

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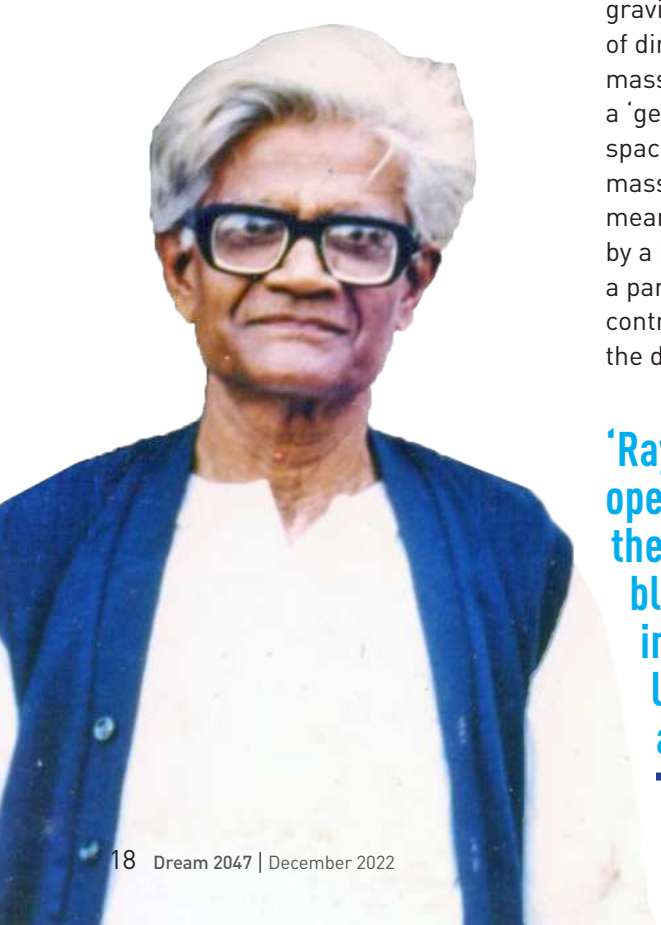
Amal Kumar Raychaudhuri

The Man behind the Raychaudhuri Equation

Achintya Pal

In late 1940s, when Amal Kumar Raychaudhuri (popularly known as AKR to his students) started his research career, most Physicists in India thought there is nothing new to be done in General Theory of Relativity (GTR) and its associated fields. However, it turned out that his work, published in 1955 and immortalized as the famous 'Raychaudhuri Equation', opened a new horizon in the field of research on black holes. It inspired a whole new generation of researchers comprising the likes of Stephen Hawking and Roger Penrose. These eminent Physicists have not only acknowledged the 'Raychaudhuri Equation' as the starting point of their work but have also referred to his work several times in their books.



The distinguishing feature of his contribution is: though it is related to GTR, it is of a very general nature and independent of the equations of GTR and Gravitation. Thus, the work is equally amenable to solution of problems related to any other type of curved space-time.

As is well-known, Albert Einstein revolutionised the concepts of space-time with his Theory of Relativity and gave an entirely new approach to the theory of gravitation. Replacing the concept of direct attraction felt by two masses, he said one body follows a 'geodesic' path in the 'curved space-time' produced by the other massive body. Here, geodesic means the 'shortest path' taken by a body on the curved surface of a particular geometry. The basic contribution of AKR was to predict the diverging or converging nature of these geodesics in any given space-time in presence of matter and energy. The question naturally arises "Why, after all, are the set of geodesics important?" This has got direct bearing on theories of the Universe (Cosmology) – one of which, the 'Big Bang Theory' says that its existence started form a 'singularity' of infinite energy density. This implies that the geodesics are convergent when extrapolated back in time.

'Raychaudhuri Equation' opened a new horizon in the field of research on black holes and inspired researchers like Stephen Hawking and Roger Penrose.

Born on 14 September 1923 in a learned family of Barishal (now in Bangladesh), AKR had to go through a very tough period of uncertainty in his research career after finishing his formative years at Presidency College. But he was steadfast in his objective and could finally achieve the goal. He was fortunate to have the endorsement of Prof. J.A. Wheeler, due to which he was awarded a DSc degree and got the due recognition for his work in this country. In 1961, he became a professor at Presidency College marking the beginning of a long and illustrious teaching career at the college. AKR was an exceptional teacher, revered by generations of physics students at the college and University of Calcutta.

He breathed his last on 18 June 2005. •

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Sailendra Nath Roy Chaudhury

Father of Gas Turbine Technology in India

Bhupati Chakrabarti

In the context of our country, particularly during the days immediately after the independence, it was not the identification of new technologies but the development indigenous technologies that were considered to be of utmost importance. Contributions in the fields of Engineering and Technology are rightly considered as the fruits of team-works. However, the leaders, who led some able teams to bring out technological fruits that were the forte of handful western countries at that time, had all-round ability. Air Vice Marshall Sailendra Nath Roy Chaudhury (SNRC) was a leader of that calibre. He brought India in the map of gas turbine technology that really helped the country to take a decisive step towards the self-sufficiency. It all happened in late 1950s under the leadership of a relatively young Air-Force officer who was born in 1923 and was trained in the British Air Force base.

The HAL, (then known as Hindustan Aircrafts Limited) established before the independence, was a private organisation for the production of aircrafts in collaboration with UK and USA. However, after independence the government took it over and SNRC was asked to head an Air Force facility for the production of Gas Turbine engines to be used in the aircrafts produced indigenously. The then Prime Minister Pandit Jawaharlal Nehru and the Defense Minister V.K. Krishna Menon took special interest in the project that began at Kanpur. The team had less than 10 engineers and about 20 technicians. It was named as Gas Turbine Research Centre (GTRC) but got shifted soon to Bengaluru. Later on, when inducted under DRDO, this became Gas Turbine Research Establishment (GTRE).

Roy Chaudhury brought India in the map of gas turbine technology that helped the country to take a decisive step towards self-sufficiency.

By the time SNRC superannuated in 1981 this unit of DRDO had nearly 1600 personnel working in it. In 1974 SNRC was inducted as a Fellow in the Engineering and Technology section of the Indian Academy of Sciences. He was also the first Indian Fellow of Royal Aeronautical Society, London and was the recipient of several prestigious prizes in his field. In his post retirement period, he developed special interest in bio-energy as that would be useful for rural development. SNRC could show that small gas turbines may use bio-fuels for the production of electricity.

SNRC remained active in his elder years. He passed away in 2016 at his home at Bengaluru at the age of 93. •

Dr Bhupati Chakrabarti has retired from the Department of Physics, City College, Kolkata. He is the former General Secretary of Indian Association of Physics Teachers.

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Tuhin Kumar Roy

A Chemical Engineer of International Repute

Bhupati Chakrabarti

Immediately after the independence of India in 1947, the new government felt the need for developing trained manpower with international exposure. In that very year the government chose five young scientists to send them to Massachusetts Institute of Technology (MIT), USA for training in their respective chosen fields. All of them were offered full scholarship for three years along with other supports. Tuhin Kumar Roy better known as T.K. Roy was among the selected five.

Roy had his schooling at Burdwan (Bardhaman) town where his father was a lawyer. Tuhin was an outstanding student and subsequently studied at St Xavier's College, Kolkata and University College of Science, both under the University of Calcutta to get his master's degree in applied chemistry. While he was selected for MIT, he was working as a scientist in the Lac Research Institute at Ranchi.

He got an extension of his scholarship and could complete his doctorate in Chemical Engineering. He got industrial exposure in USA and worked for a chemical company for some time and got a couple of patents connected to the separation of nickel and cobalt from suitable ores. He came back to India in 1954 and joined in the Chemical Engineering department of the then Engineering College at Jadavpur that very soon became the part of newly formed Jadavpur University. However, after four years he went back to USA for some time. On his return to India this time he had a very brief stint at Jadavpur University before moving and settling down at Delhi. There, with the governmental support, he built up a company for supporting the budding chemical engineers and ultimately it took the shape of Chemical Metallurgical Design Company. He became the Managing Director of the Company.

Roy was the founder member of the Indian Institute of Chemical Engineers and the Honorary Editor of the journal 'Indian Chemical Engineer'.

He technologically contributed Cuba to restore its industrial output when some of its chemical industries suffered after its relationship with USA deteriorated. The nickeliferous laterite that Cuba used to export for the US industries came to a halt and their own industries also was affected. That was by and large restored with the contribution from Roy. He was the founder member of the Indian Institute of Chemical Engineers and the Honorary Editor of the journal "Indian Chemical Engineer". He was elected a Fellow of the Indian Academy of Sciences in 1974 in the Engineering and Technology section and remained involved in the activities of the Academy for a long time. •

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Mushi Santappa

Whither Indian Leather without His Science

A. Ramachandraiah

Jonnagiri, in the Kurnool District of Andhra Pradesh, is known as a diamond-rich village wherein farmers go hunting for natural diamonds in the layers of the land eroded by monsoon rains. On 2 October 1923, an exceedingly rare and precious diamond was born in Jonnagiri, in the name of Mushi Santappa who in his long career had established himself synonymous with Leather Technology in India and abroad.

Prof. Santappa obtained his BA Degree from the University of Madras in 1943 and an MSc from the Banaras Hindu University in 1945. He was dual doctorate degree holder with his first PhD from the University of London in Organic Chemistry in 1949 and the second PhD from the University of Manchester in 1951. He returned to India in 1952 and joined as a faculty member at his own alma mater, the University of Madras and started research on grafting of vinyl monomers onto collagen. In the year, 1972, Prof. Santappa was chosen by the Govt. of India as the Director of the Central Leather Research Institute (CLRI), Chennai, a world-renowned research centre on leather and polymer science and technologies.

Under the leadership of Prof. Santappa, the CLRI, in a short span of 7 years could export leather products worth Rs. 4000 (current value at that time) annually with an overall market share of more than 80% of these products. Prof. Santappa's international reputation was so stellar that he could organise the first ever IUPAC (International Union of Pure and Applied Chemistry) Symposium in India in 1983 at the CLRI, Chennai Campus and thereby achieve global visibility and acclaim to Indian leather science and technological developments. He served as the Vice Chancellor of Sri Venkateswara University, Ttirupati, during 1979-81 and University of Madras, during 1981-84, wherein he established two new Departments, viz., the Department of Energy and the Department of Polymer Science and Technology.

Prof. Mushi Santappa had won several awards and recognitions as a research scientist and as a science administrator. He was a National Professor, Member of the University Grants Commission (UGC) and Chair of Science and Society Projects of the Department of Science and Technology (DST). The Society of Polymer Science, India has instituted an annual award the, Professor M. Santappa Award, in his honour. He was a recipient of the Shanti Swarup Bhatnagar Award in 1967. He received the Federation of Indian Chambers of Commerce & Industry's FICCI Award in 1985. He was an elected Fellow of Indian Academy of Sciences, Indian National Science Academy, National Academy of Sciences, etc., among others. He was also a Fellow of Royal Institute of Chemistry and the New York Academy of Sciences.

Prof. Santappa passed away on 26 February 2017 after leaving his bright footprints iconic to Indian polymer science and leather technologies. •

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Churya SivaRaman

A Dedicated Enzymologists

B.K. Tyagi & Vyoma Bhalla

Churya SivaRaman was an esteemed biochemist with expertise in Molecular Enzymology, Enzyme, and Microbial Technology. He was a pioneering enzymologist at CSIR-National Chemical Laboratory's (NCL) Biochemical Sciences Division. SivaRaman, together with J.C. Sadana and V. Jagannathan, began the major UNDP programme of UNESCO.

He was born on 2 December 1923 in Palghat (Kerala) to Justice C. KunhiRaman and Janaki. Following his graduation from Presidency College in 1945, he pursued his PhD under the supervision of M. Damodaran (University of Madras) on understanding dietary fats in connection to liver-fat deposition.

SivaRaman began his career as a scientist at NCL in 1950 and rose through the ranks to become the Deputy Director and Head of the Biochemistry Division till his formal retirement in 1984. He had been on deputation at the University of Leeds in the United Kingdom for two years.

He is credited with developing novel ways to study crucial enzymes derived from bacteria, such as citrase, now known as citrate lyase. It is an important enzyme in citrate fermentation and a potential evolutionary marker. He continued his study on the same enzyme at NCL. His group studied citrate lyases from Klebsiella aerogenes, Streptococcus faecalis, and Escherichia coli. SivaRaman made a substantial contribution to E. coli citrate lyase, which had a unique design with a single big fused acyl carrier protein coupled with six copies of each enzyme component.

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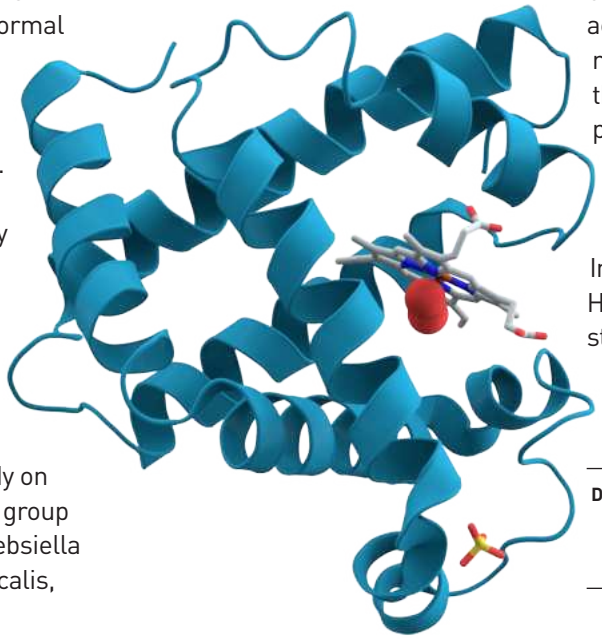

He was a pioneering scientist who paved the way for the field of biotechnology. He developed an immobilised penicillin acylase system, the effectiveness of which was demonstrated in pilot-scale investigations with S. Ramachandran and S.S. Borkar (Hindustan Antibiotics Ltd, Pune).

His latter contributions involve the development of open-pore matrices for yeast for continuous ethanol generation from cane molasses. His achievements were duly recognised by Vividhlaxi Audyogik Samshodhan Vikas Kendra (VASVIK), a non-profit NGO. He received the VASVIK prize in 1985 for his work on developing a high-tech procedure for producing 6-aminopenicillanic acid. SivaRaman continued to work on penicillin acylase as an advisor after his retirement. He was a consultant for the review of teaching and training programmes sponsored by the Department of Biotechnology, New Delhi. He was elected to the Indian Academy of Sciences and the Indian National Science Academy. He had great concern for his PhD students and his junior colleagues.

SivaRaman breathed his last on 25 June 2014. •

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B.C. Subba Rao

An Outstanding Chemist

A. Ramachandraiah

Prof. Herbert C. Brown, while receiving the 1979 Chemistry Nobel Prize for his pioneering research in boron chemistry, had acknowledged the contributions of two Indian scientists who got their PhD degrees under his guidance from the Purdue University. One was Dr B.C. Subba Rao and the other, Prof. C.N.R. Rao. An excerpt of his Nobel Lecture is given hereunder:

Sodium Borohydride ($NaBH_4$)

Prof. Subba Rao, former scientist at the National Chemical Laboratory (NCL), Pune, was born on 8 December 1923 in Mysore. He completed his masters (MSc) degree from Mysore University with a consistently outstanding academic track record. After a brief teaching career at the University of Mysore, Indian Institute of Science (IISc), Bangalore, and IIT Kharagpur, he went to Purdue University, USA in 1952, to join Prof. Brown for pursuing his doctoral studies. During his doctoral and postdoctoral research, he contributed on the path-breaking research on application of sodium borohydride (NaBH4) before returning to India in 1958.

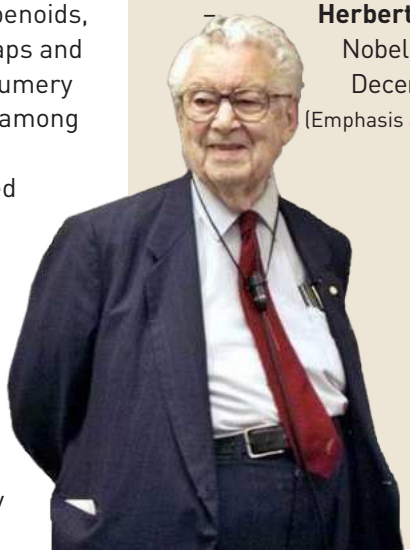
Dr Subba Rao worked on some problems of national importance, such as industrial uses of cashew nut shell oil, terpenes, etc. Later he joined as the R&D Director of HICO Products Ltd, Bombay and worked on colloids, emulsions, and surfactants. In 1967 he joined the Chemical Division of Hindustan Lever Research Limited, Mumbai as the Divisional Manager). Dr Subba Rao is well known in the chemical industry for his research contributions in boron chemistry, surfactants, terpenoids, oils and fats, soaps and detergents, perfumery chemicals, etc., among others.

He was selected as a Fellow of the Indian Academy of Sciences, Bengaluru in 1975. According to Bharat Ratna Prof. C.N.R. Rao, Dr Subba Rao was a creative chemist, a good friend and a very highly mingling type.

Dr Subba Rao is well known in the chemical industry for his research contributions in boron chemistry, surfactants, terpenoids, oils and fats, soaps and detergents, perfumery chemicals, etc.

*'...My coworker, **Dr. B. C. Subba Rao**, was examining the reducing characteristics of sodium borohydride in diglyme catalyzed by aluminum chloride ...**Dr. Subba Rao** established that oxidation of such organoboranes, in situ, with alkaline hydrogen peroxide, proceeds quantitatively, producing alcohols with the precise structure of the organoborane..., **Dr. B. C. Subba Rao** returned to India, after spending five years with me...'*

Herbert C. Brown
Nobel Lecture, 8 December 1979
(Emphasis added by the author)



He served for many long years as a Chief Scientist at National Chemical Laboratories (NCL), Pune, before taking a voluntary retirement and after leaving his indelible footprints there. He died in Mysore on 9 August 2017. •

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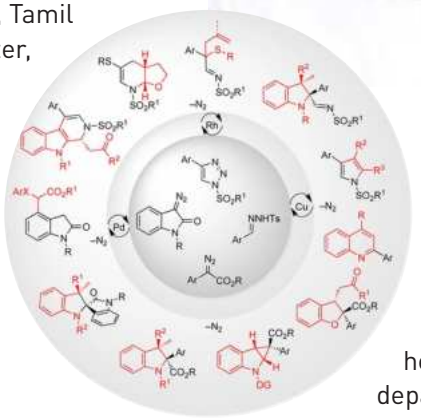
Sambasiva Swaminathan

A Remarkable Chemist

Aditi Dev

An eminent organic chemist of India, Prof. Sambasiva Swaminathan contributed significantly to the advancement of modern science in India. Born on 20 April 1923 in Madras (now Chennai), he was courageous to choose the field of science as a career path that was considered unusual in those days. Following his passion, he pursued his graduation in chemistry from Annamalai University, Tamil Nadu (1943). Thereafter, he joined the Indian Institute of Science, Bangalore (now Bengaluru) and was awarded his Associateship of the Institute (equivalent to a post-graduation degree by thesis) while working with Prof. P.C. Guha. After receiving the Government of India Scholarship, he pursued his PhD under the supervision of Prof. H.R. Snyder at the University of Illinois, USA. Subsequently, he joined Ohio State University to pursue his post-doctoral degree under Prof. M.S. Newman.

On his return in 1953, he joined as a Reader at the Department of Organic Chemistry, University of Madras. Continuing his association with the University of Madras, he took upon himself a mission to establish a modern organic chemistry research laboratory in Madras. In 1960, he became the Professor and Head of the



Department and in the following years, with tremendous efforts and diligence, he made the department the most effective and recognised centre for research in organic chemistry in India.

His significant research contributions were in synthetic approaches to non-aromatic steroids; molecular rearrangements; alicyclic chemistry; chemistry of indole and related heterocycles; etc. Prof. Swaminathan was among the pioneers to synthesise the critical intermediate known as Wieland–Miescher ketone on a preparative scale and elaborated it to synthesize non-aromatic steroids. He was also the first to develop an efficient synthesis of 2-methyl-cyclopentane-1,3-dione used as a pre-formed ring D in many steroid syntheses.

Apart from being an excellent scientist, he was a great mentor who believed in and advocated equality and transparency in his professional and personal life. He was honoured with many prestigious awards, including the Prof. T.R. Govindachari award (1980), the Sir P.C. Ray medal (1981), a Lifetime achievement award from the Chemical Research Society of India (2001), Fellowship of the Indian Academy of Sciences and Fellowship of the Indian National Science Academy.

He was also one of the five founding trustees of the National Organic Symposium Trust (NOST), formed in 1983. Since then, the institution has been organising Symposia in Organic Chemistry in India, popularising science, promoting synergy between scientific and academic institutions, and providing a common platform for interactions among scientists, researchers, academia, and industries around the globe.

In 2004 he successfully published an important paper on the chiral synthesis in the absence of solvent of the important Wieland–Miescher and Hajos–Parrish diketones after his 80th birthday. Prof. Swaminathan's remarkable dynamism and zeal for his work and research will always be inspiring in furthering modern science in India. •

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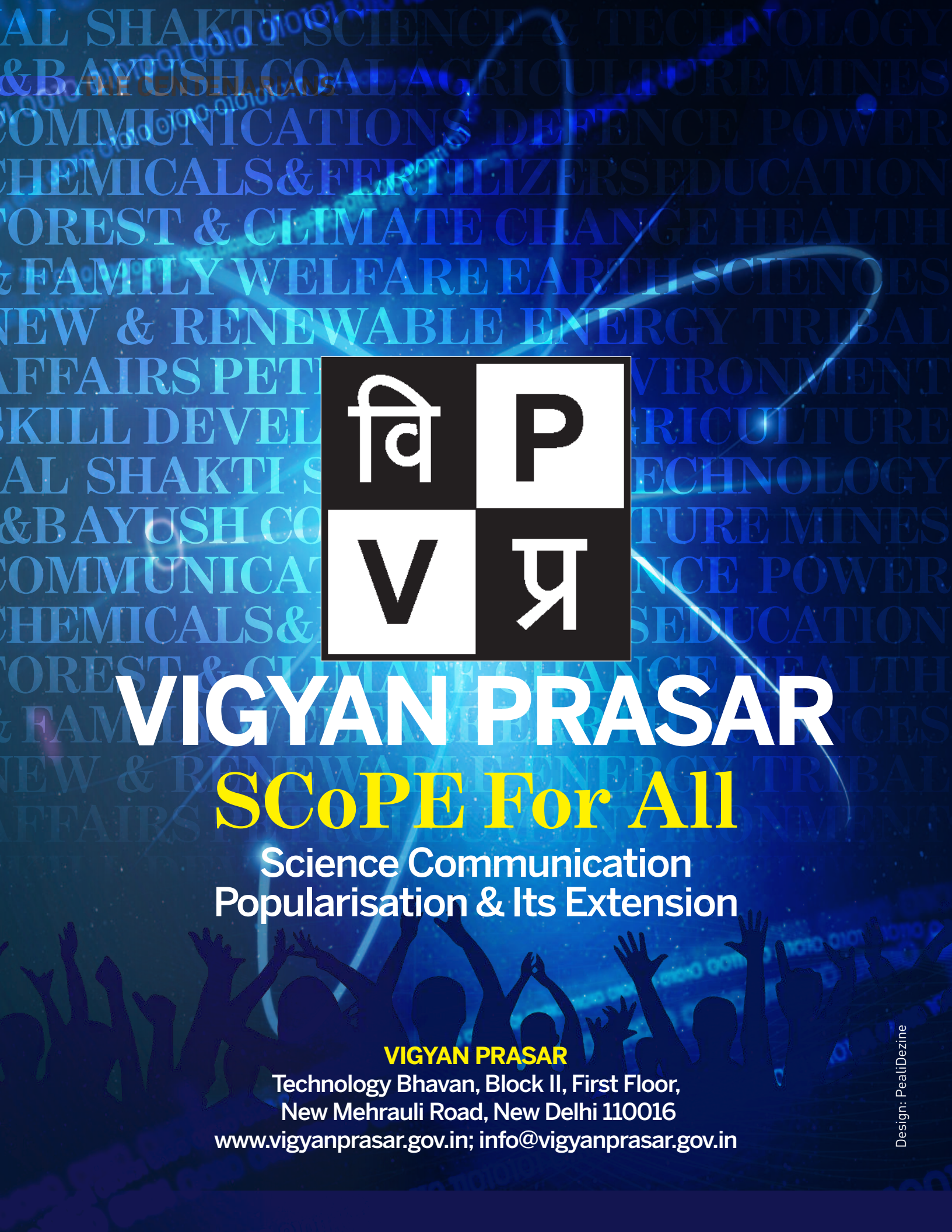

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