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YUVARAJA'S COLLEGE
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CHINTANA MANTHANA

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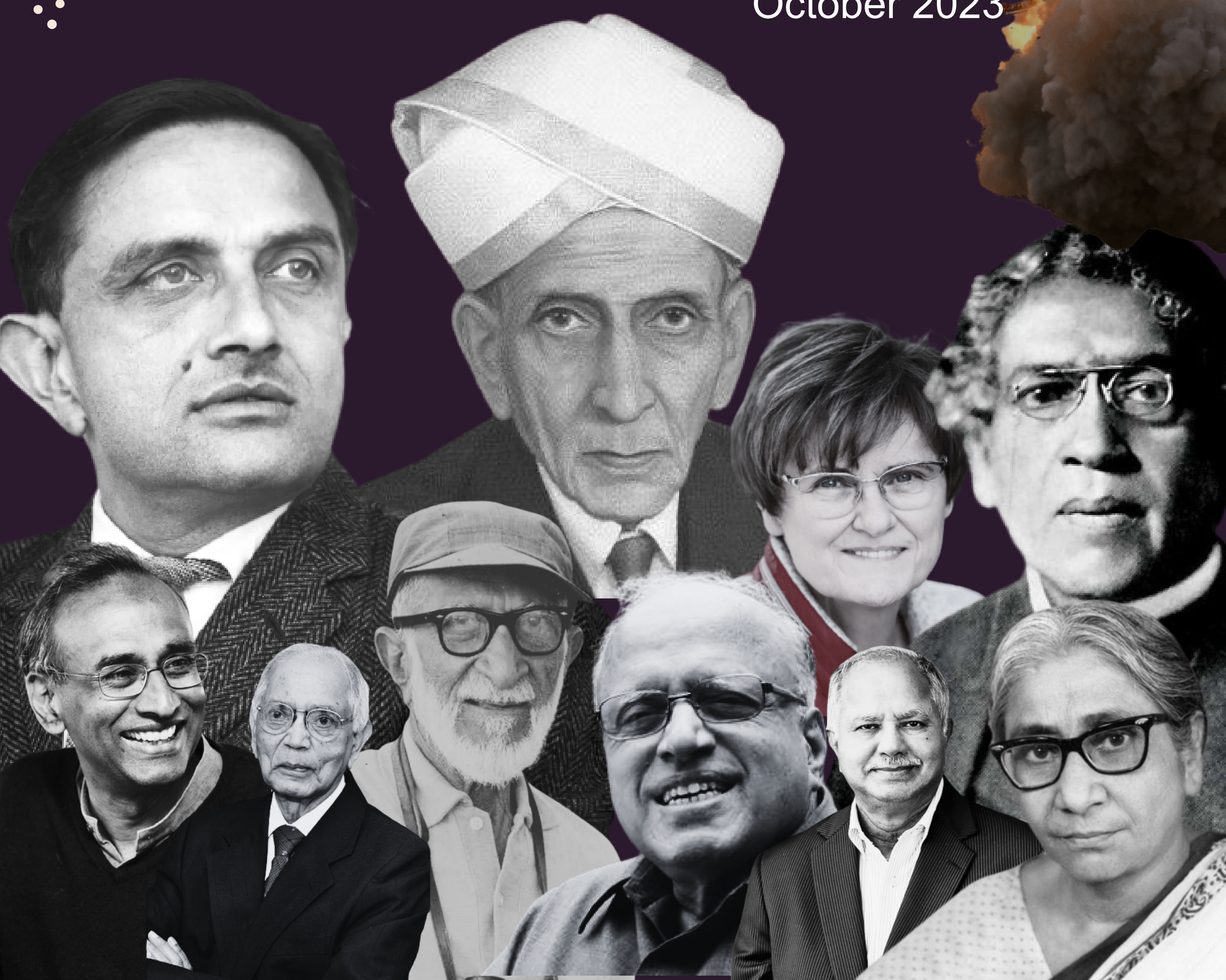


University of Mysore

Yuvaraja's College (Autonomous)

(A CONSTITUENT AUTONOMOUS COLLEGE)

Mysore-570 005

Chintana Manthana

Vol 2

Message from Principal

I am delighted to know that the 2nd volume of the online Science magazine ***Chintana Manthana*** of Yuvaraja's College (Autonomous) is ready for the benefit of our student's community. This effort of our college Science magazine editorial board and of our students is appreciable. It is good to know that our students are getting opportunities to get involved in diverse type of cocurricular activities along with their regular academic activities. The capability of science communication of our students as shown through this science magazine *Chintana Manthana* is commendable. I wish all success for this science magazine.

Oct 28, 2023

Prof H C Devaraje Gowda

Principal

From Editor's Desk…

I am very happy to be the Editor of the 2nd volume of the online Science magazine ***Chintana Manthana*** of the Yuvaraja's College (Autonomous). In this volume many scientific achievements of our scientists along with significant scientific achievement made during 2023 along with write up on the Nobel Prizes 2023 are recorded. I am very proud of students of our college who have come forward to write articles to this online magazine. This is giving an opportunity to inspire our young minds towards science writing and understand deeper aspect of basic science and application of science for betterment of humanity. Students have collected information on fourteen accomplished Indian Scientists and written in their own style and conveyed in the best possible way to record the achievement of our scientists. Chandrayaan-3: India's assent into deep space article gves the beautiful account of our country's achievements of our ISRO scientists. Articles related to the Nobel Prize in Physiology or Medicine, Chemistry, Physics shows that our students are updated to the current progress in all the fields of science. Our editorial board is also happy to record the list of students who got opportunity to do internships in our country's prestigious research institutions. Through such endeavors, our college is supporting scientific progress. I hope this scientific temper will continue to grow in our college for the benefit of all stake holders and progress of our country.

Oct 28, 2023 Dr Devaki N S

Chintana Manthana

Online Science Magazine: Vol 2

Theme: **Indian Scientists**

CONTENTS

Asima Chatterjee:-The Doyenne of Chemistry

Asima Chatterjee

(23 September 1917 – 22 November 2006)

Asima Chatterjee (née Mukherjee) **was an Indian chemist and** she was the first woman to be awarded a Doctor of Science by an Indian University - in 1944, by the University of Calcutta. Asima Chatterjee was born on September 23, 1917, in Calcutta, being the elder of the two children of late Dr. Indranarayan Mukherjee and late Kamala Devi. In 1945 she married Dr. Baradananda Chatterjee, D.Sc. F.N.A., a well-known physical chemist who became Professor and Head of the Department of Chemistry, Geology and Metallurgy and Vice-Principal, Bengal Engineering College, Howrah. They soon had their daughter, Julie. Prof. Baradananda Chatterjee had a profound influence on his wife. Without his constant inspiration, encouragement and co-operation it would have been impossible for Mrs. Chatterjee to dedicate herself to the cause of science.

Education And Career

She is best known for her work in the fields of organic chemistry and phyto-medicine. She is also credited for synthesising various plant-based drugs like Vinca alkaloids, which are used in cancer treatment.

Chatterjee was born in British India in 1917 and went on to study at the Scottish Churches College in Kolkata where she earned her BSc from Calcutta University in 1936.In 1940 Mrs. Chatterjee joined Lady Brabourne College,

Calcutta, as the founder-Head of the Department of Chemistry. In 1944 she was appointed a Honorary Lecturer in Chemistry, Calcutta University. In 1947 she left for the U.S.A. on study leave from Lady Brabourne College. In 1944, she received her MSc from the University of Calcutta and later that year became a lecturer at the same institution. In 1945, Chatterjee became a Fellow of the Indian Institute of Science and began teaching at Bose Institute. In 1947, she was awarded a scholarship to Cambridge University in England where she studied under Nobel Laureate Sir Robert Robinson and completed a doctorate degree in organic chemistry in 1951.Upon return to India, Chatterjee continued to teach at the Bose Institute until 1956. She then joined the University of Calcutta as a professor and served in that post until her retirement in 1984.

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. On the request of the late Professor Satyendranath Bose, FRS, she wrote Sarai Madhyamic Rasayan, a book in Bengali on chemistry for secondary school students, published by BangiyaBijnanParishad, an Institute for the Popularisation of Science founded by SN Bose himself.

Research, Achievements and Notable Contributions.

The research activities of Professor Asima Chatterjee extended over a period of nearly sixty years. She made significant contributions in the field of medicinal chemistry with special reference to alkaloids, coumarins and terpenoids, analytical chemistry, and mechanistic organic chemistry. Besides her keen interest on fundamental research, Professor Chatterjee always stressed on the utilization of phytochemicals from indigenous plants as drugs and drug intermediate**.**

Chatterjee successfully developed the anti-epileptic drug, 'Ayush-56' from Marsiliaminuta and the anti-malarial drug from Alstoniascholaris, Swrrtiachirata, Picrorphiza kurroa and Ceasalpinna crista. The patented drugs have been marketed by several companies.

– Initiated chemical investigation of alkaloids in Rauwolfiacanescens.

– Investigated the chemistry of almost all principal types of indole alkaloids.Contributions with regard to elucidation of structure and stereochemistry of ajmalicine and sarpagine.

– First suggested stereo-configuration of sarpagine. Isolated and characterized geissoschizine, a key precursor in biogenesis of indole alkaloids from Rhazya stricta.Carried out synthetic studies on a number of complex indole alkaloids, quinoline and isoquinoline alkaloids.

Awards and recognition

- She was a PremchandRoychand Scholar of the University of Calcutta.
- From 1962 to 1982, she was the Khaira Professor of Chemistry, one of the coveted chairs of the University of Calcutta.
- In 1960, she was elected a Fellow of the Indian National Science Academy, New Delhi.
- In 1961, she received the Shanti Swarup Bhatnagar Award in chemical science, becoming the first female recipient of this award.
- In 1975, she was conferred the Padma Bhushan and became the first female scientist to be elected as the General President of the Indian Science Congress Association .
- She was nominated by the President of India as a Member of the Rajya Sabha from February 1982 to May 1990.
- On 23 September 2017, the search engine Google deployed a 24-hour Google Doodle in honour of the 100th anniversary of Chatterjee's birth.
- She won the C.V Raman award, P.C Ray Award, and the S.S Bhatnagar award.

Professor Chatterjee's rise to eminence was possible due to her sincere devotion to duty, hard work and unquenched thirst for knowledge. She was always learning throughout her life, never hesitating to learn more, even from her students, even in her senior years. A true 'Karma Yogi', she believed in carrying out her duties and her responsibilities without aspiring for the results and rewards.

-Noor Subiya Taj

3rd semester, Int. MSc in Molecular Biology.

Professor Birbal Sahni:-First Jurassic Scientist

Birbal Sahni

(14 November 1891 – 10 April 1949)

Birbal Sahni was a great Indian palaeobotanist who founded the Institute of Palaeobotany at Lucknow, which was ofter renamed as Birbal Sahni Institute of Palaeobotany later his death. He was a pioneer in palaeobotanical research in India and was also a geologist who took an interest in archaeology. Palaeobotany is the study of fossil plants, and his interest in the subject stemmed from his childhood fascination with plants, shells, and stones

He was born in 14th November 1891 at Behra, a small town in Shahpur District. He was a third kid of his parents, Mrs. Ishar Devi and Mr. Ruchi Ram Sahni. Ruchi Ram Sahni was an enthusiastic educationist, a great patriot and a devoted social worker. He was a professor at Chemistry at Government College in Lahore. Mrs. Ishwar Devi was a religious lady and was devoted to her family.

Birbal completed his early education at Lahore, first in the Mission and Central Model schools and later at the Government College. He was intelligent student and got many academic distinctions during his student life e.g got first in Sanskrit in Matriculation, attaining a province position in intermediate Science. He cleared the matriculation examination from the Punjab University. After, finishing graduation in 1911 by the Punjab University, he went to Cambridge University for his higher studies. He obtained BSc degree from London University and started his research under inspiring teacher Sir Albert Charles Seward whom he regarded as guider. Along with him, he worked in the study of Indian Gondwana Plants, the findings of which were published in the book, 'Indian Gondwana Plants: A Revision' in 1920. Along with Sahni was awarded his DSc degree from the University of London in 1919. Sahni was interested in music and could play the sitar and the violin. He was also curious in clay-modelling and in playing chess and tennis. At Oxford he used to play tennis for Indian majlis. Other interests include geology, photography, archaeology and numismatics.

Birbal Sahni was not just botanist but also geologist. He was a teacher of par excellence and had great affection for palaeobotany. After completion of his education Birbal Sahni returned to India and worked as Professor at Botany at Banaras Hindu University, Varanasi and Punjab University for about a year. Sahni was identified by many academies and institutions in India and abroad for his research. He was elected as Fellow of the Royal Society of London (FRS) in 1936, the highest British scientific honour, awarded for the first time to an Indian botanist. He was elected Vice-President, Palaeobotany section, of the 5th and 6th International Botanical Congresses of 1930 and 1935, respectively; General President of Indian Science Congress for 1940; President, National Academy of

Sciences, India, 1937–1939 and 1943–1944. In 1948 he was selected as Honorary American member Academy of Arts and Sciences. Other high honour which came to him was his election as Honorary President of the International Botanical Congress, Stockholm in 1950.

Maulana Abul Kalam Azad, Minister of Education in 1947 offered the Secretary post to the Ministry of Education to Sahni. This he reluctantly recieved. A bust of Sahni is placed in the Geological Survey of India in Calcutta

Birbal Sahni was elected fellow of Geological Society of Great Britain. He also served an editorial board of the Botanical Journal Chronica Botanica. He was elected as vice president of the 5th and 6th International Botanical Congress in 1930 and 1935 conducted at Cambridge and Amsterdam respectively. In 1936 he was selected as fellow of Royal Society of London. His greatest ambition was to bring palaeobotanical research in India to a structuredand organized framework. For this purpose, he built the committee of Indian Palaeobotanists & give the named as “The Palaeobotanical Society” in 1939 and headed a meeting to coardinate and develop a research fields in India. He was general President of the Indian Science Congress at 1940. He was a creator fellow of the National Institute of Science Academy (now Indian Science Academy, New Delhi). The University of Cambridge had recognized his researches and honoured as a Sc. D. in 1929, American Academy of arts and Science selected him as its foreign honorary member in 1948. However, at 1950 destiny prevented him to preside as honorary president in International Botanical Congress, held in Stockhlom.

Birbal Sahni married Savitri Suri in 1920. She was a Sunder Das Suri daughter Suri who was an Inspector of Schools at Punjab. His wife took an active interest in his scientific pursuits and was a pillar of support to him.

Sahni died of a sudden heart attack on the night of 10th April, 1949 within less than a week of the foundation stone laying ceremony of his institute. Sahni's wife finished the work he had left undone. The institute is today called as the Birbal Sahni Institute of Palaeobotany.

Sahni was the founder of Palaeobotany Institute which was later recalled the Birbal Sahni Institute of Palaeobotany in his honor. The institute encourage the higher learning in the field of plant fossil research and works in close coordination with various organizations such as Geological Survey of India, Oil and Natural Gas Commission, Physical Research Laboratory, Oil India Limited, Coal India Limited, and Coal Mine Planning and Design Institute.

He was a teacher of par excellence and had great passion for palaeobotany. He begin this subject from a small corner in the Botany Department, Lucknow University and ultimately succesededed in get going a well-recognized International Institute on this subject. His love and devotion for this subject helped him to acquire fossil material from several countries. He made comprehensive studies on Indian Conifers. After, he explored wealth of fossil plants from Rajmahal Hills. He studied *Ptilophyllum* and another elements and found that stem *Bucklandia*, leaf *Ptilophyllum* and flower *Williamsonia* component to the same plant. He made rebuild of *Williamsonia sewardiana*. He find petrified wood of *Homoxylon rajmahalense*, later, which was named as *Sahnioxylon* rajmahalense. Along with

this he also described *Glossopteris angustifolia* Brongniart, *Palmoxylon sundram* a petrified wood, *Cocos* wood and a water fern *Azolla intertrappea*. This was followed from the study of Gondwana plants of Salt Range, Karewa flora from Kashmir. Being a teacher, Sahni first elevate the standard of teaching at the Department of Botany. Next he started the Department of Geology. A logical sequence was establishment of the institute of palaeobotany. It was the first of its kind in the world. Birbal Sahni's work encouraged his younger brother M.R. Sahni and his nephew Ashok Sahni to take up a career in palaeontology.

Along with, he was greatly interested in Archaeology. He did his studies in Yaudheya Coin Moulds from Khokhra- Kot in Rohtak (1936) and from Sunhet near Ludhiana (1941). He threw light on the studies of coin moulds and published his results on “The Technique of Casting Coins in Ancient India” in masterly monograph, Numismatic Society of Memoirs of India in 1945. This got Nelson Wright Medal award. In his research paper he had mentioned that the aims and methods of the palaeobotanist are not essentially different from those of the archaeologis

Sahni received many awards and prizes for his great contributions. He was received the Barclay Medal of Royal Asiatic Society of Bengal in 1936, He was selected a Fellow of the Royal Society at London (FRS) in 1936, the highest British scientific honor, becoming the first Indian botanist to be accorded this honor. He also got the Barclay Medal of the Royal Asiatic Society of Bengal the same year. He received the Nelson Wright Medal of the Numismatic Society of India in 1945 and the Sir C. R.

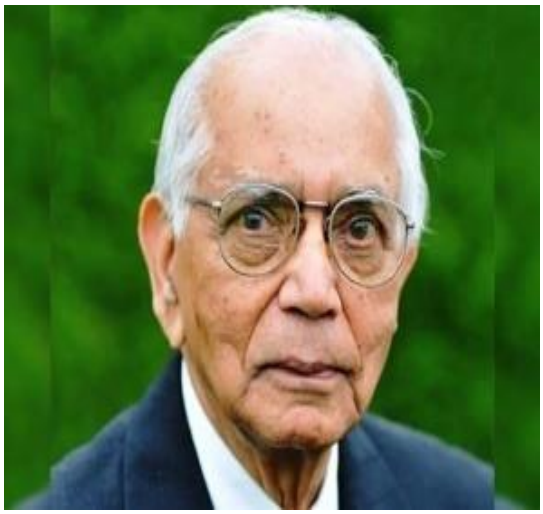
Reddy National prize in 1947. The Government of United Provinces gifted a land next to Lucknow University in September 1948. He made extensive studies in the crop pattern of the Indus Valley Civilization and the age of the Salt Range, now in Pakistan. For his work in numismatics he received the Nelson Wright Medal in 1945. A few days before his final departure Pt. Jawaharlal Nehru had laid the foundation stone of the Institute of Paleobotany at Lucknow. Later this institute was renamed as the Birbal Institute of Paleobotany. An award called Birbal Gold Award was also instituted in his memory and is presented every year to the best botanist in the country. prof. Birbal sahni was the great son of mother India. He was the first Indian scientist who worked for Palaeobotany.

Birbal Savitri Sahni Memorial Museum is situated at Birbal Sahni Marg in Lucknow, Uttar Pradesh. It was established in the year of 1984 by the eminent professor and scientist Mr. Birbal Sahni who has donated all his personal collection to this Museum. It is mainly a science Museum. Birbal Savitri Sahni Memorial Museum comprises of collections like furniture, clothing, coins, manuscripts, research papers, valuable letters, photographs and books on different subjects

The Birbal Sahni Institute of Palaeosciences (formerly, Birbal Sahni Institute of Palaeobotany; BSIP) is a autonomous institute constituted under the Department of Science and Technology, Government of India. The institute is located at Lucknow, Uttar Pradesh, India and is a seat of higher learning in the field of plant fossil research.

-**Shwetha A.C**

Calyampudi Radhakrishna Rao:-Mathematical Statistician



Calyampudi Radhakrishna Rao

(10 sept 1920-22 Aug 2023)

C. R. Rao was an Indian-American mathematician and statistician. He was professor emeritus at Pennsylvania state university and research professor at the university at buffalo.

Life and Career

C. R. Rao was born in 10 September 1920 in Huvanna Hadagalli, now in Karnataka state, in the southern part of India. He was an eighth child in a family of six brothers and four sisters. His father was an inspector with reputation in CID work and his mother was A. Laxmikanthamma. He was admitted to class 2 in 1925 when he was only five years old and was able to memorize multiplication tables up to 16 by 16. He was completed his M. An in Mathematics in Andhra Pradesh and M.A in Statistics in university of Calcutta and he obtained a PhD under R. A fisher in 1948 and a Scd in 1965 at king's college, Cambridge.

Rao first worked at the Indian statistical institute and the anthropological museum in Cambridge. Later he held several important positions, as the director of the Indian statistical institute, Jawaharlal Nehru professor and national professor in India, university professor at the university of Pittsburgh and elderly professor and chair of statistics and director of the center for multivariate analysis at Pennsylvania state university.

Rao stayed for 40 years in Calcutta. After getting his M. A, he worked there as a research scholar, superintending statistician, professor and head of research and training school, later director of the ISI, Jawaharlal Nehru professor and national professor, before he took mandatory retirement at the age of 60.

Among his bestknown discoveries are the cramer-rao bound and the Rao Blackwell theorem both related to the quality of estimators. Other areas he worked in include multivariate analysis, estimation theory, and differential geometry. His other contributions include the fisher-Rao theorem, Rao distance, and orthogonal arrays.

Awards

Receiving the Shanti Swarup Bhatnagar Award, Council of Scientific and Industrial Research, from Prime Minister Nehru, India on March 23, 1963

Mahalanobis Prize, International Statistical Institute "for life time achievement"

Padma Vibhushan, second highest civilian award, Government of India for "Outstanding Contributions to Science and Engineering/Statistics"

- Guy medal in gold (2011) of the royal statistical society.
- India science award 2010 (the highest award in a scientific field presented by government of India).
- Shanti Swarup Bhatnagar award, council of scientific and industrial research, from Prime Minister Nehru, India on March 23, 1963.
- Mahalanobis prize , international statistical institute 'for life time achievement'(2003)

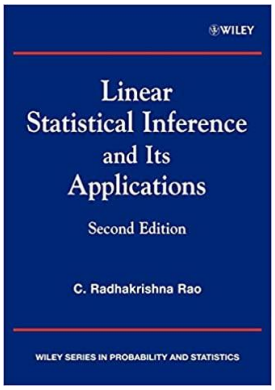
- Padma Vibhushan, second highest civilian award, government of India for outstanding contributions to science and engineering statistics
- Sardar Patel lifetime achievement international award (Sardar Ratna) (2014) by Sardar Patel international foundation, India.
- Mehnadh Saha medal (1969) 0f the Indian national science academy.
- Guy medal in silver (1963) of the royal statistical society.
- S. S. Bhatnagar award (1963) of council of scientific and industrial research.
- JC Bose gold medal of the Bose institute.
- Gold medal of the University of Calcutta.

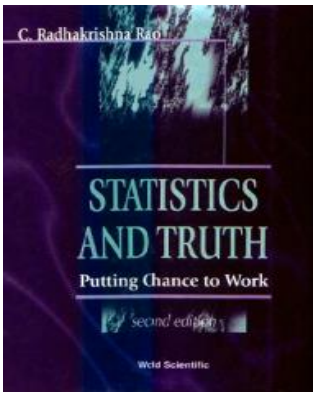
Publications

He is the author of 14 books and about 350 research papers in high impact journals. Three of his books have been translated into several European, Chinese, and Japanese languages. His most cited books are the following;

Linear statistical inference and its application, John Wiley, first edition: 1965, second edition: 1973. Amazone.com lists this book under the list of "Must have statistics books", quoting a reviewer's comment "information packed book, bible of matrix and linear theory in statistics".

Statistics and truth, World scientific, first edition: 1989, second edition: 1997. Review by statistician Sir David Cox: "The book is a powerful illustration of the nature of statistical arguments.





Breakthroughs in Statistics

C. R. Rao is among the world leaders in statistical science over the last seven decades. His research, scholarship, and professional services have had a profound influence on theory and applications of statistics. His research in multivariate analysis, for example, is useful in economic planning, weather prediction, and medical diagnosis, tracking the movements of spy planes, and monitoring the movements of spacecrafts. Technical terms bearing his name appear in all standard textbooks on statistics, econometrics, Biometrics and engineering.

-Latha M

Dr Meghanad Saha:-Astrophysicist

Dr Meghanad Saha

(6 Oct 1893- 16 Feb 1956)

Born: 6 October 1893, Kaliakair Upazila, Bangladesh

Died: 16 February 1956, New Delhi

MEGHNAD SAHA was among the great Indian scientist who belonged to a poor family and struggled to come up in life. He was born in Seoratali, Dacca district, Kaliakair Upazila now in Bangladesh, on October 6, 1893. He was the fifth son of his parents, Sri Jagannath Saha and Smt. Bhuvaneshwari Devi, had five sons and three daughters. The family depended on the shopkeeping business, and Saha's early education was filled with many hardships. His father was a petty grocer who barely managed to keep his large family from starving.

Meghnad Saha started his education in a primary school in the village. while Saha was studying in his school, the Governor of Bengal was coming to inspect his school, which was opposed by many student, and Saha was also among those students. Due to this, the school administration had also stopped the scholarship given to Saha, not only that, but he was also thrown out of school. Later he was admitted to a private school.

He took admission to the Kishorilal Jubilee School and passed the Entrance examination of the Calcutta University in 1909, he was the first student from East Bengal to obtain the highest marks in languages (English, Bengali, Sanskrit combined) and in Mathematics. In 1911, He ranked first in the all-Bengal

competition examination in the Bible, open to school and college students, conducted by the Baptist Mission. Saha passed the Dacca College, Dacca, the Intermediate Science Examination of Calcutta University. Saha was first in maths, he ranked third in the ISC exam. After that, he was admitted to Presidency College Calcutta. In 1913, he graduated from Presidency College with Mathematics major and got second rank. He planed at a time to take the competitive examination for the Indian Finance Service, but permission was not granted by the Government. He resolved to study and do research in applied mathematics and physics. To support himself and his younger brother staying with him, for a few months he took private tuitions of which at one time he was doing as many as three in different parts of Calcutta, covering such long distances on a bicycle. In 1915, he stood first in MSc. exam, in Applied Mathematics.

He made a remarkable contribution to the field of Astrophysics. He was the first person to relate the temperature of stars to their spectrum and he proposed the Saha ionization equations - a foundation for many advancements in astrochemistry and astrophysics. He also worked on other topics like stellar spectra, thermal ionization, selective radiation pressure, spectroscopy, molecular dissociation, propagation of radio waves in the ionosphere, solar corona, solar radio emission, beta radioactivity, and the age of the rocks. He submitted an “ionization formula” which explained the presence of the spectral lines.

In 1917, He started his professional career and joined as a lecturer at the newly opened University College of Science in Calcutta. He used to teach Quantum Physics. He translated the papers of Einstein and Hermann Minkowski on relativity into English from German versions. Shortly after the end of the First World War, there was an announcement of the momentous discovery of the deflexion of starlight by the gravitational field of the sun, confirming Einstein’s theory of general relativity. Saha got deeply interested in the relativity theory. He joined with S. N. Bose and prepared an English translation of Einstein’s papers, later published in the form of a book by the University of Calcutta. The study of relativity led Saha to some investigations in electromagnetic theory and Saha’s first original paper authorized ‘On Maxwell’s stresses’ appeared in the Philosophical Magazine in 1917.

In 1919, the American Journal of Astrophysics a research paper – “On Selective Radiation Pressure and its Application”- published in the Journal named Royal

Asiatic Society of Bengal (Calcutta) a paper on the measurement of the pressure of light, using a method of resonance. In 1920, Saha formulated thermal ionization theory and his thesis on ‘’Origin of Lines in Stellar Spectra’ won him the Griffith Prize at Calcutta University. The formula proved to be a breakthrough in astrophysics, it links the composition and appearance of the spectrum with the temperature of the light source and thus can be used to determine either the temperature of the star or the relative abundance of the chemical elements investigated.

Saha’s greatest contribution is, undoubtedly, the theory of high-temperature ionization and its application to stellar atmospheres. The equation that goes by his name was first given in the paper ‘On ionization in the solar chromosphere’, published in the Philosophical Magazine on October 1920. Using the language of physical-chemistry he called it the ‘equation of the reaction-isobar for ionization’. Discussing the case of the ionization of calcium, he wrote:

‘We may regard the ionization of calcium atom as taking place according

to the following scheme, familiar in physical chemistry,

Ca ^ Ca++ e— U

where Ca is the normal atom of calcium (in the vapour state), Ca+ is an atom that has lost one electron, and U is the quantity of energy liberated in the process. The quantity considered, is 1 g atom

To calculate the “Reaction isobar” K, let us assume that P is the total pressure, and a fraction x of the Ca-atom is ionized.

Then we have

log K = l o g - f - g P — _ 4 ^ T T +2-5 log r - 6 - 5

This is the equation of the “reaction-isobar” which is throughout employed for calculating the “electron-affinity” of the ionized atom.’ The value 6*5 in the above expression is the value of the chemical constant obtained from the Sackur-Tetrode-Stern relation.

He went abroad and stayed there for two years. He spent time in research at Imperial College, London, and research at Imperial College London, and a research laboratory in Germany. In 1927, Saha was elected as a fellow of ‘London’s Royal Society.

In 1932, Saha moved to Allahabad, Uttar Pradesh Academy of Science was established. He came back to Science College, Calcutta in 1938. During this time, he got interested in nuclear physics, which later was named after him as the Saha Institute of Nuclear physics (SINP) in the curriculum of higher studies in science. he was serving as a means of pursuing the creation of the Calcutta Institute of Nuclear Physics, of which he became honorary director. He saw cyclotrons used for research in nuclear physics abroad, he ordered one to be installed in the institute. India had its first cyclotron in operation in 1950. He discovered an instrument to measure the weight and pressure of solar rays. He produced the famous equation, which he called 'the equation of the reaction-isobar for ionization', which later became known as Saha's "Thermo-Ionization Equation". Saha was the leading spirit in organizing scientific societies like the 'National Academy of Science' in 1930, 'The Indian Institute of Science in 1935, and the 'Indian Association for the Cultivation of science in 1944. The long-lasting memorial to him is the 'Saha Institute of Nuclear physics' founded in 1943 in Calcutta.

In his later years, Saha increasingly turned his attention to the social relation of science and founded the outspoken journal Science and Culture in 1935. In 1951 he was elected to the Indian Parliament as an independent candidate in the country's first general election held after the independence of the country, and in this election, he won from Calcutta by a huge number of votes. He worked with the country's first Prime Minister Jawaharlal Nehru in the National Planning Committee. He was a co-author of Treatise on Heat (4th ed., 1958) and A Treatise on Modern Physics (1934). One of his very important papers is "Ionization in the Solar Chromosphere,". The University of Allahabad has instituted the "MEGHNAD SAHA AWARD" for best research scholars.

He was a chief architect of river planning in India. He prepared an original plan for Damodar Valley Project. Apart from physics, Saha was also interested in ancient history and archaeology. One of the most renowned scientists of his time, he was nominated for the Nobel Prize multiple times. However, his nominations were rejected because of his contributions were considered mere 'applications' and not 'discoveries'.

Saha was married in June 1918 to Shrimati Radha Rani Saha. Her kindliness and genuine simplicity of character have won her the affection and respect of generations of students and colleagues of Saha. Saha is survived by his wife,

three sons, and three daughters. The eldest son, A. K. Saha, is a Professor in the Institute of Nuclear Physics.

Meghnad Saha was also nominated for the 'Nobel prize' in physics in 1935-36. He was elected as a Member of Parliament for the North-West Calcutta constituency In 1952. And he stood as an independent candidate for Parliament and was elected by a wide margin. He was an advocate for the peaceful use of nuclear energy and instrumental in the reformation of the Indian calendar. He died on February 16, 1956, due to a heart attack, when he was going to attend a meeting of the Scientific Planning Commission held at Rashtrapati Bhavan.

The University of Calcutta (informally known as Calcutta University; abbreviated as CU) is the highest public research university located in Kolkata, West Bengal, India. It has 151 affiliated undergraduate colleges and 16 institutes in Kolkata and nearby areas. It was established on 24 January 1857 and is the first multidisciplinary and Western-style institution in Asia. Indian Association for the Cultivation of Science (IACS) is a public, deemed, research university for higher education and research in basic sciences under the Department of Science & Technology, Government of India, situated at the heart of the Cultural capital of India. Established in 1876 by Mahendralal Sarkar, a private medical practitioner, it focuses on fundamental research in basic sciences. It is Asia's oldest research institute Located at Jadavpur, South Kolkata near Jadavpur University, Central Glass and Ceramic Research Institute and Indian Institute of Chemical Biology.

Birla Industrial & Technological Museum (BITM), a unit under National Council of Science Museums (NCSM), Ministry of Culture, Government of India, is at Gurusaday Road, Kolkata. inaugurated on May 2, 1959, under the governmental jurisdiction of the Council of Scientific & Industrial Research (CSIR), is commonly recognized as the precursor of India's science museum concept.

From being a young boy eager to excel in his studies to be one of the world's most renowned scientists, Saha shaped the face of modern science in India. The life of Saha was in a sense an integral part of the growth of scientific research and progress in India, and the effect of his views and powerful personality would be felt for a long time to come in almost every aspect of scientific activity in the country. His dedication to science, his forthrightness, and utter disregard for personal comforts in the pursuit of his chosen vocation will long remain an inspiration and an example. Saha may not be present among us today, but he will always be remembered for his remarkable disco8302veries in the field of astronomy.

-Meghana HD

Dr Shanti Swarup Bhatnagar:- Chemist

Dr Shanti Swarup Bhatnagar

(21 Feb 1894- 1 Jan 1955)

Introduction:

Dr Shanti Swarup Bhatnagar was the Founder Director (and later first Director General) of Council of Scientific & Industrial Research (CSIR) who is credited with establishing twelve national laboratories in as many years. Dr Bhatnagar played a significant role in building of post independent infrastructure and in the formulation of India's policies. Dr Bhatnagar concurrently held number of important position in the Government. He was the first Chairman of the University Grants Commission (UGC). He was Secretary, Ministry of Education and Educational Adviser of Government. He was the first Secretary to Ministry of Natural Resource & Scientific Research and also Secretary of Atomic Energy Commission. He played an instrument role in the establishment of the National Research Development Corporation (NRDC) of India. His research contribution in the areas of magneto chemistry and physical chemistry of emulsion were widely recognized. In 1936, Dr Bhatnagar was conferred with Order of British

Empire (OBE). He was Knighted in 1941and elected Fellow of Royal Society, London in 1943. He was awarded the Padma Vibhushan in 1954 by the President of India.

Dr Bhatnagar passed the Intermediate Examination of the Panjab University in 1913 in the first division and joined Forman Christian College for the BSc degree. After taking the Bachelor's degree in 1916 he decided to take up his first formal employment as Demonstrator in the Physics and Chemistry Department of the Forman Christian College. Later he became the Senior Demonstrator in the Dyal Singh College. The employment, however, did not hinder Bhatnagar's efforts in pursuing higher studies. He joined the MSc course in chemistry in the Forman Christian College

Shanti Swaroop Bhatnagar was born in the Bhera, Punjab region of British India, in a Hindu kayastha family (21 February 1894 – 1 January 1955) was an Indian colloid chemist, academic and scientific administrator. The first director-general of the Council of Scientific and Industrial Research (CSIR), he is revered as the "father of research laboratories" in India. He was also the first Chairman of the University Grants Commission (UGC)

In 1958, to honour his name and legacy, the Indian Council of Scientific and Industrial Research (CSIR) instituted the Shanti Swarup Bhatnagar. Prize for Science and Technology for scientists who have made significant contributions in various branches of science.

His father, Parmeshwari Sahai Bhatnagar, died when he was eight months old, and he spent his childhood in the house of his maternal grandfather, an engineer, who helped him develop a liking for science and engineering. He

enjoyed building mechanical toys, electronic batteries, and string telephones. From his maternal family he also inherited a gift of poetry. He completed his elementary education from the Dayanand Anglo-Vedic High School, Sikandrabad (Bulandshahr). In 1911 he joined the newly established Dayal Singh College, Lahore (which was later moved to New Delhi, India after independence) where he became an active member of the Saraswati Stage Society and earned a good reputation as an actor. He wrote an Urdu one-act play called Karamati (Wonder worker), the English translation of which earned him the Saraswati Stage Society prize and medal for the best play of the year in 1912. Bhatnagar passed the Intermediate Examination of the Punjab University in 1913 in first class and joined the Forman Christian College, where he obtained a BSc in physics in 1916, and an MSc in chemistry in 1919

Achievements:

Shanti Swaroop Bhatnagar was awarded a scholarship by the Dayal Singh College Trust to study abroad, and he left for America via England. However, he could not find open berths on English ships, as they were all reserved for American troops, who were then being demobilised due to the First World War. The Trustee permitted him to join the University College London under chemistry professor Frederick G. Donnan. He earned his Doctorate in Science in 1921. While in London, he was supported by the British Department of Scientific and Industrial Research with a fellowship of Rs250 a year. In August 1921, he returned to India and immediately joined the newly established Banaras Hindu University (BHU) as a professor of chemistry, where he remained for three years. He wrote the ‘Kulgeet’, or University anthem. Justice N.H. Bhagwati, the then Vice-Chancellor of BHU said: "Many of you perhaps do not know that besides being an eminent scientist, Professor Bhatnagar was a Hindi poet of repute and

that during his stay in Banaras, he composed the ‘Kulgeet’ of the University. Professor Bhatnagar is remembered with reverence in this University and will continue to be so until this University exists." He then moved to Lahore as a Professor of Physical Chemistry and Director of University Chemical Laboratories of the University of the Punjab. This portion of his career was the most active period of his life in original scientific work. His research interests included emulsions, colloids, and industrial chemistry, but his fundamental contributions were in the field of magneto-chemistry, the use of magnetism for the study of chemical reactions. In 1928 he and K.N. Mathur jointly developed the Bhatnagar-Mathur Magnetic Interference Balance, which was one of the most sensitive instruments at the time for measuring magnetic properties. It was exhibited at the Royal Society Soiree in 1931 and it was marketed by Messers Adam Hilger and Co, London.

Shanti Swaroop Bhatnagar's first industrial problem was developing the process for converting bagasse (peelings of sugarcane) into food-cake for cattle. This was done for Sir Ganga Ram, the Grand Old Man of Punjab. He also solved industrial problems for Delhi Cloth & General Mills, J.K. Mills Ltd. of Kanpur, Ganesh Flour Mills Ltd. of Layallapur, Tata Oil Mills Ltd. of Bombay, and Steel Brothers & Co. Ltd. of India.

His major innovation was an improvement of the procedure for drilling crude oil. The Attock Oil Company at Rawalpindi (representative of Messers Steel Brothers & Co London) had confronted a peculiar problem, wherein the mud used for the drilling operation was hardened upon contact with saline water, thereby clogging the drill holes. Shanti Swaroop Bhatnagar realised that this problem could be solved by colloidal chemistry. He added an Indian gum, which had the remarkable property of lowering the viscosity of the mud suspension and of increasing at the same time its stability against the flocculating action

of electrolytes. M/s Steel Brothers was so pleased that they offered Shanti Swaroop Bhatnagar a sum of Rs. 1,500,000/- for research work on any subject related to petroleum. The company placed the fund through the university and it was used to establish the Department of Petroleum Research under the guidance of Shanti Swaroop Bhatnagar. Investigations carried out under this collaborative scheme included deodorisation of waxes, increasing flame height of kerosene and utilisation of waste products in the vegetable oil and mineral oil industries. Recognizing the commercial success of the research, the company increased the fund, and extended the period from five years to ten.

Shanti Swaroop Bhatnagar persistently refused any personal monetary benefit from his research fundings, and instead advocated for strengthening research facilities at the university. Meghnad Saha wrote to Shanti Swaroop Bhatnagar in 1934 saying, "You have hereby raised the status of the university teachers in the estimation of public, not to speak of the benefit conferred on your Alma Mater".

Shanti Swaroop Bhatnagar wrote jointly with K.N. Mathur Physical Principles and Applications of Magnetochemistry which is considered a standard work on the subject.

Establishment of CSIR:

The first industrial research organisation in India was created as an Industrial Intelligence and Research Bureau, which came into operation in April 1935 under the Indian Stores Department. With its limited budget of Rs. 1.2 lakhs per year, the bureau was virtually inactive. In 1939 there was a strong movement to abolish the bureau, and to replace it with a Board of Scientific and Industrial Research, similar to the British BSIR. Under the persuasive pressure of Arcot Ramaswamy Mudaliar, the Board of Scientific and Industrial Research (BSIR) was formed on 1 April 1940 for a period of two years. Shanti Swaroop Bhatnagar, as

a leading scientist of the time, was appointed as the Director, and Mudaliar became the Chairman. The BSIR had an annual budget of Rs. 5 lakhs which was placed under the Department of Commerce. Shanti Swaroop Bhatnagar persuaded the government to set up an Industrial Research Utilisation Committee (IRUC) in early 1941 for further investment into industrial research. Mudaliar also won the demand for an establishment of Industrial Research Fund, and that it should have an annual grant of Rs 1 million for a period of five years, at the Central Assembly in Delhi at its session on 14 November 1941. These finally led to the constitution of the Council of Scientific and Industrial Research (CSIR) as an autonomous body, which came into operation on 28 September 1942. The BSIR and IRUC became the advisory bodies to the governing body of the CSIR. In 1943 the governing body approved the proposal mooted by Shanti Swaroop Bhatnagar to establish five national laboratories the National Chemical Laboratory, the National Physical Laboratory, the Fuel Research Station, and the Glass and Ceramics Research Institute. This was the beginning of scientific laboratories in India.

Shanti Swaroop Bhatnagar was elected one of the first Fellows of the Indian Academy of Sciences (FASc) in 1934, he was appointed a Foundation Fellow of the National Institute of Sciences of India (FNI; now the Indian National Science Academy) the following year. For his contributions to pure and applied chemistry, Shanti Swaroop Bhatnagar was appointed an Officer of the Order of the British Empire (OBE) in the 1936 New Year Honours List. The British government knighted him in the 1941 New Year Honours List for his contributions to the advancement of science. Shanti Swaroop Bhatnagar was appointed a Fellow of the Institute of Physics (FInstP) in 1942, and was also appointed a Fellow of the Royal Institute of Chemistry (FRIC) that year. In 1943 the Society of Chemical Industry, London, elected him as Honorary Member and

later as Vice-President. Shanti Swaroop Bhatnagar was elected a Fellow of the Royal Society (FRS) in 1943.

In independent India, he was the President of the Indian Chemical Society, National Institute of Sciences of India and the Indian National Science Congress. He was awarded Padma Bhushan by the government of India in 1954.

An Indian science award, Shanti Swarup Bhatnagar Prize for Science and Technology was created in his honour.

Scientific work:

Bhatnagar made a large number of publications. Most of them were in the field of physical chemistry and the major subjects were magneto-chemistry and physical chemistry of emulsions.

Magneto-chemistry:

Though the foundations of magneto-chemistry were laid by Michael Faraday over a hundred years ago, substantial advancement of the subject has been made only during the past fifty years. Early in his career Bhatnagar realized that the application of magnetism to chemistry had great possibilities and he started his initial investigations in this field even while he was at Banaras. However, his main contributions came from the Punjab University Chemical Laboratories. They covered a large number of important and complex problems in chemistry and established the usefulness of the magnetic method as a powerful tool in the hands of chemists. The relation between physical properties and chemical constitution has been exciting interest from the early days of structural organic chemistry. What are known as colligative properties were useful for this study and were employed. That magnetic susceptibility measurements could be used for this purpose effectively, has been the main theme of Bhatnagars contribution. He has used this method not only for the study of pure chemical

compounds but also for the study of solutions, films and colloids. Bhatnagar's results have been published in several scientific periodicals and the following are the important reviews: (i) Physical principles and applica-tions of magneto-chemistry by Bhatnagar and Mathur, a book published by Macmillan and Co., Ltd, in 1935; (ii) 'A survey of recent advances in magne-tism relating to chemistry5, the presidential address delivered by Bhatnagar to the Chemistry section of the Jubilee session of the Indian Science Congress in 1938, and (iii) 'Some new magneto-chemical problems' by Bhatnagar and Kapur, published in /jeitschrift fu r Eletrochemie in 1939.To begin with there was need for an accurate method of determining the changes in diamagnetic susceptibilities that are usually quite small. Hence Bhatnagar-Mathur interference balance was designed and patented and its production was entrusted to Adam Hilger and Co, London. Besides greater degree of accuracy, it had the advantages of stability and quickness of operation. As the next step the scope of Pascal's law of additivity (xm = 2xa + X) was examined and dependable values for atomic and constitutive constants were obtained. It was later shown that the law could be applied not only to organic compounds but also to inorganic compounds, in \which case the sum of the ionic susceptibilities gave the molecular susceptibility. A study of the effect of temperature on diamagnetic suscepti-bilities exhibited appreciable differences between different groups of com-pounds and provided a method of classification: (i) non-polar and symmetric molecules like ryr/ohexane and carbon tetrachloride show no change, (ii) associated liquids like water and aliphatic alcohols show an increase, and (iii) aromatic compounds like benzene, toluene, xylene and a large number of other substances show decrease in susceptibility with rise of temperature. This effect was correlated with magnetic birefringence shown by the three groups of compounds.

The magnetic method was also used for the study of complex problems connected with (i) colloid formation, for example the adsorption and absorption of atmospheric gases on the surface of particles during the process of size reduction and changes in microcrystalline structure, (ii) solutions including solid solutions, (iii) atomicity of elementary molecules like those of mercury, iodine and selenium under different conditions, (iv) allotropy and (v) photochemical decompositions and phototropy. The differences between isomers of organic compounds and the nature of complex compounds, of amalgams and of ions in colourless and coloured glasses were other important topics investigated. An ingenius application was the investigation of the nature of oxide films formed on strips of copper when heated. From the para-magnetic nature of these films, it was deduced that they contained the higher oxide CuO and not Cu20. Another interesting piece of work was done on the relationship between magnetic fields and optical rotation. This led to an application of the method of magnetic rotation for the study of the nature of solutions of salts of higher fatty acids in water an alcohol and provided definite evidence for the existence of ionic micelles. The relationship between chemical affinity, electricity and magnetism suggested that a magnetic field would exert some influence on the character or the speed of a chemical reaction. But earlier work on this subject provided very contradictory information. Bhatnagar and co-workers made a study of a large number of reactions of various types in and outside the magnetic field and concluded that the influence of the field depended on the difference between the sum of the molecular susceptibilities of the initial reactants and of the final products; where there was no difference the field had no effect. Further the importance of the orienting effect of the field on the atoms and ions concerned was also brought out. These considerations were used in the study of adsorption in which chemical action is involved.

Bhatnagar brought the adsorption film theory of emulsions to a definite form, by laying adequate stress on the wetting of adsorbed film. According to this theory, there are no limiting concentrations of oil-in-water or vice versa, the dispersion being independent of the volumes employed. Emulsifica-tion is influenced by the mass of the emulsifying agent, the ease with which it can be adsorbed at the interfacial separating surface and the nature of ions adsorbed by the resulting film. He emphasized that the two main factors which governed the process of emulsification were (a) the relative wetting power of the two phases with respect to the emulsifying agent, surface potential of the membrane between the phases. The reversal of phase was considered to be due to changes in this membrane with respect to one or both of the above factors. He made the following generalization: 'All emulsifying agents with an excess of negative ions on them and wetted by water will yield oil-in-water emulsions while those having excess of adsorbed positive ions and wetted by oil will give water-in-oil emulsions.'

-MADIHA ANJUM JK

Jagadish Chandra Bose-Plant Physiologist

Jagadish Chandra Bose

(30 Nov 1858-23 Nov 1937)

JAGADISH CHANDRA BOSE also called as **J.C. BOSE** was a multi-talented Indian scientist who also invented wireless communication (born November 30,1858). He was a founder of modern science in the subcontinent. A biologist, a physicist, a botanist and a writer of science fiction. He is considered as the father of radio science as he was the first person in the world to demonstrate **wireless transmission of electromagnetic waves** after returning to India (although he did not patent this invention, which was brought out by Marconi two years later). Bose then demonstrated how plants responded to various stimuli, demonstrating the electrical nature of this conduction. He is considered a pioneer in the field of biophysics. **Bose** proved that plants are like any other life form. He proved that plants have a defined life cycle, a reproductive system and are aware of their surroundings. The demonstration took place in the royal society in London, England.

Bose is considered as the father of **Bengali science fiction, and also invented the crescograph,** a device for measuring the growth of plants. A crater on the moon has been named in his honor. He founded Bose institute, a premier research institute of India and also one of its oldest. He invented crescograph which is a device for measuring growth in plants. It was invented in the early 20^{th} century. The Bose crescograph uses a series of clockwise gears and a smoked glass plate to record the movement of the tip of a plant. The electronic crescograph plant movement detector is capable of measurements as small as

1/1,000,000 of an inch. However, its normal operating range is from 1/1000 to 1/10,000 of an inch. The component which actually measures the movement is a differential transformer along with a movable core hinged between two points. A micrometer is used to adjust and calibrate the system. It can record plant growth, magnifying a small movement as much as 10,000,000 times. This machine is highly sensitive; Bose padded the legs of the table on which the Crescograph is being used with Indian –rubber sponges. This negated any vibration which could affect results.

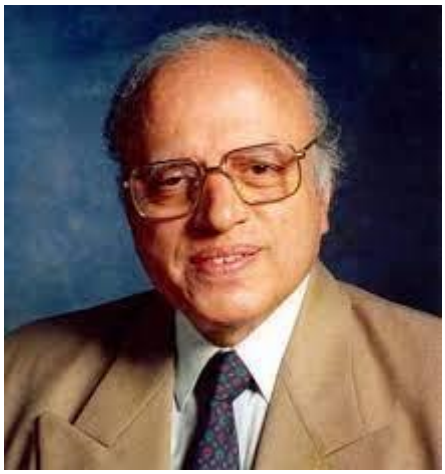
He conducted the first communication experiments in 1895 becoming the pioneer in multimedia communication. He presented his first scientific paper. "On the polarization of Electric Rays by Double Reflecting crystals` before the Asiatic Society of Bengal in May 1895. His paper was later published by the Royal Society of London in 1896. In 1896 he met Marconi who was also working on wireless signaling experiment and in 1899 he developed the "iron-mercury-iron coherer with telephone detector" which he presented at the Royal Society.

Fellowship of the Royal Society is an Award granted by the judges of the Royal society of London to individuals who have made a "substantial contribution to the improvement of natural Knowledge, including mathematics, engineering science, and medical science". He awarded for "contributions to the improvement of natural knowledge". For his wireless Millimeter wave experiment at the Royal Institution, LONDON in January 1897. In May 1897 by Marconi, to whom the **NOBEL PRIZE** was however award. In 1917 Bose established the Bose institute in Kolkata, west Bengal, India. Bose served as its director for its first twenty years until his death. Today it is a public research institute of India and also one of its oldest. Bose in his inaugural address on 30 November 1917 dedicated the institute to the nation saying.

To commemorate Bose birth centenary in 1958, the JBNSTS scholarship program was started in West Bengal. In the same year, India issued a postage stamp bearing his portrait. The same year Acharya Jagdish Chandra Bose, a document film directed by Pijush Bose, was released. It was produced by the GOVERNMENT OF INDIA`S FILMS DIVISION. on 14th September 2012, Bose`s experiment work in Millimeter-band radio was recognized as an IEEE Milestone in Electrical and Computer Engineering, the first such recognition of a discovery in India. The **BANK OF ENGLAND** has decided to redesign the **50 UK Pound currency** note with a prominent scientist. The Indian Botanic Garden was renamed in his honor as the **ACHARYA JAGADISH CHANDRA BOSE INDIAN BOTANIC GARDEN** ON 25th June 2009.

-Bhavana M

M S Swaminathan:-Agronomist and Agricultural Scientist



M S Swaminathan

(7 Aug 1925-28 Sept 2023)

Introduction:

Mankombu Sambasivan Swaminathan was born on 7 August 1925, is an Indian agronomist, agricultural scientist, plant geneticist, administrator and humanitarian. Swaminathan was a global leader of the green revolution. He has been called the main architect of the green revolution in India for his leadership and role in introducing and further developing high-yielding varieties of wheat and rice. Swaminathan's collaborative scientific efforts with Norman Borlaug, spearheading a mass movement with farmers and other scientists and backed by public policies, saved India and Pakistan from certain famine-like conditions in the 1960s. His leadership as Director General of the International Rice Research Institute (IRRI) in the Philippines was instrumental in his being awarded the first World Food Prize in 1987, recognized as agriculture., United Nations has called him 'the Father of Economic Ecology'.

Swaminathan contributed basic research related to potato, wheat and rice, in areas such as cytogenetics, ionizing radiation and radiosensitivity. He has been a President of the Pugwash Conferences and the International Union for Conservation of Nature (IUCN). In 1999, he was one of three Indians, along with Gandhi and Tagore, on *TIME* magazines' list of the '20 Most Influential Asian People of the 20th Century', along with Eiji Toyoda, Dalai Lama and Mao

Zedong. He is the founder of an eponymous research foundation. He coined the term 'Evergreen Revolution' in 1990 to describe his vision of 'productivity in perpetuity without associated ecological harm'. He was nominated to the Parliament of India for one term between 2007 and 2013.

Life and Career:

Swaminathan was born in Kumbakonam, Madras Presidency on 7 August 1925. He was the second son of general surgeon Dr. M. K. Sambasivan and Parvati Thangammal Sambasivan. Swaminathan was educated at a local high school and later at the Catholic Little Flower High School in Kumbakonam, from which he matriculated at age 15. Right from childhood, he had an interaction with farming and farmers; his extended family grew rice, mangoes and coconut, later expanding into areas such as coffee. He saw the impact fluctuations in the price of crops had on his family, including the devastation that weather and pest could cause to crops as well as incomes. His parents wanted him to study medicine. With that in mind, he took started off his higher education with zoology. But, when he witnessed the impacts of the Bengal famine of 1943 during the Second World War and shortages of rice throughout the sub-continent, he decided to devote his life to ensuring India had enough food. Despite his family background, and belonging to an era where medicine and engineering were considered much more prestigious, he chose agriculture.

He went on to finish his undergraduate degree in zoology at Maharaja's College in Trivandrum, Kerala (now known as University College, Thiruvananthapuram at the University of Kerala). He then studied at University of Madras (Madras Agricultural College, now the Tamil Nadu Agricultural University) from 1940 to 1944 and earned a Bachelor of Science degree in agricultural science. During this time, he was also taught by Cotah Ramaswami, professor of agronomy.

In 1947 he moved to the Indian Agricultural Research Institute (IARI) in New Delhi to study genetics and plant breeding. He obtained a post-graduate degree with high distinction in cytogenetics in 1949. His research focused on the genus *Solanum*, with specific attention to the potato. Social pressures resulted in him competing in the examinations for civil services through which he was selected to the Indian Police Service. However, at the same time, an opportunity for him arose in the agriculture field in the form of a UNESCO fellowship in genetics in the Netherlands. He chose genetics.

Netherlands and Europe

He was a UNESCO fellow at the Wageningen Agricultural University, Institute of Genetics in the Netherlands, for eight months. The demand for potato during the second world war resulted in deviations in age-old crop rotations. This caused golden nematode infestations in certain areas such as reclaimed agricultural lands. Swaminathan worked on adapting genes to provide resilience against such parasites, as well as cold weather. To this effect, the research succeeded. During this time he also made a visit to Max Planck Institute for Plant Breeding Research in war-torn Germany; this would later influence him deeply as during his next visit, a decade later, he saw that the Germans had transformed Germany, both infrastructurally and energetically.

United Kingdom

In 1950, he moved to study at the Plant Breeding Institute of the University of Cambridge School of Agriculture. He earned a Doctor of Philosophy (Ph.D.) degree in 1952, for his thesis, "Species Differentiation, and the Nature of Polyploidy in certain species of the genus *Solanum* – section Tuberarium." The next Christmas he stayed for a week with a F.L. Brayne, a former Indian Civil Service officer, whose experiences with rural India influenced Swaminathan in his later years.

United States of America

Swaminathan then spent 15 months in the United States. He accepted a post-doctoral research associateship at the University of Wisconsin, Laboratory of Genetics to help set up a USDA potato research station. The laboratory at the time had Nobel laureate Joshua Lederberg on its faculty. His associateship ended in December 1953. He was offered a faculty position, however Swaminathan refused. His aim continued to be to make a difference back home in India.

India

He returned to India in early 1954. There were no jobs in his specialisation and it was only three months later that he got the opportunity through a former professor to work temporarily as an assistant botanist at Central Rice Research Institute in Cuttack. At Cuttack, he was under an indica-japonica rice hybridisation program started by Krishnaswami Ramiah. This stint would go on to influence his future work with wheat. Half a year later he joined Indian Agricultural Research Institute (IARI) in New Delhi in October 1954 as an assistant cytogeneticist. Swaminathan was critical of India importing food grains

when seventy percent of India was dependent on agriculture. Further drought and famine-like situations were developing in the country.

Swaminathan and Norman Borlaug collaborated, with Borlaug touring India and sending supplies for a range of Mexican dwarf varieties of wheat, which were to be bred with Japanese varieties. Initial testing in an experimental plot showed good results. The crop was high-yield, good quality, and disease free. There was hesitation by farmers to adopt the new variety whose high-yields were unnerving. In 1964, following repeated requests by Swaminathan to demonstrate the new variety, he was given funding to plant small demonstrations plots. A total of 150 demonstration plots on 1 hectare were planted. The results were promising and the anxieties of the farmers reduced. More modifications were made to the grain in the laboratory to better suit Indian conditions. The new wheat varieties were sown and in 1968 production went to 17 million tonnes, 5 million tonnes more than the last harvest.

Personal Life:

M.S. Swaminathan was married to Mina Swaminathan whom he met in 1951 while they were both studying at Cambridge. They live in Chennai, Tamil Nadu. Their three daughters are Soumya Swaminathan (a paediatrician), Madhura Swaminathan (an economist), and Nitya Swaminathan (gender and rural development).

Gandhi and Ramana Maharshi were influences in his life. Of the 2000 acres their family owned, they donated one-third to Vinoba Bhave's cause. In an interview in 2011, he said that when he was young, he followed Swami Vivekananda.

Scientific Career

POTATO

In the 1950s, Swaminathan's explanation and analysis of the origin and evolutionary processes of potato were a major contribution. He elucidated its origin as an autotetraploid and its cell division behaviour. His findings related to polyploids were also significant. Swaminathan's thesis in 1952 was based on his basic research related to "species differentiation and the nature of polyploidy in certain species of the genus Solanum, section Tuberarium". The impact was the greater ability to transfer genes from a wild species to the cultivated potato.

What made his research on potato valuable was its real-world application in the development of new potato varieties. During his post-doctoral at Wisconsin University he helped develop a frost-resistant potato. His genetic analysis of

potato, including the genetic traits that govern yield and growth, important factors in increasing productivity, was pivotal. His multi-disciplinary systems approach perspective brought together many different genetic facets.

WHEAT

In the 1950s and 60s Swaminathan did basic research into the cytogenetics of hexaploid wheat. The varieties of wheat and rice developed by Swaminathan and Borlaug were foundational to the green revolution.

RICE

Efforts towards growing rice with C_4 carbon fixation capabilities, which would allow a better photosynthesis and water usage, were started at International Rice Research Institute (IRRI) under Swaminathan. Swaminathan also played a role in the development of the world's first high-yielding basmati.

RADIATION BOTANY

The Genetics Division of Indian Agricultural Research Institute (IARI) under Swaminathan was globally renowned for its research on mutagens. He set up a 'Cobalt-60 Gamma Garden' to study radiation mutation. Swaminathan's association with Homi J. Bhabha, Vikram Sarabhai, Raja Ramana, M. R. Srinivasan and other Indian nuclear scientists allowed agricultural scientists to access facilities at the Atomic Energy Establishment, Trombay (which would later become the Bhabha Atomic Research Centre). Swaminathan's first PhD student A. T. Natarajan would go on to write his thesis in this direction. One of the aims of such research was to increase plant responsiveness to fertilisers and demonstrate real world application of crop mutations. Swaminathan's early basic research on the effects of radiation on cells and organisms partly formed the base of future redox biology.

Awards and Honours:

One of the first national awards he received was the Shanti Swarup Bhatnagar Award in 1961. Following this he has been conferred with the Padma Shri, Padma Bhushan, Padma Vibhushan, India's fourth, third, and second-highest civilian awards, as well as the H K Firodia award, the Lal Bahadur Shastri National Award and the Indira Gandhi Prize. As of 2002, he had 28 national and 24 international awards. Swaminathan received the Mendel Memorial Medal from the Czechoslovak Academy of Sciences in 1965.International awards and honours: Ramon Magsaysay Award (1971), the Albert Einstein World Science Award (1986), the first World Food Prize (1987), the Tyler Prize for Environmental Achievement (1991), the Four Freedoms Award (2000),] and the Planet and Humanity Medal of the International Geographical

Union (2000).China awarded him with the "Award for International Co-operation on Environment and Development". In the 'Dr Norman E. Borlaug Hall of Laureates' at Des Moines, Iowa, United States, there is an artwork of Swaminathan made up of 250,000 pieces of glass. International Rice Research Institute (IRRI) has named a building and a scholarship fund after him. In 2016 *Biotech Express* magazine listed 33 national and 32 international awards. In 2004, an agricultural think-tank in India named an annual award after Swaminathan, the eponymously named 'Award for Leadership in Agriculture'.

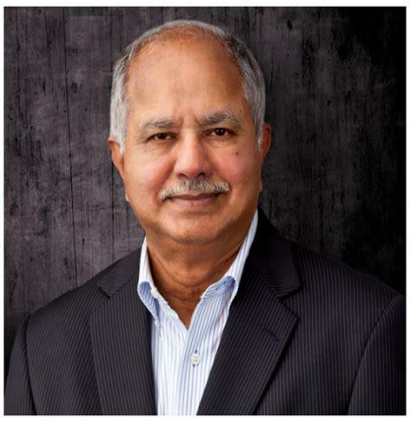
Honorary Doctrate and Fellowships:

He is the recipient of 84 honorary doctorates and has been a guide for numerous Ph.D. scholars. Sardar Patel University conferred him with an honorary degree in 1970, Delhi University, Banaras Hindu University and others would follow. Internationally, Technical University of Berlin (1981) and Asian Institute of Technology (1985) has honoured him. University of Wisconsin honoured Swaminathan with an honorary doctorate in 1983. When University of Massachusetts, Boston honoured him was a science doctorate they commented on the "magnificent inclusiveness of (Swaminathan's) concerns, by nation, socioeconomic group, gender, inter-generational, and including both human and natural environments." Fitzwilliam College, Cambridge, from where he got his PhD in botany, made him an honorary fellow in 2014.

Swaminathan has been elected a fellow of a number of science academies in India. Internationally he has been recognised as a fellow by 30 academies of science and societies across the world including USA, United Kingdom, Russia, Sweden, Italy, China, Bangladesh, as well as the European Academy of Arts, Science and Humanities. He was a founder fellow of The World Academy of Sciences. National Agrarian University in Peru conferred him with an honorary professorship.

-**MARIYAM FAROOQUI**

Dabbala Rajagopala Reddy: Father of Indian Robotics



Dabbala Rajagopala Reddy

(13 June 1937)

"Raj Reddy" full name was Dabbala Rajagopala Reddy born on 13th June 1937 in a Telugu family in Katur village of Chittor District of Andra Pradesh, India. His father Sreenivasulu Reddy was a farmer and his mother Pitchamma was a home maker. He was the first member of his family to attend college.

He received his bachelor's degree in civil engineering from College of Engineering, Guindy. Then affiliated to the University of Madras (now to Anna University, Chennai), India, in 1958 and a MEng degree from the University of New South Wales, Australia, in 1960. He received his PhD degree in Computer Science from Stanford University in 1966.

Dr. Raj Reddy is the Moza Bint Nasser University Professor of Computer Science and Robotics in the School of Computer Science at Carnegie Mellon University. From 1960-63, Dr. Reddy worked as an Applied Science Representative for IBM Corp. in Australia. He was an Assistant Professor of Computer Science at Stanford University from 1966 to 1969. He joined

the Carnegie Mellon faculty as an associate professor of Computer Science in 1969. He became a full professor in 1973 and a university professor, in 1984.

He was the founding director of the Robotics Institute from 1979 to 1991 and the Dean of School of Computer Science from 1991 to 1999. As a dean of SCS, he helped create the Language Technologies Institute, Human Computer Interaction Institute, Centre for Automated Learning and Discovery (since renamed as the Machine Learning Department) and the Institute for Software Research. He is the chairman of Governing Council of IIIT Hyderabad.

Reddy was a co-chair of the President's Information Technology Advisory Committee (PITAC) from 1999 to 2001. He was one of the founders of the American Association for Artificial Intelligence and was its president from 1987 to 1989. He served on the International board of governors of Peres Centre for Peace in Israel. He served as a member of the governing councils of EMRI and HMRI which use technology-enabled solutions to provide cost-effective health care coverage to rural population in India. He worked in three fields i.e. Artificial Intelligence, Robotics and Human-Computer Interaction.

Reddy's early research was conducted at the AI labs at Stanford, first as a graduate student and later as an assistant professor, and at CMU since 1969. His AI research concentrated on perceptual and motor aspect of intelligence such as speech, language, vision and robotics. Over a span of five decades, Reddy and his colleagues created several historic demonstrations of spoken language systems, e.g., voice control of a robot, large vocabulary connected speech recognition, speaker independent speech recognition and unrestricted vocabulary dictation. Reddy and his colleagues have made seminal contributions to Task Oriented Computer Architectures, Analysis of Natural Scenes, Universal Access to Information and Autonomous Robotic Systems. Hearsay I was one of

the first systems capable of continuous speech recognition. Subsequent systems like Hearsay II, Dragon, Harpy and Sphinx I/II developed many of the ideas underlying modern commercial speech recognition technology as summarized in his recent historical review of speech recognition with Xuedong Huang and James K. Baker. Some of these ideas—most notably the "blackboard model" for coordinating multiple knowledge sources—have been adopted across the spectrum of applied artificial intelligence.

Reddy proposed that a fully connected population makes it possible to think of a KG-to-PG-Online-College in every village providing personalized instruction. Assuming that all students are provided digital literacy and learning-to-learn training as part of primary education before they dropout, anyone can learn any subject at any age even if there are no qualified teachers on the subject. AI can be used to empower the people at the bottom-of-the-pyramid, who have not benefited from the IT revolution so far. Reddy proposed that recent technological advances in AI will ultimately enable anyone to watch any movie, read any textbook, and talk to anyone independent of the language of the producer or consumer. He also proposed that the use of Smart Sensor Watches can be used to eliminate COVID lockdowns by monitoring the sensor data to identify and isolate people with symptoms.

Reddy's other major research interest has been in exploring the role of "Technology in Service of Society". One of the early efforts, Centre Mondial Informatique et Resource Humane was founded by Jean-Jacques Servan-Schreiber in France in 1981 with a technical team consisting of Nicholas Negroponte, Alan Kay, Seymour Paper, Raj Reddy, and Terry Winograd. Reddy served as the Chief Scientist for the centre. The centre had as its objective the Development of Human Resource in Third World Countries using Information Technology. Several seminal experiments in providing computerized classrooms

and rural medical delivery were attempted. In 1984, President Mitterrand decorated Reddy with the Légion d'Honneur medal.

He is a fellow of the Association of advancement of Artificial intelligence (AAAI), Association for computing machinery (ACM), Acoustical Society of America, Institute of Electric and Electronic Engineers (IEEE) and Computer History Museum. Reddy is a member of the United States National Academy of Engineering, American Academy of Arts and Sciences, Chinese Academy of Engineering, Indian National Science Academy and Indian National Academy of Engineering.

He has been awarded honorary doctorates (Doctor Honoris Causa) from SV University, University Henri-Poincare, University of New South Wales, Jawaharlal Nehru Technological University, University of Massachusetts, University of Warwick, Anna University, IIIT (Allahabad), Andhra University, IIT Kharagpur, Hong Kong University of Science and Technology, Rajiv Gandhi University of Knowledge Technologies, and Carnegie Mellon University.

In 1994 Raj Reddy and Edward Feigenbaum received the Turing Award, the highest honour in computer science "for pioneering the design and construction of large scale artificial intelligence systems, demonstrating the practical importance and potential commercial impact of artificial intelligence technology. In 1984, Reddy was awarded the French Legion of Honour by French President François Mitterrand. Reddy also received Padma Bhushan, from the President of India in 2001, the Okawa Prize in 2004, the Honda Prize in 2005 and the the U.S. National Science Board Vannevar Bush Award in 2006.

- Vidya H R

Sir M Vishvesvaraya:-Father of Modern Mysore

Sir M. Vishvesvaraya

(15 sept 1860 - 14 April 1960)

Sir M Visvesvaraya, popularly known as Sir MV, was an engineer, statesman, and scholar. Sir MV served as the Diwan of Mysore during the period of 1912-1918. In 1955, he was honored with Bharat Ratna. For his contributions to public goodness, he was bestowed as Knight Commander, by King George V, during the British Indian Empire. sir MV was born on September 15,1860 in a Muddenahalli village in Chikkaballapur Thaluk, Kolar district. His Father Srinivasa shastri was a Sanskrit schlor and ayurvedic practitioner. His mother venkachamma was a religious woman. His mother tongue is Telugu.

Sir MV enrolled for his early education in Chikballapur, where he completed his primary education. Then for his high school education, Sir MV came to Bangalore. In 1881, after receiving a bachelor's degree in Arts from the Central College in Bangalore, affiliated to the Madras University, he pursued civil engineer from the reputed College of Engineering, Pune.He ranked first in the LCE and FCE examination. After the successful completion of civil engineering Sir MV, joined the PWD department, of Mumbai. Later he joined the Indian irrigation commission, where he carried out some effective irrigation techniques in the Deccan area.

Sir MV was patented for designing automatic barrier water floodgates. These floodgates were initially installed at the Khadakvasla Reservoir near Pune in 1903. Later with successful implementation, similar floodgates were designed and installed at Tigra Dam and Krishna Raja Sagara Dam.

Sir MV was privileged enough to be sent to Aden to study the various techniques in water supply and the drainage system during the year 1906-07. Later he became societal for his impeccable contribution to make Hyderabad city flood-free. His ideas helped the city of Vishakhapatnam port to be saved from sea erosion. Even at the age of 90, he undertook work on designing and advising in the building of dams across rivers.

In 1912 Maharaja of Mysore appointed him as his Dewan.As diwan of Mysore he worked tirelessly for educational and industrial development of the state. When he was the dewan many new industries came up like 'The Sandal Oil Factory' , ' The chrome Tanning Factory', were some of them. Of the many factories he started, the most important is the Badravati iron and steel works. Sir M. Vishvesvaraya

voluntarily retired as dewan of Mysore in 1918.He worked actively even after his retirement.

The Krishnarajasagara dam is the biggest landmark in Mysuru. Dating back to the 1930s, this 130feet high dam is not just a popular tourist attraction, it is also the source of irrigation and drinking water for large parts of Karnataka. The dam is closely linked to two individuals; Krishnaraja Wodeyar IV, the erstwhile king of Mysuru at the time this dam was built and the dam's designer and engineer, Sir Mokshagundam Visvesvaraya.

It is believed that before taking over the Mysuru PWD, Visvesvaraya had toured Egypt and taken particular note of the Aswan dam. He had also worked on other Indian dam projects such as the Khadakwasla dam and the Bhatghar dam.

In 1910, Visvesvaraya and his engineers took on a fresh survey of the region and made preliminary sketches for the dam and reservoir project. The plans were quite different from the initial plans in terms of technicalities, practicalities and costs. It was designed to become the core of an irrigation system that would promote commercial agriculture and industrial enterprises.

It was designed to be constructed over a decade and with a completed capacity of 39 TMC. Visvesvaraya predicted that the irrigation share of the project capital would be as much as 8%. The construction for the dam began in 1911 and with it, Visvesvaraya took on the role of Dewan. Despite his new responsibilities, he continued to track the project and took back the reins in 1918. As the dam grew taller, its effects began to be felt. By 1915-16, farmers with lands irrigated by the project's canals had started growing sugarcane crops. Electricity production at the Sivasamudram project was also ramped up. By the early 1920s, the dam had

reached a height of 80 feet and work on the second stage commenced. By then the courts had ruled that Madras could not keep the Krishnarajasagara dam height from being raised. The historic Bangalore - Chikkaballapur Light Railway was another project that began while

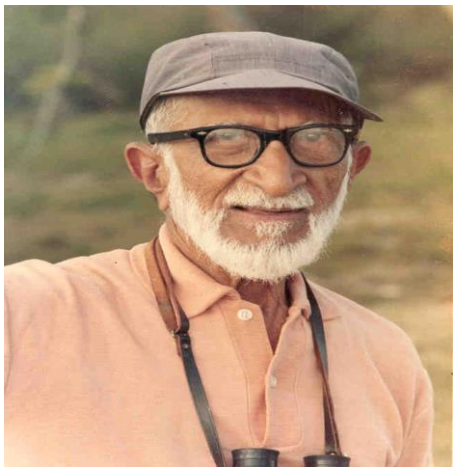
Sir M. Visvesvaraya was the Diwan of Mysore. It was sanctioned in 1909 as a two-feet, six-inch gauge railway line. The section between Devanahalli and Chikballapur became operational on August 1, 1915. This was the first railway line established by a private enterprise. It ran under the guarantee that if the company earned less than $5 of the capital, the Princely State would pay the difference. On the other hand, a surplus earned would be shared equally between the company and the government.

Honors and Awards:

Sir M. Vishvesvaraya was awarded in 1904 for the Honorary membership of London Institution of Civil Engineer's for an unbroken period of 50 years, In 1906 he was awarded with Kaiser -i-Hind in the recognition of his services, in 1911 he was C.I.E(companion of the Indian Empire) at the Delhi Darbar and in 1915 he was given K. C. I. E(knight commander of the order of the Indian Empire) and in 1943 he was elected as an Honorary life member of the Institution of Engineers(India) and in 1953 he was awarded with The Honorary Fellowship of the Institute of Town planners, India, In 1955 he was conferred 'Bharat Ratna'(The Gem of India), the highest distinction of the country, In 1958 he was given the Durga Prasad Khaitan Memorial Gold medal by the Royal Asiatic Society Council of Bengal.

-Hemavathy R

Salim Ali:- Ornithologist and Naturalist



Salim Ali

(12 Nov 1896- 20 June 1987)

Introduction:

Salim Moizuddin Abdul Ali was born on 12 November 1896 the youngest of nine children. His father's name is Moizuddin, mother's name is Zeenat-un-nissa, his father was died when Ali was a year old and his mother was passed away when Ali was three. Now orphaned, Salim Ali was raised by an aunt, Hamida Begum and uncle, Amiruddin Tyabji, in Mumbai.

Salim was introduced to the serious study of birds by W. S. Millard, secretary of the Bombay Natural History Society (BNHS) where Amiruddin was a member, who identified an unusually coloured sparrow that young Salim had shot for sport with his toy air gun. Millard identified it as a yellow-throated sparrow, and showed Salim around the Society's collection of stuffed birds. Millard lent Salim a few books including Eha's *Common birds of Bombay*, encouraged Salim to make a collection of birds and offered to train him in skinning and preservation. Millard later introduced young Salim to (later Sir) Norman Boyd Kinnear, the first paid curator at the BNHS, who later supported Ali from his position in the British Museum. In his autobiography, *The Fall of a Sparrow*, Ali notes the yellow-throated sparrow event as a turning point in his life, one that led him into ornithology, an unusual career choice, especially for an Indian in those days. Even at around 10 years of age, he maintained a diary and among his earliest bird notes were observations on the replacement of males in paired sparrows after he had shot down the male.

Education:

Salim went to primary school at Zenana Bible and Medical Mission Girls Hig School at Girgaum along with two of his sisters and later to St. Xavier's College, Bombay. Around the age of 13 he suffered from chronic headaches, making him drop out of class frequently. As soon as Salim returned, he studied and completed a degree in zoology from St Xavier's College.

Achievements:

He was an Indian ornithologist and naturalist , and He was referred to as the "*Birdman of India*", Salim Ali was the first Indian to conduct systematic bird surveys across India and wrote several bird books that popularized ornithology in India. He became a key figure behind the Bombay Natural History Society after 1947 and used his personal influence to garner government support for the organisation, create the Bharatpur bird sanctuary (Keoladeo National Park) and prevent the destruction of what is now the Silent Valley National Park. He got a job as a guide–lecturer at Bombay's Prince of Wales Museum in 1927.

Dr Ali documented several bird species throughout his research life and was also determined to conserve them and their habitats. He was the pioneer of introducing systematic ornithology surveys in India. Among several of Dr Ali's writings, 'The Book of Indian Birds'—a book that avid bird watchers still consider a bible—was published in 1940. create the Bharatpur bird sanctuary (Keoladeo National Park) and prevent the destruction of Silent Valley National Park.

He wrote the landmark ten volume *Handbook of the Birds of India and Pakistan*, a second edition of which was completed after his death. He was awarded the Padma Bhushan in 1958 and the Padma Vibhushan in 1976.

Awards and Honours:

The earliest was the "Joy Gobinda Law Gold Medal" in 1953, awarded by the Asiatic Society of Bengal based on an appraisal of his work by Sunder Lal Hora and in 1970 he received the Sunder Lal Hora memorial Medal of the Indian National Science Academy. He received honorary doctorates from the Aligarh Muslim University (1958), Delhi University (1973) and Andhra University (1978). In 1967 he became the first non-British citizen to receive the Gold Medal of the British Ornithologists' Union. In the same year, he received the J. Paul Getty

Wildlife Conservation Prize consisting of a sum of $100,000, which he used as a corpus for the Salim Ali Nature Conservation Fund.

In 1969 he received the John C. Phillips memorial medal of the International Union for Conservation of Nature and Natural Resources. The USSR Academy of Medical Sciences awarded him the Pavlovsky Centenary Memorial Medal in 1973 and in the same year he was made Commander of the Netherlands Order of the Golden Ark by Prince Bernhard of the Netherlands. In 1990, the Sálim Ali Centre for Ornithology and Natural History (SACON) was established at Coimbatore by the Government of India. Pondicherry University established the Salim Ali School of Ecology and Environmental Sciences. The government of Goa set up the Salim Ali Bird Sanctuary and the Thattakad bird sanctuary near Vembanad in Kerala also goes by his name. The location of the BNHS headquarters in Mumbai was renamed as "Dr Salim Ali Chowk".

Dr. Salim Ali died in Bombay at the age of 90 on 20 June 1987, after a protracted battle with prostate cancer.

-Sangeetha D

Shreeram S Abhyankar: Mathematician

Shreeram S Abhyankar
(22 July 1930 – 2 Nov 2012)

Shreeram Shankar Abhyankar was born on 22 July 1930 at Ujjain in central India. His parents were Shankar Keshav Abhyankar and Uma Tamhankar although Shreeram (known to his friends as Ram) was born in Ujjain, he only spent the first two years of his life there. His father taught mathematics in Ujjain from 1928 to 1932 but then moved to Gwalior where he was a mathematics teacher at a college. Shreeram was brought up in Gwalior where his father Shankar later became principal of the college.

Sheeram has done his education in Gwalior school. After graduating went to the Royal Institute of Science of Bombay University intending to major in physics. It may seem strange that he wanted to major in physics when he was passionate about mathematics but he did this because his father was a mathematician. However, while studying at the Royal Institute of Science, he also attended mathematics lectures at the Tata Institute of Fundamental Research. In particular, he attended lectures by Marshall Stone, who was visiting from Chicago, and this experience persuaded him that he must study outside India. He was also influenced by Damodar Dharmananda Kosambi, who had studied under George David Birkhoff, and by Pesip Masani (1919-1999), who had studied for his Ph.D. advised by Garrett Birkhoff. Kosambi strongly advised Abhyankar to make a career in mathematics while Masani, who had connections in Harvard, managed to arrange for Abhyankar to be admitted there to study for his Ph.D. Owing to an illness on the boat while travelling to the USA, Abhyankar was detained in England for about two months and reached Harvard later than scheduled.

Thesis work was a major breakthrough where he succeeded in settling the problem of resolution of singularities of algebraic surfaces in prime characteristic. Invitations to several places followed and in the subsequent years, he held regular and visiting positions at some of the leading universities worldwide including Columbia, Cornell, Johns Hopkins, Harvard, Princeton and Yale in USA, Erlangen and Münster in Germany, Leiden in Holland, Angers, Nice, Paris, Saint-Cloud and Strasbourg in France, and Kyoto in Japan. In 1963 he moved to Purdue University, West Lafayette, Indiana, USA, and since 1967 he was the Marshall Distinguished Professor of Mathematics at Purdue. Moreover, since 1987–1988, he was also made a Professor in the Departments of Industrial Engineering and Computer Science at Purdue.

Quite naturally, Shreeram Abhyankar received numerous Honours and awards during his lifetime. This includes McCoy Prize from Purdue, Lester Ford Prize and the Chauvenet Prize from the Mathematical Association of America, a Medal of Honour from the University of Valliadolid, Spain, as well as the University of Brasilia, Brazil, and the honorary title of Vidyan Sanstha Ratna from the Institute of Science, Mumbai. He received a honorary doctorate from the University of Angers, France in 1998.Abhyankar was elected as a Fellow of the Indian National Science Academy in 1987 and the Indian Academy of Sciences in 1988. Most recently, he was among the inaugural batch of Fellows of the American Mathematical Society (AMS) announced by the AMS on November 1, 2012. He has guided about 30 PhD students and has inspired many more at different stages of their education and research career. International conferences in algebra and algebraic geometry in honour of Shreeram Abhyankar were held at Purdue in 1990, 2000, 2010 and 2012 around the month of July and also at Pune, India, in December 2010.

Shreeram Shankar Abhyankar, an extraordinary mathematician and educator, passed away on November 2, 2012 at the age of 82. He remained active in research as well as teaching and was constantly engaged in “doing mathematics” almost till his last breath.

-Chandana H M

Dr Vikram Ambalal Sarabhai: Physicist and Astronomer

Vikram Ambalal Sarabai

(12 Aug 1919 – 30 Dec 1971)

Dr Vikram Sarabhai was born on 12 August 1919 in the city of Ahmedabad, Gujarat State in western India. The Sarabhai family was an important and rich Jain business family. His father Ambalal Sarabhai was an affluent industrialist and owned many mills in Gujarat. Vikram Sarabhai was one of the eight children of Ambalal and Sarala Devi. Dr Vikram Sarabhai died on 30 December 1971 at Kovalam, Thiruvananthapuram, Kerala.

Education:

Sarabhai matriculated from the Gujarat College in Ahmedabad after passing the Intermediate Science examination. After that he moved to England and joined the St. John's College, University of Cambridge. He received the Tripos in Natural Sciences from Cambridge in 1940.With the escalation of the Second World War, Sarabhai returned to India and joined the Indian Institute of Science in Bangalore and began research in cosmic rays under the guidance of Sir C. V. Raman, a Nobel Prize winner.He returned to Cambridge after the war in 1945 and was awarded a PhD degree in 1947 for his thesis titled Cosmic Ray investigation in Tropical Latitudes.

Achievements:

Dr. Sarabhai is considered as the Father of the Indian space program; He was a great institution builder and established or helped to establish a large number of institutions in diverse fields. He was instrumental in establishing the Physical Research Laboratory (PRL) in Ahmedabad after returning from Cambridge to an independent India in 1947, he persuaded charitable trusts controlled by his family and friends to endow a research institution near home in Ahmedabad. Thus, Vikram Sarabhai founded the Physical Research Laboratory (PRL) in Ahmedabad on November 11, 1947. He was only 28 at that time. Sarabhai was a creator and cultivator of institutions and PRL was the first step in that direction. Vikram Sarabhai served of PRL from 1966-1971. He was also the Chairman of the Atomic Energy Commission. He along with other Ahmedabad-based industrialists played a major role in the creation of the Indian Institute of Management, Ahmedabad.

Some of the most well-known institutions established by Dr. Sarabhai are:

1. Physical Research Laboratory (PRL), Ahmedabad
2. Indian Institute of Management (IIM), Ahmedabad
3. Community Science Centre, Ahmedabad
4. Darpan Academy for Performing Arts, Ahmedabad (along with his wife)
5. Vikram Sarabhai Space Centre, Thiruvananthapuram
6. Space Applications Centre, Ahmedabad (This institution came into existence after merging six institutions/centres established by Sarabhai)
7. Faster Breeder Test Reactor (FBTR), Kalpakkam
8. Variable Energy Cyclotron Project, Calcutta
9. Electronics Corporation of India Limited (ECIL), Hyderabad
10. Uranium Corporation of India Limited (UCIL), Jaduguda, Bihar

Indian Space Program:

The establishment of the Indian Space Research Organization (ISRO) was one of his greatest achievements. He successfully convinced the government of the importance

of a space programme for a developing country like India after the Russian Sputnik launch. Dr. Sarabhai emphasized the importance of a space program in his quote:

"There are some who question the relevance of space activities in a developing nation. To us, there is no ambiguity of purpose. We do not have the fantasy of competing with the economically advanced nations in the exploration of the moon or the planets or manned space-flight. "

"But we are convinced that if we are to play a meaningful role nationally, and in the community of nations, we must be second to none in the application of advanced technologies to the real problems of man and society."

Dr Homi Jehangir Bhabha, widely regarded as the father of India's nuclear science program, supported Dr. Sarabhai in setting up the first rocket launching station in India. This center was established at Thumba near Thiruvananthapuram on the coast of the Arabian Sea, primarily because of its proximity to the equator. After a remarkable effort in setting up the infrastructure, personnel, communication links, and launch pads, the inaugural flight was launched on November 21, 1963 with a sodium vapour payload. As a result of Dr Sarabhai's dialogue with NASA in 1966, the Satellite Instructional Television Experiment (SITE) was launched during July 1975 - July 1976 (when Dr Sarabhai was no more). Dr Sarabhai started a project for the fabrication and launch of an Indian Satellite. As a result, the first Indian satellite, Aryabhata, was put in orbit in 1975 from a Russian Cosmo drome. Dr Sarabhai was very interested in science education and founded a Community Science Centre at Ahmedabad in 1966. Today, the Centre is called the Vikram A Sarabhai Community Science Centre.

Awards:

Shanti Swarup Bhatnagar Award (1962)

Padma Bhushan (1966)

Padma Vibhushan, posthumous (after-death) (1972)

Distinguished Positions

President of the Physics section, Indian Science Congress (1962)

President of the General Conference of the I.A.E.A., Verína (1970)

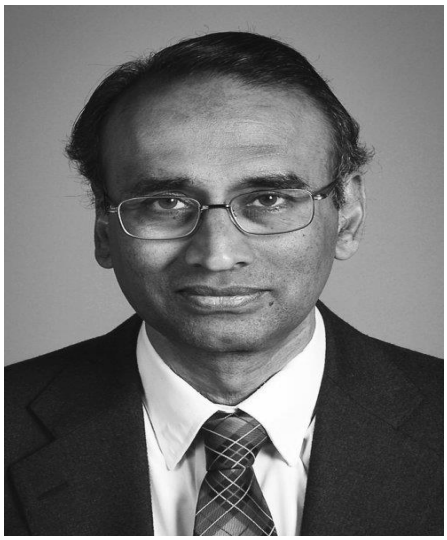
Vice-President, Fourth U.N. Conference on 'Peaceful uses of Atomic Energy' (1971)

Honors:

The Vikram Sarabhai Space Centre, (VSSC), a research institute specialising in solid and liquid propellants for rockets located in Thiruvananthapuram (Trivandrum), capital of Kerala state, is named in his memory. In 1974, the International Astronomical Union at Sydney decided that a Moon Crater BESSEL in the Sea of Serenity will be known as the Dr. Sarabhai.

-Divyashree M

Venkataraman Ramakrishnan- Structural biologist



Venkataraman Ramakrishnan
(1 April 1952)

About his life:-

Born – 1st April 1952, Chidambaram [ancient temple town, best known for his temple of Nataraja: The Lord of Dance.

Education:-

- Pre schooling at Convent of Jesus and Mary school[Gujarat] and Adelaide, Austral - Pre science course at Maharaja Sayaji Rao, University of Baroda.
- BSc in Physics [Baroda].
- University of Illinois [graduate programme in Physics].
- PhD in Physics [1976, Ohio, USA]- for ferro electric phase transition of potassium dihydrogen phosphate.
- Again two years at the University of California, San Diego.
- Began to work on 'RIBOSOMES' as a Post doctoral fellow with Peter Moore at Yale university.

Father and son bonding:-

When Venki was born his father C.V Ramakrishnan was away on a Post doctoral fellowship in Madison, Wisconsion along with famous enzymologist David Green. Because his father was from a poor family and he did not think he

could support him and his mother [R. Rajalakshmi, thought at Annamalai university] for Post doctoral income, so he went alone.

How I came to know about Venki:-

Science is always fascinating and interesting. It drives one`s soul to the soul of deep thinking. During third semester of my cell biology lecture, while learning about the protein factories of the cell [Ribosomes] and translation[protein synthesis], it had pulled my mind quickly open up my mobile phone after the class. So I went through ribosomal studies on google, apart from George E.Palade [discovered ribosome] I also saw about Venki and his works related to structure and functions of the ribosomes. Later I bought his book 'THE GENE MACHINE` and started reading about it.

About gene machine [The race to decipher the secrets of the ribosomes]

When I saw the cover page, which was about the beautiful picture regarding the X-ray crystallography of a ribosome, turned up my mind to finish the book in a day. It worked well , because he included his life journey along with his studies. My favourite chapter [chapter 2 – stumbling into the ribosome]. He says DNA has become a metaphor for the fundamental qualities of almost everything and how a protein carry out thousands of functions in life. About enzymes, ds DNA structure, replication, transcription, translation etc

About his Discovery:-

Venkatraman Ramakrishnan along with Thomas Steeitz and Ada Yonath shared the noble prize for studying the structure and functions of a ribosome. "RIBOSOMES" – A revelatory structures of the very machinery that reads the genetic code and translates its nucleic acid sequence into chain of amino acids that forms proteins necessary for life on earth and how the multiple antibiotic drugs block the action of the bacterial enzymes and there by eliminate microbial infections.

My reaction to his short NDTV interview

When a female anchor expressed, Now you might think this is a queue for the latest film release, but no this is a queue of people lining up to hear a talk by noble laureate "Venkatraman Ramakrishnan". I smiled a bit, No I burst into teary laughter after seeing the lineup of people gathered to hear his words. **Interviewer** :- you get used to this Rockstar treatment

His reaction :- No and I hope I`ll die out soon. Its only in India to be honest and it's really an Indian Phenomena.

"Getting noble prize must have been easy compared with being rock star scientist"

Famous Quotes:-

"Think of science as a marathon and not as a sprint"

"I choose a path that is not very standard"

Abhi S

BSc Final year

Dr. Yellapragada Subbarow: Biochemist

Yellapragada Subbarow

(1895 -1948)

Learning little or nothing about ATP and its functions makes the study of life sciences incomplete. What if there was no medicine in the world to cure a wide spread disease like filariasis? How thankful should doctors and patients be for the discovery of a drug like methotrexate -successful in treating cancer and arthritis.

I take this opportunity to share my learnings about one of the unsung scientists of the world- Dr. Yellapragada SubbaRow, credited for these and many other discoveries in the field of biochemistry.

Dr. Yellapragada SubbaRow was born on 12th January 1895, in Bhimavaram, Andhra Pradesh to a poor Brahmin family. He had to pass through a hard childhood due to the early death of his father. His mother Venkamma, had struggled hard to give her children a good life by educating them. She had sold her jewellery to educate SubbaRow – a bright student with a great passion for science.

Education and Career:

Achieving a degree in medicine and offering his services in hospitals affiliated to the Ramakrishna Mission had been his priority. However, he was denied the MBBS degree in the Madras Medical College since he stood by the Non-Cooperation Movement by showing his support wearing Khadi clothes. This had enraged his professors at the college who awarded him a lower degree- the Licentiate in Medicine and Surgery (LMS).

He applied to join the Madras Medical Service but was rejected for the same. He later took up a job as a lecturer in Anatomy in Dr. Lakshmipathi's Ayurvedic College at Madras and began to work in research to blend ayurveda and modern science. The promise of some charities in Kakinada, and financial assistance raised by his father-in-law Kasturi Suryanarayana Murthy, enabled him to proceed to the U.S. He arrived in Boston in 1922, earned a diploma from the Harvard Medical School in Tropical Medicine and then joined the biochemistry laboratory of Dr. Cyrus Fiske as a junior faculty member.

Notable works: **Discovery of the Fiske-Subbarow Method:** It is a method used to estimate phosphorus in body fluids and tissues. It can be done based on the production of blue colour when the sample is treated with ammonium molybdate and aminonaphthol sulfonic acid. A paper on the same was published in the Journal of Biological Chemistry (1925). It stands out to be one of the most highly cited papers in the history of biochemistry.

Finding the functions of ATP: SubbaRow discovered that adenosine triphosphate (ATP) provided energy for every biochemical process including muscle contractions. SubbaRow had disproved Hill and Meyerhof's theory which said glycogen is the cause for energy production in muscle cells for which they were awarded the Nobel Prize in 1922.His research work on the same had been published in 'Science' (1927) and had brought him a PhD degree in 1929.

Synthesizing Vitamin B_9: Based on Lucy Willis's findings that folate is necessary to cure anaemia during pregnancy. SubbaRow and his team members in Lederle Laboratory called the 'folic acid boys', could isolate folic acid for the first time in the world in a pure crystalline form as a protective agent against anaemia (1943-1945).

Discovery of Methotrexate: Over the past 34 years methotrexate (MTX) had become the most popular treatment of adult rheumatoid arthritis and psoriasis. Methotrexate is also one of the first anti-cancer drugs to be discovered (1947) and still in use. It is affective in curing breast cancer, lung cancer, certain types of lymphoma, and leukemia.

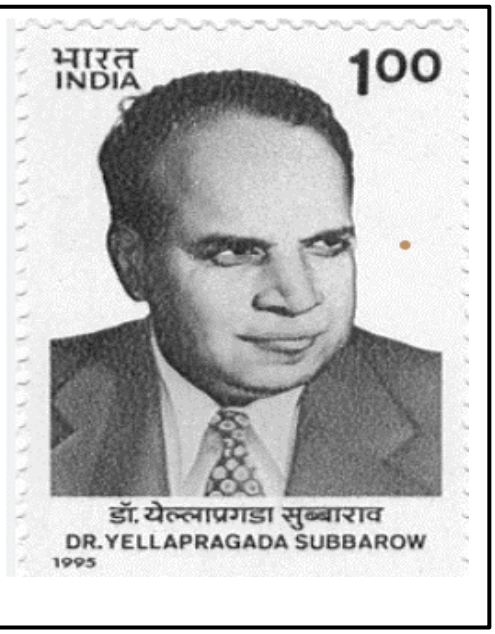
Discovery of Diethylcarbamazine: SubbaRow had also discovered diethylcarbamazine (1947) which is an antihelminthic drug used by the World

Health Organization as a remedy for filariasis. Eosinophilic lung, Loiasis, are few more conditions that can be cured by the same.

Dr Yellapragada Subbarow- *The Man of Miracle Drugs*, had expired on 9th August 1948. His loss had been acknowledged by many.

General Manager of American Cynamid at Dr. Subbarow's Memorial

- The American Cyanamid honoured Subbarow's memory with a plaque at its research laboratory and inaugurated the Subbarow library.
- A fungus was named *Subbaromyces splendens*.
- Subbarow's birth centenary was celebrated in 1995.
- India Post released a stamp in his honour, and a bust was erected in the campus of National Institute of Nutrition, Hyderabad.
- A portrait of SubbaRow had been placed in "Karolinska Institute", which awards the Nobel Prize in physiology and medicine; this fascinated him during his early years at Harvard.
- The portrait was spotted by his colleagues in the 1950's. Dr. Yellapragada Subbarow's contribution to the field of science is incomparable. He is a pride to the nation who has not been celebrated yet. There are many more works of SubbaRow which couldn't come to limelight due to politics with his



Dr. Subbarow's Stamp by India Post

Subbarow's service to science could be rightly explained by these words:

"You have probably never heard of Dr. Yellapragada SubbaRow. Yet because he lived you may be alive and well today, because he lived you may live longer."

-Doron. K. Antrim

-Ishwarya MVN

Chandrayaan 3 : India’s assent into deep space

Chandrayaan-3

I reached my destination and you too!'

This message from Chandrayaan 3, marked India's first successful landing on the Moon, and created a remarkable milestone in India's space journey history. India became the first country in the world to land on the southern pole of the moon. India became the 4th country in the world to make a soft landing on the surface of the moon. Chandrayaan 3 blasted off towards the moon on 14th July 2023 from the launch pad of Sathish Dhawan space- station, Sriharikota.

The lander named Vikram touched down the lunar south pole on 23rd August, 18:03 IST.

With careful planning and robust designs, Chandrayaan 3 has gotten us closer to landing on the moon and discovering its hidden secrets.

The primary objectives of Chandrayaan-3 are to demonstrate the capability of the Vikram-Lander's soft landing on the south polar region of the Moon where no country has attempted to reach so far and to conduct the Pragyan rover on the lunar surface.

The lunar south pole region is of special interest as Chandrayaan-1 found signatures of water ice deposits in the craters of the Moon's Poles. The south pole zones of the Moon that remain in shadow are much larger than the North Pole. There is possibility of the presence of icy walls in the permanently shadowed areas. These cold trap craters in the south pole region may also contain a fossil record of the early Solar System. Ice found inside these craters and within the lunar soil could provide a vital source of water as humans venture back to the lunar surface.

Chandrayaan-3 consists of an indigenous Lander module (LM), Propulsion module (PM) and a Rover with an objective of developing and demonstrating new technologies required for Inter planetary missions.

Vikram Lander: The Vikram lander was responsible for the soft landing on the Moon. It is of box-shaped, with four landing legs and four landing thrusters capable of producing 800 newtons of thrust each. It carried the rover and has various scientific instruments to perform on-site analysis.

One of the main reasons for Chandrayaan-2's landing failure was altitude increase during the camera coasting phase. This was removed by allowing the lander to control attitude and thrust during all phases of descent.

Instruments in the lander

Chandra's Surface Thermophysical Experiment (ChaSTE) will measure the thermal conductivity and temperature of the lunar surface. Instrument for Lunar Seismic Activity (ILSA). Langmuir Probe (LP) will estimate the near-surface plasma density over time.

Propulsion module:

The propulsion module carried the lander and rover configuration to a 100-kilometre (62 mi) lunar orbit.

Instruments on the propulsion module

Spectro-polarimetry of Habitable Planet Earth (SHAPE) will study spectral and polarimetric measurements of Earth from the lunar orbit.

Rover:

The Pragyan rover is a six-wheeled vehicle with a mass of 26 kilograms. The rover is expected to take multiple measurements to support research into the composition of the lunar surface, the presence of water ice in the lunar soil and the history of lunar impacts instruments in rover. An alpha particle X-ray spectrometer (APXS) will derive the chemical composition of the lunar surface. Laser-induced breakdown spectroscopy (LIBS) will determine the elemental composition (Mg, Al, Si, K, Ca, Ti, Fe). Chandrayaan-3 is operated for one lunar day (14 Earth days) on the lunar surface.

The Pragyan rover moved around the landing site within a radius of 500 meters, conducting experiments and sending data and images to the lander. The Vikram lander will relay the data and images to the orbiter, which will then transmit them to Earth.

On 3 September, the rover was put into sleep mode after it had completed all of its assignments. Through Chandrayaan-3, India aims to showcase its technological prowess, scientific capabilities, and its commitment to space exploration. The success of Chandrayaan-3 has strengthened India's position in the global space community. The success achieved by Chandrayaan 3 has inspired millions of young minds to dream big. This mission has planted seeds of curiosity regarding space exploration even in the minds of people who remotely knew about it. Chandrayaan-3 has surely sparked the light to the unknown insights of the space to billions of people. We as the citizens of India, should be extremely proud about our country's achievement.

-CHETHAN DC

P01AB21S0013

3rd year MSc molecular biology

The Nobel Prize in Medicine or Physiology 2023

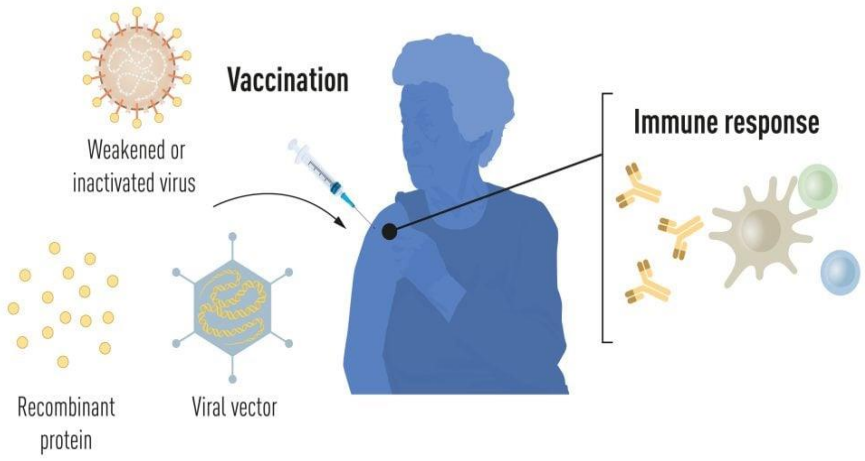
Two popular figures who became more popular at the time of COVID-19 pandemic are Katalin "Kati" Karikò and Drew Weissman. The world has shown the gratitude to these two for their significant contributions during the pandemic.

The Nobel Prize 2023 in Physiology and Medicine was jointly awarded to Katalin Karikó and Drew Weissman for their discoveries concerning nucleoside base modifications that enabled the development of effective mRNA vaccines against COVID-19, The Nobel Assembly at the Karolinska Institute said on October 2.

During the early 1990s, while working as an assistant professor at the University of Pennsylvania, Katalin realized the potential of mRNA as a therapeutic. She faced difficulties in convincing research funders of the significance of her project. She joined with Drew on this study soon.

During this time, she met Drew Weissman at the University of Pennsylvania. Drew had interest in dendritic cells that have immense significance in immunity and help in the activation of vaccine induced immune response.

After a chance meeting while photocopying research papers, Katalin and Drew started investigating mRNA as a potential therapeutic. In 2005, while working at Penn Medicine, Katalin and Drew together found a way to modify mRNA. The findings were published in the journal Immunity, titled "Suppression of RNA recognition by Toll-like receptors: the impact of nucleoside modification and the evolutionary origin of RNA.



Katalin Karikò –

Katalin Kariko,

Szeged University, University of Pennsylvania, USA

She is a Hungarian-American biochemist who specializes in ribonucleic acid (RNA)-mediated mechanisms, particularly in vitro-transcribed messenger RNA (mRNA) for protein replacement therapy. Born on 17th January 1955 in Szolnok, Hungary, she has completed 68 years of her life successfully. Karikò laid the scientific groundwork for mRNA vaccines, overcoming major obstacles and scepticism in the scientific community.

In 1989, she was hired by the University of Pennsylvania to work with cardiologist Elliot Barnathan on messenger RNA mRNA. In 1990, while an adjunct professor at the Perelman School of Medicine at the University of Pennsylvania, Karikò submitted her first grant application in which she proposed establishing m-RNA based gene therapy. Karikò's research and its specializations have a broad impact with potential implications for areas such as the generation of pluripotent stem cells, and messenger RNA-based gene therapy, as well as "a new class of drugs".

Drew Weissman-

Drew Weissman

Penn Institute for RNA Innovations, University of Pennsylvania, USA

Drew Weissman (born September 7, 1959) is an American physician and immunologist known for his contributions to RNA biology. Weissman is the inaugural Roberts Family Professor in Vaccine Research, director of the Penn Institute for RNA Innovation, and professor of medicine at the Perelman School of Medicine at the University of Pennsylvania.

Weissman received his B.A. and M.A. degrees from Brandeis University in 1981, where he majored in biochemistry and enzymology and he worked in the lab of Gerald Fasman. He performed his graduate work in immunology and microbiology to receive his M.D. and Ph.D. in 1987 at Boston University. Afterward, Weissman did a residency at Beth Israel Deaconess Medical Center, followed by a fellowship at the National Institutes of Health (NIH), under the supervision of Anthony Fauci, then director of the National Institute of Allergy and Infectious Diseases.

At the university, Weissman, met his future colleague and collaborator Katalin Karikó at a photocopier, where they sympathized about the lack of funding for RNA research.

The duo has been recognized with several awards like the Lasker-De Bakey Clinical Medical Research Award, the Breakthrough Prize, the Princess of Asturias Award, the Albany Medical Center Prize in Medicine and Biomedical Research, the Vin Future Grand Prize, and the Tang Prize in Biopharmaceutical Science.

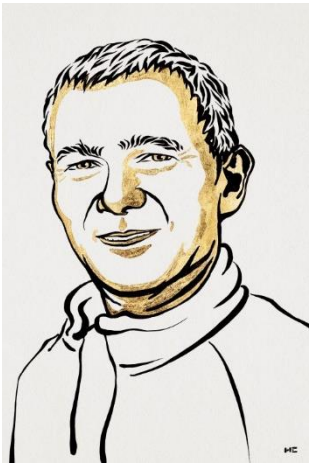
-SRILAKSHMI N

P01AB21S0019

3rd year MSc molecular biology

The Nobel Prize in Chemistry 2023

Moungi G. Bawendi, Louis E. Brus and Aleksey I. Yekimov were awarded the Nobel Prize in Chemistry 2023 for the discovery and development of quantum dots. In the early 1980s, Brus and Ekimov succeeded in creating quantum dots independently of each other. In 1993, Bawendi revolutionised the methods for manufacturing quantum dots.



Moungi G. Bawendi

Massachusetts Institute of Technology (MIT)

Louis E. Brus

Columbia University

Aleksey I. Yekimov

Formerly at Nanocrystals Technology Inc

Colouring the Nanoworld

Quantum dots are man-made nanoscale crystals that exhibit unique optical and electronic properties, including the ability to transport electrons and emit light of various colours when exposed to UV light, literally adding colour to the world of nanotechnology.

It all began with the mystery of how a single substance would give different colours to the glass. Coloured glasses have existed for a very long time. Glassmakers discovered that adding substances like silver, gold and cadmium and playing with temperatures while making glass would result in beautiful coloured glass. Scientists began to examine this phenomenon of how a single substance could result in different colours. For example, a mixture of cadmium selenide and cadmium sulphide could make glass turn either yellow or red – which one it became depended on how much the molten glass was heated and how it was cooled.

During his doctoral degree, Yekimov studied semiconductors. He decided to systematically produce glass that was tinted with copper chloride. He heated the molten glass to a range of temperatures between 500°C and 700°C, varying the heating time from 1 hour to 96 hours. Once the glass had cooled and hardened, he X-rayed it. The scattered rays showed that tiny crystals of copper chloride had formed inside the glass and the manufacturing process affected the size of these particles. In some of the glass samples they were only about two nanometres, in others they were up to 30 nanometres.

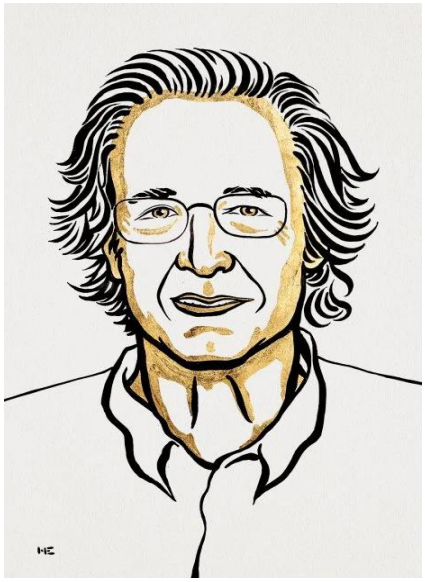
Interestingly, it turned out that the glass' light absorption was affected by the size of the particles. The biggest particles absorbed the light in the same way that copper chloride normally does, but the smaller the particles, the bluer the light that they absorbed. As a physicist, Yekimov was well acquainted with the laws of quantum mechanics and quickly realised that he had observed a size-dependent quantum effect. So what is this Quantum effect? Once the size of matter starts to be measured in millionths of a millimetre, strange phenomena start to occur – quantum effects – that challenge our intuition.

Louis Brus working at the Bell laboratories in the US and was not aware of the discovery. He independently discovered the existence of size dependent quantum effect. Moungi Bawendi in 1993 made a huge breakthrough by revolutionising the method of production of quantum dots. The research group injected the substances that would form nanocrystals into a heated and carefully chosen solvent. They injected as much of the substances as was necessary to precisely saturate the solution, which led to tiny crystal embryos beginning to form simultaneously. Then, by dynamically varying the temperature of the solution, Moungi Bawendi and his research group succeeded in growing nanocrystals of a specific size. During this phase, the solvent helped give the crystals a smooth and even surface. The nanocrystals that Bawendi produced were almost perfect, giving rise to distinct quantum effects. Because the production method was easy to use, it was revolutionary – more and more chemists started working with nanotechnology and began to investigate the unique properties of quantum dots.

There are not just any coloured dots: These quantum dots add a whole new dimension to the periodic table. These have a number of applications from being used in TV screens to being used to detect cancer. Some applications include QLED screens, live imaging of tissues, catalyse chemical reactions, tumour detection, etc.

-Ananya M S(7th Sem)molecular Biology

The Nobel Prize in Physics 2023



Pierre Agostini	Ferenc Krausz	Anne L' Huillier
The Ohio State University, Columbus, USA	Max Planck Institute of Quantum Optics, München, Germany	Lund University, Sweden

The Nobel Prize in Physics 2023 was awarded to Pierre Agostini, Ferenc Krausz and Anne L' Huillier "**for experimental methods that generate attosecond pulses of light for the study of electron dynamics in matter".**

In 1987, Anne L' Huillier made a significant discovery in the field of optics and laser physics. She found that when she passed infrared laser light through a noble gas, various overtones of light were generated. These overtones represent light waves with specific numbers of cycles for each cycle of the original laser light. The generation of these overtones was a result of the laser light interacting with the atoms in the gas. This interaction caused some of the electrons in the atoms to gain extra energy, and as a result, they emitted additional light in the form of these overtones.

In 2001, two scientists, Pierre Agostini and Ferenc Krausz, achieved remarkable advancements in the field of attosecond physics.

Pierre Agostini managed to create a sequence of consecutive light pulses, where each individual pulse was incredibly short, lasting only 250 attoseconds.

Simultaneously, Ferenc Krausz was working on a different experiment. He developed a technique that enabled the isolation of a single light pulse, which had an even longer duration of 650 attoseconds.

The laureates' experiments involved groundbreaking contribution to the field of Physics, which deals with extremely fast events at the timescale of attoseconds (a billionth of a billionth second).

"**We can now open the door to the world of electrons. Attosecond physics gives us the opportunity to understand mechanisms that are governed by electrons. The next step will be utilising them**," says Eva Olsson, Chair of the Nobel Committee for Physics.

There are many significant applications in diverse areas. In electronics, for example, it is important to understand and control how electrons behave in a material. Attosecond pulses can also be used to identify different molecules, such as in medical diagnostics.

Srinandini K R

(7th sem)

Int MSc in Molecular biology

Summer Internship Program: (2021-2023)

List of students selected for Summer Internship/Training during 2021-2023

Sl no	Student Name	Institute name	Name of the Guide	Name of the fellowship
1	Harshith K G	Central University of Rajasthan, Ajmer	Dr. Vishwanath Tiwari	IAS SRFP
		Central Sericulture Research and Training Institute	Dr. Gnanesh BN	-
		University of Alberta, Edmonton	Dr. Amit P Bhavsar	Mitacs GRI
2	Prajwal.S	University of Hyderabad, Hyderabad	Prof.Dayananda Siddavattam	-
3	Jayashree E V	Indian institute of Science Education and Research, Pune	Dr. Mayurika Lahiri	-
		NIUS-HBCSE, TIFR Mumbai	-	-
4	Ruchith B K	Regional Centre for Biotecnology, Faridabad	Dr. Avinash Bajaj	-
5	Likitha Umesh Kanagal	Central Sericulture Research and Training Institute, Mysuru	Dr. Madhusudhan .K.N	-
6	Vasudha Varma J	Central Sericulture Reasearch and Training Institute, Mysuru	Dr. Madhusudan K. N	-
7	Yashaswini M B	Central Sericulture Research and Training Institute, Mysuru	Dr. Madhusudhan K N	-
8	Shashank M S	Dr. B. R. Ambedkar Centre for Biomedical Research, New Delhi	Dr. Manisha yadav	-
9	Deeksha C M	Cochin University of Science and Technology, Cochin	Dr Sarita G Bhat	IAS SRFP
10	Ananya M	JSS Academy of Higher Education and Research	Dr Sumana K	-

11	Pannaga Prasad G	Agricultural & Horticultural Research Station, Thirthahalli	Dr. Ravikumar	-
12	Prakruthi U N	Adichunchanagiri Institute of Molecular Medicine	Dr Shobith Rangappa	-
13	Manoj S	Hemachandracharya North Gujarat University, Patan	Dr Gignesh Trived	-
14	Prithvi Hegde	JSS Academy of Higher Education and Research	Dr. Sumana K	-
15	Trupti K	Central Sericulture Research and Training Institute, Mysuru	Dr. Madhusudhan K N	-
16	Sharanya Bhargav	Tripura University, Tripura	Dr. Ashwini Chauhan	IAS SRFP
17	Shryli K S	National Institute of Mental Health and Neuro Sciences	Dr Phalguni Anand Alladi	-
18	Prerana S Bhat	Ayurveda Research center, Mysuru and Mysore Organic Farms Pvt.Ltd.	Dr. Lakshminarayan Shenoy and Raghavendra K	-
19	Deeksha P Hebbar	Ayurveda Research center, Mysuru and Mysore Organic Farms Pvt.Ltd	Dr. Lakshminarayan Shenoy and Raghavendra K	-
20	Amarthya Siddhartha	National institute of mental health and neuroscience	Dr Phalguni Anand Alladi	-
21	Eepsitha	NIUS-HBCSE, TIFR Mumbai	-	-
		Central Sericulture Research and Training Institute, Mysuru	Dr. Gnanesh B N	-
		Indian Institute of Science(IISc), Bangalore	Dr.Nikhil.R.Gandasi	INSPIRE
22	Inchara Muralidhara	Indian Institute of Science (IISC), Bangalore	Dr Kavita Babu	IAS SRFP
		Central Sericulture Research and Training Institute, Mysuru	Dr. Gnanesh B N	-
23	Akshar A	Center for DNA Fingerprinting & Diagnostics (CDFD), Hyderabad	Dr. Sangita Mukhopadhyay	IAS SRFP
		CSIR-Indian Institute of Toxicology Research (IITR), Lucknow	Dr. Neeraj Kumar Satija	IAS SRFP

24	Rakshita N	Indian Institute of Science(IISc),Bangalore	Prof. Dipshika Chakravortty	-
25	Yavanika S	CSIR- Indian Institute of Chemical Biology	Prof.Nahid Ali	IAS SRFP
26	Jayarajashekara T S	Central Sericulture Research and Training Institute	Dr. Gnanesh B N	-
27	Srinandini K R	Ashoka University, Haryana	Prof. Bittu K Rajaraman	JNCASR SRFP
28	Ananya M S	National Centre for Cell Science, Pune (NCCS)	Dr Gaurav Das2	JNCASR SRFP
29	Revanth Gowda S R	Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR)	Prof. Sheeba Vasu	-
30	Chaya S	Sharada University, Greater Noida	Prof. Baishnab Charan Tripathy	IAS SRFP
31	Maheshwari R	National Centre for Cell Science, Pune (NCCS)	Dr Sharmila A Bapat	IAS SRFP