Science Week Chronicle

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Fellows of the Royal Society from Punjab

"And That is Why ... I Grow Red Roses"

Aryan Chugh

"The gate of life swings to and fro
And soon, too soon, it closes
And that is why, beside my door,
I grow red roses"

This is the journey of a child who was so fascinated by the roses in his garden that he became a legend of plant sciences. Benjamin Peary Pal, or Brahma Das Pal (childhood name), was born in Jalandhar district of Punjab. A devoted man of science, he spent his life working for the establishment of agricultural research and education in India. He completed his B.Sc. and M.Sc. from Rangoon University and went for his PhD at Cambridge University where he studied Hybrid Vigour in Wheat with Engledow. After completing his PhD, he returned to Burma and joined the Department of Agriculture as Assistant Rice Research Officer. In 1933, he joined the Imperial Agricultural Research Institute PUSA (Indian Agricultural Research Institute or IARI), Bihar as Second Economic Botanist. But in 1936, the Institute moved to New Delhi following extensive damage to the old building in an earthquake. Pal was appointed as the Director of the IARI in 1950 in which he served till 1965. He then joined as Director General of Indian Council of Agricultural Research. Realizing that the loss of crops was due to rust infection, in 1934, he initiated a breeding program for evolving rust-resistant wheat varieties. As a result, at the Golden Jubilee of the IARI in 1955, K.M. Munshi, former union minister, in his speech mentioned that the varieties developed by Pal had led to an increase of annual income for farmers by 300 million rupees. The contributions by Pal were not only limited to the IARI. His love for flowers led him to become the Founding President of the Rose and Bougainvillea Societies of India. Other honors include Padma Shri (1959) and Padma Bhushan (1968) bestowed upon him by the Government of India. Benjamin Peary

Pal was elected as Fellow of Royal Society (FRS) in 1972. He was also interested in developing human resource for agriculture in India and thus, established a postgraduate school at the IARI for degrees such as M.Sc. and PhD. In fact, most of the faculty teaching at various universities of India is from the IARI. Pal fostered the growth of agricultural institutions in India and strengthened them with triple function capacity, that is, research, education and extension. He also emphasized the need for kinship between farmers and universities which would later become the basis for the Green Revolution in India. Many agricultural societies and organizations owe their origin to the support and encouragement provided by Pal. In fact, his devotion towards the IARI was so great that he willed both his houses to the Institution. Pal, a bachelor, who was married to his love of plant-breeding, remains a constant inspiration for students, researchers and scientists across the globe.

(Courtesy: "Benjamin Peary Pal" by M.S. Swaminathan, 26 May 1906-14 September 1989. *Biographical Memoirs of Fellows of the Royal Society*, 42, 267–274, 1996. www.jstor.org/stable/770209. A Meditation on the Nobel Prize Award for Medical Research, *A Meditation on the Nobel Prize Award for Medical Research, 1912)*

HERscope

BIMLA BUTI: A Dedicated Scientist

Sukhvir Kaur

Bimla Buti, the first Indian Woman Fellow of the Academy of Sciences of the Developing World (TWAS) and the first Indian woman Physicist Fellow of Indian National Science Academy (INSA), was born in 1933 in Lahore. As her mother passed away in her early childhood, the young Bimla was brought up by her father. At the time of the Partition of India, her family migrated to Delhi from Lahore. Buti got admission in a government school which did not offer science as an option. She did a one-year course at Delhi University where she opted for Physics, Chemistry, Mathematics rather than Biology. In one of her articles she claims that she did not choose Biology as she was scared of cutting frogs perhaps because she was a vegetarian. Though her brother-in-law tried to persuade her to study medicine, her father encouraged her to pursue the career of her choice. Buti subsequently went to University of Chicago in the U.S. where she worked on relativistic plasma with Nobel Laureate Professor S. Chandrasekhar. She earned her PhD in plasma physics in 1962. Buti attributes her success to her father as well as to her guru, Guru Chandra (Professor Chandrasekhar was addressed as Chandra by his students, colleagues and friends) whose

training was to leave an indelible mark on on her professional life later on. The virtues instilled during her childhood, such as self-reliance and the ability to cope with challenges head-on, were strengthened by Buti's association with Professor S. Chandrasekhar. She always spoke her mind fearlessly, and most of her seniors did not like this. Therefore, she suffered professionally both because of this and because of gender bias. But Buti states that she has no regrets.

At a party hosted by then Indian Prime Minister Smt. Indira Gandhi, Buti met Professor Vikram Sarabhai for the first time and he invited her to work at the Physical Research Laboratory (PRL). She joined PRL and

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Guest Column

Reasoning Beyond Binaries

Surinder Pal Singh

What is Truth? It is a popular fancy question, widely discussed among philosophers as well as masses. A standard perception is that it is relative. Is it? If yes/no, why? Can there be general answers to such general questions? Can every issue be discussed in binaries?

If an experiment is successful thousands or millions of times, can you say that it always holds? A mathematician's answer would always be 'no'. For example, the statement 'every number is less than one million' is true for one million whole numbers. In fact, it is true for all negative integers, which are infinitely many. Still, that statement is false in general. Therefore, a general rigorous proof is required to establish the truthfulness of a statement, rather than a multi-fold verification.

In Mathematics, we always set the rules before playing a game. In other words, we fix up some definitions and notations before starting any argumentation. However, any definition comprises some words, which in turn need to be defined through some other words. This is an unending process. Since the English vocabulary has finitely many words, the words in these successive definitions would eventually repeat. (Why?) Does this conclude that definitions are futile and hence the results?

Since it is impossible to rigorously define everything, mathematicians thought of providing a set of basic axioms or postulates which could serve as a foundation of this subject. In other words, it was aimed to provide a few basic assumptions from which the whole mathematics can be deduced. In 1900, Hilbert suggested in his inaugural address to the International Congress of Mathematicians that in the twentieth century, mathematics should be completely axiomatized.

Various mathematicians e.g.

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TECHtionary

- **Buoyancy:** ਉਛਾਲ
- **Conduction:** ਸੰਚਾਲਨ
- **Evolution:** ਵਿਗਾਸ
- **Inference:** ਅਨੁਮਾਨ

Curated: Dimple Bhatia

(**Courtesy:** *Takniki shabdavali*, Punjabi University, Patiala)

Azadi Ka Amrit Mahotsav

Do you Know?

Gregor Johann Mendel

(1822-1884)

Gregor Mendel, famously known as the 'Father of Genetics' was Austrian biologist, meteorologist and mathematician. He is known for his work on cross breeding of garden peas (Pisum sativum) which was done in the backyard of a church. His experimental data helped in the development of the fundamental laws of inheritance. He is considered as the first scientist who integrated mathematics and biology during his work on garden peas. Although he made a fundamental breakthrough, his work was largely criticized because of his statistical approach to explain a biological process. But the contribution was later recognized by Erich von Tschermak, Hugo De Vries and Carl Correns independently, years after the death of Mendel.

(Courtesy: *The Mendelian Revolution*, by Peter J. Bowler, Bloomsbury Business India, 2018.)

Curated: Radhika

Guest Column
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Reasoning Beyond Binaries

Zermelo, Cantor, Godel, and Cohen worked in that direction. An interesting milestone is Cantor's diagonal argument which is often stated as the following popular paradox by Bertrand Russell.

Suppose that there is a barber who shaves all those people who do not shave themselves. Will that barber shave himself?

In 1931, with Godel's incompleteness theorems, it became evident that every axiomatic system is incomplete in the sense that there are statements that can neither be proved nor be disproved within its framework of axioms. So now we have the following possible set of infinite possibilities for questions of the type 'Is X true?'

Yes, no, X can neither be proved nor be disproved, it can neither be proved nor be disproved that 'X can neither be proved nor be disproved',… and so on.

(The author teaches Mathematics in the Department of Mathematics in Punjab University, Chandigarh.)

Archives

Solving the Mysteries of Bio-Molecules

Rito Chophi

Gopalasamudram Narayana Ramachandran (GNR or Ram to those who knew him well) was one of the most brilliant Indian scientists of the 20th Century. He discovered the triple helical structure of collagen and made a fundamental advancement in the understanding of peptide structure. "The Ramachandran phi-psi plot" or simply the "Ramachandran Plot" has become a standard description of protein structures in text books and ranks among the most outstanding contributions in structural biology, along with Pauling's description of the α-helix and Watson and Crick's discovery of the double helical structure of DNA. He started two centres of molecular biophysics, first at the University of Madras, now Chennai, and second at the Indian Institute of Science, Bangalore. Both the centres became internationally recognized centres for research in biophysics

Ramachandran was born on October 8,1922 in Ernakulam near Cochin in Kerala. His father was a Professor of Mathematics at a local college and thus had considerable influence in shaping Ram's interest in mathematics. Ramachandran graduated in 1942 as the top-ranking student in the B.Sc. (Honors) Physics course of the University of Madras and soon joined the Master's program in Electrical Engineering at the Indian Institute of Science at Bangalore. However, he was soon brought into the Physics stream by the Head of the Physics Department, Sir C.V. Raman, who was awarded the 1930 Nobel Prize in Physics for his discovery of the Raman effect. He obtained his Doctor of Science (DSc) degree in 1947. In the same year, Ramachandran went to the Cavendish Laboratory in Cambridge, England, headed by Sir Lawrence Bragg at the time. At Cambridge, he worked with W.A. Wooster and A. Lang on a crystallographic project and developed a mathematical theory for determining the elastic constants of crystals from measurements of diffuse X-ray reflections. He received a PhD from Cambridge University in 1949. Ramachandran returned to Bangalore in 1949 and worked as an Assistant Professor in Physics until 1952. In 1952, Ramachandran became a Professor of Physics at the University of Madras at the age of 29. He was nominated as Fellow of the Indian National Science Academy (FNA), Fellow of the Royal Society of Arts, London (FRSA), Fellow of the Royal Society, London (FRS) among other positions and assignments.

Ramachandran was undoubtedly one of the most outstanding scientists of post-independent India and truly, a jewel in the crown of India's science. He was laid to rest in 2001.

(Source: www.vigyanprasar.gov.in/g-n-ramachandran/Subramanian, E.G.N. Ramachandran obituary. Nature Structural&Molecular Biology 8, p.p 489–491, 20010. www.doi.org/10.1038/88544)

Iconoclast

The Ecclesiastical Rebel

Gurwinder Singh

History is replete with examples of philosophers and scientists who were executed for thinking differently and for speaking their mind. Filippo Giordano Bruno, an Italian philosopher, priest, cosmologist and occultist is one of them. He put forward the same argument as Galileo would some years later. He was born in Nola, Italy in 1548. He is known for his ideas on extrasolar planets and extraterrestrial life. He supported Nicolaus Copernicus's heliocentric model as opposed to the Church's teachings of an earth-centered universe. He believed in an infinite universe with numerous inhabited worlds.

Reformation reached Italy twenty years before his birth but it could not survive there for long. The Catholic Church and the Italian authorities were often on hair-trigger alert and they would prosecute any dissenters to prevent their ideas from spreading among the masses. The Catholic Church was criticised all over Europe and it gave rise to Calvinism in Geneva, Anglicanism in England and further derivations elsewhere. Bruno's ideas were highly unorthodox and the Catholic Church could not bear them.

Bruno entered the Dominican convent of San Domenico Maggiore in Naples in 1565 where he assumed the name Giordano. Exasperated by the strictures of religious life, he fled from his convent in 1576. A fugitive and an excommunicate, he wandered across Europe for many years. Around 1582, he moved to Paris and continued his research on the art of remembering. Bruno's memory enhancement techniques, including mnemonics are described in his book *The Art of Memory* and it brought him to the attention of King Henry III of France and Elizabeth I of England. He spent seven productive years in France. His other works like *On Cause, Principle and Unity* and *Of Infinity, the Universe and the World* are also very famous. But he could not find an academic institution willing to permit him to teach his ideas. He wrote three dialogues on cosmology and three dialogues on morality. He talked about the moving earth and argued for an infinite universe containing other stars like the sun and other worlds like the earth. He claimed that the Bible should be seen as providing moral teaching, not the teaching of physics. Christianity, according to him, was a religion which was held through faith, not through philosophical or scientific reasoning. He attacked Aristotle's physics in his works and publicly lectured against him. He also attacked and mocked a young Catholic mathematician, Fabrizio Mordente, in his four dialogues. He believed that different Christian churches should coexist and they should respect each other. He went to Padua where he wrote *Lecture on Geometry* and *Art of Deformation*. Interestingly, when he applied for a post at the University of Padua, he lost to Galileo Galilei.

In 1591, he arrived in Venice. He was the only sixteenth century philosopher to have been excommunicated from all three major confessions: Roman Catholic, Calvinist and Lutheran. Moreover, he was intolerant of those whom he considered fools, often causing offense. Bruno's believed that "[t]here are countless constellations, suns and planets; we see only the suns because they give light; the planets remain invisible, for they are small and dark. There are also numberless earths, circling round their suns". In the end, Bruno was incarcerated, tortured and burnt at the stake for his beliefs on 17th February, 1600. Bruno's ideas, his defiance and his subsequent execution represent the long struggle of Renaissance thinkers to free philosophy from the narrow constraints of religion.

(Source:www.plato.stanford.edu/entries/bruno/

Ioan James, *Remarkable Physicists: From Galileo to Yukawa*, Cambridge UP, 2004.)

Azadi Ka Amrit Mahotsav

An Ode to Science

In 1912, the Nobel prize for medicine was awarded to Alexis Carrel, whose work on keeping blood-vessels and organs alive outside the body would eventually lead to heart-transplantation technology.

"The Heart In The Jar"

Percy Mackaye

A Meditation on the Nobel Prize Award for Medical Research, 1912.

Alive it beats in a bosom of glass —
A glowing heart!
It has come to pass!
Ventricle, auricle.
Artery quivering:
No metaphorical
Symbol of art,
No cold, mechanical trick of a cog,
But ardent — an organ mysterious.
Alive, delivering
Serene, continuous
Pulses, poised in its chamber of glass.
Beating — the heart of a dog!

(Courtesy: *The Present Hour: A Book of Poems*, The Macmillan Company, 1914, pp.106, Lines 1-13)

Wonders

Fossil Collection and Zoology Museum

Rumanipreet Kaur

There are two museums for fossils in the University campus. One is situated in the Department of Zoology and Environmental Sciences and the other one is the Herbarium in the Department of Botany. The Botany Museum is housed in a separate building adjacent to the Department, whereas Zoology Museum is located on the ground floor of the Department of Zoology and Environmental Sciences. Dr Geetika Sirhindi, Associate Professor in the Department of Botany, reveals that many of the fossils preserved have either been discovered by the faculty of the Department itself or have been gifted to them by their friends and colleagues. As the plants or parts of plants fall on rocks, they leave an impression/imprint on the rocks. This phenomenon is known as Petrification and these impressions are used for fossil studies. The first fossil preserved in the Department in 1967, DryoxonSp, was the Setrifaction of dicot stem, when the Department was established. Professor S.S. Bir, founding Head of this Department, contributed many fossils to this Museum. Some of the fossil species present in the Botany Museum are Nilssonia, Dadoxylon Sp., Phyllotheca Indica Bunbury, Cyclanthodendron, Cycadeoidea, Dryoxcon Sp., Iron ore, Coal, Gypsum, Cladophelebis Denticulata, Williamsonia etc. Interestingly, the Nilssonia fossil gives the impression of a stone but it is actually a stem. It was found in the Rajmahal hills by the Department of Geology, Aligarh Muslim University, Aligarh. This Museum provides great exposure to B.Sc., M.Sc. and PhD students of the Department working in domains such as Anthropology, Ethnobotany, Evolutionary Biology etc.

The Zoology Museum houses hundreds of specimens of mammals, reptiles, fishes etc. The specimens are preserved in wet and dry forms. A major attraction of this Museum includes preserved specimens of birds, osteology/skeletons of cobras, turtles to camels and horses. A research scholar from the Department, Jaspreet Kaur, claimed that this Museum has a collection of thousands of insects such as dragonflies, butterflies, bees which have been collected by the faculty and students of the Department. Each specimen is labelled with its

class, subclass, genus and species. The labelling enables students to become familiar with many zoological specimens. It gives a hands-on experience to students and researchers and helps them in their research work.

HERscope

The Confluence of North and South

Dr Darshan Markan was born on 4th June, 1941 at New Delhi and received her entire education from University of Delhi including her PhD in Organic Chemistry in 1966. In 1967, she won 'The Senior Research Scholarship' conducted by the Royal Commission for the Exhibition of 1851 for her doctoral work with Derek Barton at the Imperial College, London. She returned to Delhi in 1969 to join teaching and research at Miranda College, Delhi where she became Head of the Department of Chemistry. In 1970, at a Natural Product Conference, she met her future husband Dr S. Ranganathan from the Department of Chemistry at IIT Kanpur. After marriage,

she moved to join him and worked with him as his research associate. Together they published research papers, scholarly books on organic chemistry and published a monthly journal called *Current Highlights in Organic Chemistry*. In 1993, Dr Ranganathan moved to the Regional Research Laboratory, Thiruvananthapuram as an emeritus scientist and Dr Darshan also joined as a regular staff scientist. In 1998, they moved again to the Indian Institute of Chemical Technology, Hyderabad. Dr Darshan's major research contributions encompass the understanding of biological processes at a molecular level through the design of simple and elegant chemical models. With Dr Ranganathan, she jointly published large number of research papers and eight books. She was a Fellow of the Indian Academy of Sciences and the Indian National Science Academy. She was a recipient of Jawaharlal Nehru Birth Centenary Visiting Fellowship, Third World Academy of Sciences (TWAS) Award, Professor K. Venkataraman Lectureship. In addition, the Indian National Science Academy has also instituted Professor Darshan Ranganathan Memorial Lecture in her honour. Dr Darshan Ranganathan died on 26 August, 2001.

(Courtesy: S.K. Sahni and R.K. Kohli eds., *Sparkling Punjabi Scientists*, SLM Publishers, 2018.)

HERscope ... Continued from page 1

BIMLA BUTI: A Dedicated Scientist

spent the next twenty-three years of her professional life there. She founded the Plasma Science Society of India whose registered office is still at PRL. At the International Centre for Theoretical Physics, Trieste, Italy, Buti was the Director of Plasma Physics from 1985 to 2003. She worked with a brilliant plasma physicist T. G. Northrop in National Academy of Sciences, at the Goddard Space Flight Centre, NASA. Buti also served as a member of the Nuclear Science Centre's Governing Council in New Delhi from 1996 to 1998 and the Inter University Centre for Astronomy and Astrophysics from 1997 to 1999.

She got the Vikram Sarabhai Award for Planetary Sciences in 1977, the Jawaharlal Nehru Birth Centenary Lectureship award in 1993, the Vainu Bappu International Award in Astrophysics in 1994, and the Lifetime Achievement Award from the University of Chicago in 1996. She has edited four books and she has written many academic papers. She worked in areas that are considered extremely difficult and fought gender discrimination and jealousy of male colleagues. Her dedication was so great that early on in her adult life, Buti had made the conscious decision to remain single so as to dedicate her life to her professional commitments. Now, she is living in Delhi, and continuing her research. She is doing her social work through the 'Buti Foundation' which was founded in 2003.

(Courtesy: "A woman scientist in a field dominated by men," *Lilavati's Daughters: The Women Scientists of India*, Rohini Godbole and Ram Ramaswamy, eds., Indian Academy of Sciences, Banglore, 2016., www.Insaindia.res.in/detail.php?id=N81-0132)

Quiz

1. What is the approximate size of bacterial cell ?
2. How much grams of salt is there in one litre of sea water ?
3. What is the scientific name of water?
4. What is the previous name of Indian Institute of Science?
5. In which season Rabi crops are grown?

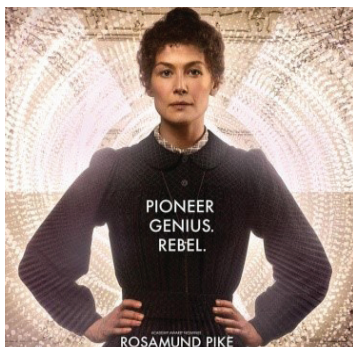
Only the first three (3) respondents will be aptly rewarded.

Submit your answers on: daljitami@pbi.ac.in

Curated: Brahamjeet Singh

Science on Reel

Radioactive, 2019



Starring: Rosamund Pike

The film delineates the life of famous scientist, Marie Curie. Her struggle to find a foothold in the predominantly male world of science has also been brought to light.

Mega Icons: *Kalpana Chawla*, 2020

National Geographic has cinematically recreated the life of Indian-born astronaut Kalpana Chawla in their *Mega Icons* series (Season Two, Episode Four). This 45-minute documentary, in English as well as in Hindi, provides an insight into Kalpana Chawla's life with interviews of her loved ones. The episode was premiered on October 11, 2020. Directed by Ankit Arora, it is now available on *Disney* and *Hotstar*.

Curated: Aastha Chawla

Photo Gallery

Glimpses of Activites at Punjabi University Campus and Constituent Colleges during Science Week

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