CONNECT

WITH THE INDIAN INSTITUTE OF SCIENCE
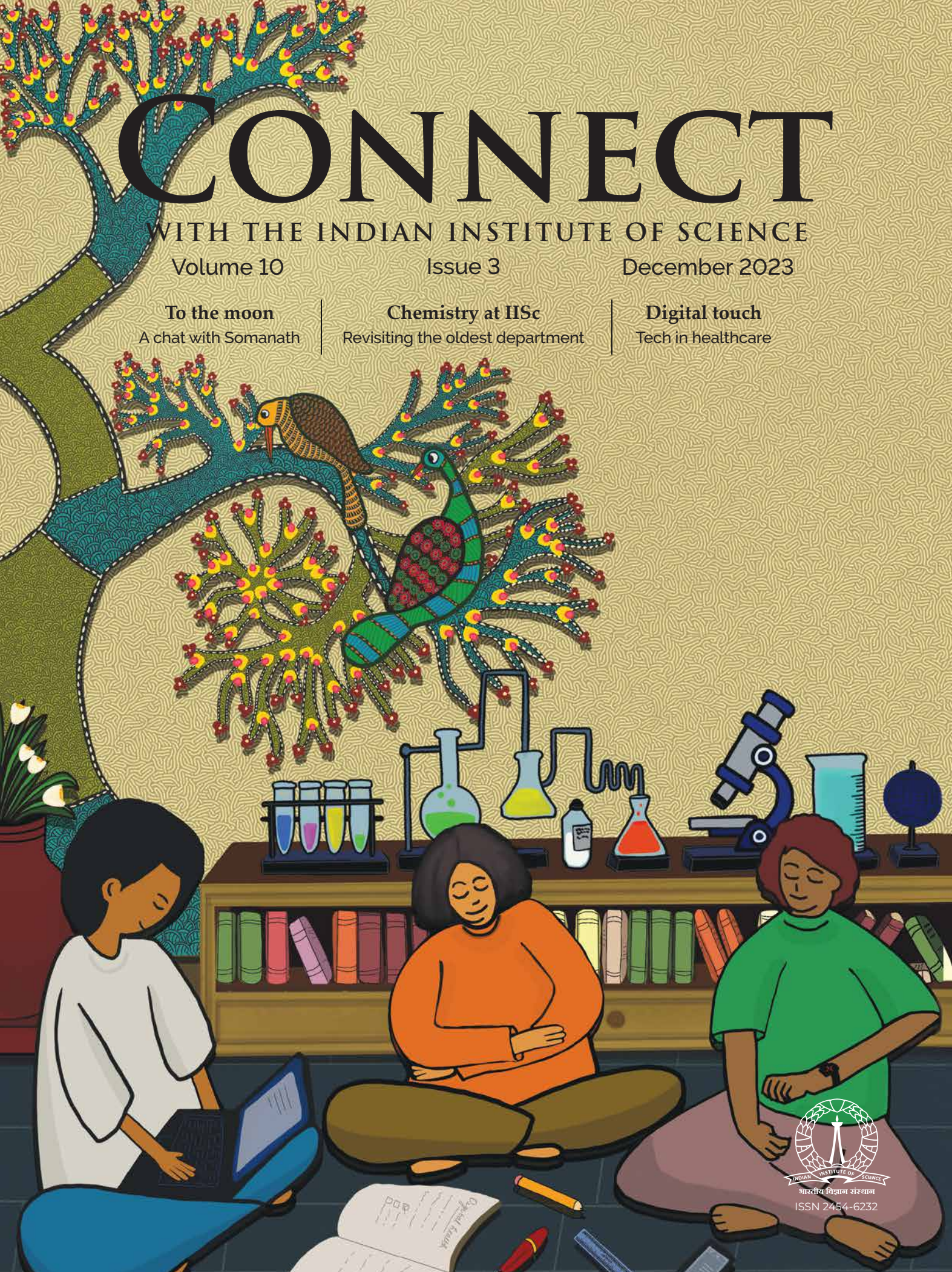
Volume 10   Issue 3   December 2023

To the moon
A chat with Somanath

Chemistry at IISc
Revisiting the oldest department

Digital touch
Tech in healthcare

IN THIS
ISSUE

Editorial

From machine learning models to digital organs, emerging technologies are making inroads into healthcare research and delivery. In this issue of *CONNECT*, we feature efforts by researchers seeking to build a digital health initiative at the Institute.

This issue also features stories from alumni who have made significant contributions to science and society. Sudhakar Varanasi shares with us the incredible impact that the 108 helpline has had on the nation's emergency response. In a candid interview, S Somanath, the current ISRO chair, speaks about India's space missions, the future of space research, and how his days on campus shaped his career. We also trace the life and times of Rama Krishna Baliga, the man who conceived the idea of Electronic City, the founding of which transformed Bangalore into a major industrial hub.

In a deeply personal essay, former faculty member S Mahadevan describes the difficulties of living with a debilitating disease. Another story highlights the role played by the Pensioners' Association in enriching the lives of former employees.

The Department of Inorganic and Physical Chemistry is as old as the Institute itself. We explore its contributions over the years, some far ahead of their time.

In other stories, a student describes the history and growth of IISc's Bachelor of Science (Research) programme. As part of the same programme, a humanities course has been encouraging students to use Indian folk art to depict and debate science for the last 10 years. We also spotlight one of India's longest running conservation conferences, which has nurtured a thriving community working to save the planet.

Happy reading!

Team Connect

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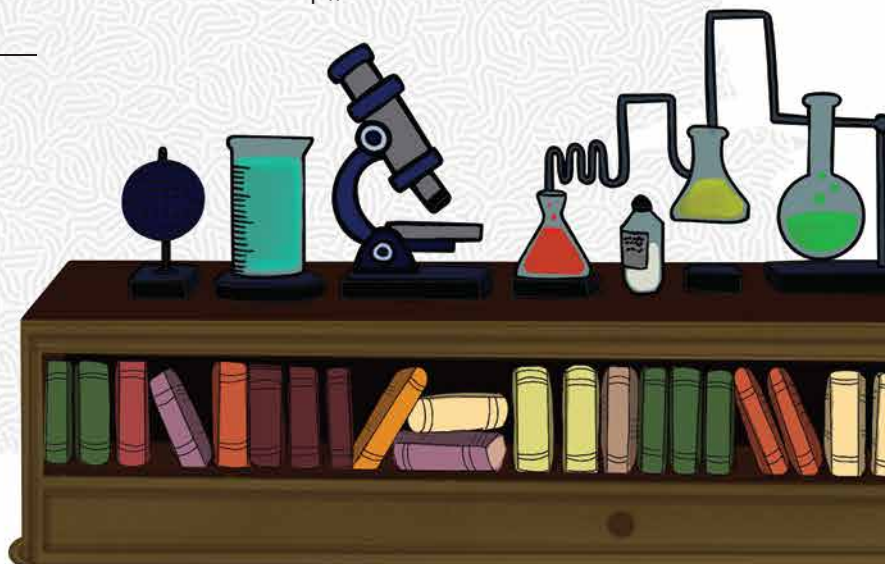**Address:** Office of Communications, Indian Institute of Science, Bangalore 560 012
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'Chandrayaan-3 showed what India is capable of'

- Ananthapathmanabhan MS

Sreedhara Panicker Somanath is the 10th Chair of the Indian Space Research Organisation (ISRO). He graduated with a Bachelor's degree in Mechanical Engineering from TKM College of Engineering, Kollam, in 1985. Soon after, he started his stint in ISRO as team leader of the Polar Satellite Launch Vehicle (PSLV). After 10 years of service, he joined IISc to pursue his Master's in Aerospace Engineering in 1994.

Somanath has worn many hats at ISRO, having overseen the successful launch of PSLV, GSLV Mk-III (LVM3), SSLV, RLV-TD landing and Gaganyaan-TV-D1, and several key technological missions. Under his leadership, in July 2023, ISRO launched Chandrayaan-3, which touched down on the lunar surface on 3 September 2023, making India the first country to reach the lunar south pole and the fourth to make a soft landing on the moon. Along with four others, he received the Distinguished Alumnus Award from IISc this year. Somanath talks to CONNECT about ISRO's upcoming missions, his days in the Institute, and his journey to the top of India's space agency. The interview is lightly edited for clarity and flow.

Photo courtesy: ISRO

Chandrayaan-3 lifting off from the Satish Dhawan Space Centre in Sriharikota

The Chandrayaan-3 rover, Pragyan, has sent its first updates. How are these findings going to help ISRO's missions?

The whole experiment was about going to the moon, making a soft landing, and collecting the data, which has been accomplished. All the five instruments on board functioned well. They collected enough data. Now, scientists will delve deep into the data, uncovering patterns and missing links to bring out new science outcomes.

For example, the ChaSTE (Chandra's Surface Thermophysical Experiment) probe, assigned to measure the thermo-physical properties of regolith on the moon, drilled 10 centimetres deep and measured the temperature profile. The result was surprising. The surface temperature was found to be near 20°C. On the other hand, the temperature at 10 centimetres depth was found to be around -30 °C. Within a small distance, we see that there is a huge temperature difference. This can reveal details about the properties of the moon's surface. But to interpret it more specifically, we will have to study the data and then create models to find out more details.

In a similar way, we have measured the electron density at a short height from the surface. We found a lower concentration of electrons than previously thought. But why? We do not know yet. We will have to make sense of the data in the future.

We have also got data on seismic measurements (moonquakes). Whether these moonquakes are due to internal movements or some asteroid collision is a question yet to be resolved.

The presence of sulphur was another finding. A detailed examination of this data will give us information on the moon's formation.

Chandrayaan-3 is a very inspiring story. It showed everyone what India is capable of.

Can you tell us about your days in IISc?

I had completed almost 10 years of service at ISRO when I joined IISc. I worked on the PSLV rocket and joined with that background and experience. Academic work and industry work are different. So, when I came to IISc, I was initially shocked by the academic demand. But being in IISc helped me in the long term. I could connect what I was learning at the Institute with my job at ISRO. I ensured that I studied papers and took up subjects that had a strong connection to my work.

> **I could connect what I was learning at IISc with my job at ISRO**

For example, before coming to IISc, my exposure to mathematical modelling was minimal. At ISRO, I was more into systems engineering and design. After learning mathematical modelling at IISc in different domains, I could look at physical processes and find out the mathematical connections needed to solve a problem. This has increased my confidence, an important outcome from IISc for me.

I also ensured that I took subjects across departments. Although I was an aerospace engineering student, I took subjects offered by the Departments of Mechanical Engineering, Computer

Photo courtesy: ISRO

Somanath at an event in ISRO

Science and Automation, and Mathematics. I made sure that my course work would help me to handle the complex problems of rocket-building. This helped me later in my career. I tried to make the best use of my time at IISc to grasp new knowledge. I would spend many late nights at SERC (Supercomputer Education and Research Centre), as most of my work was in computer modelling and simulation.

Apart from burning the midnight candle, what were some of your favourite activities and spots in IISc?

The Gymkhana. I used to play badminton regularly in the evenings. After that, I would go to C Mess and have my dinner...

...Your favourite cuisine?

Whatever C Mess had (*laughs*). It was a good place, and I enjoyed the food there. In fact, my weight increased from 68 to 74 kg!

As I was a sponsored candidate, I was not staying in the hostel. We were put up in a bungalow near the swimming pool. We were away from the hustle and bustle of the regular hostels.
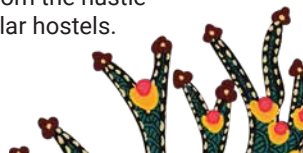
Could you tell us about Aditya-L1, the mission that seeks to understand the solarscape?

Solar observation and related science have been an ongoing research domain at ISRO. We have a solar observatory at Udaipur, which uses terrestrial-based solar observations, and our scientists have published several papers. They collaborate globally with other observatories as well.

Aditya-L1 is a unique satellite. Study of the sun is very important because we are looking at the effects of solar coronal emissions on [Earth's] weather.

The Sun is not a static object. It is very dynamic, and a lot of modelling is needed to understand it. Here, the goal is to look at Coronal Mass Ejections [CMEs – outbursts of materials from the Sun]. We need to understand these emissions and measure them up to distances at least three times the radius of the Sun.

Next, we need to look at the effects of emissions from solar particles travelling towards Earth. We have two instruments to study these particles. We have soft and hard X-ray detector instruments. We also have an instrument to measure the magnetic effect of such particles on the free space between the Sun and Earth.

All of this is to understand the mechanics of solar coronal emissions. The mission will help us model and predict space weather effects which are very prominent in the southern and northern regions [of Earth]. Space weather modified by severe CMEs can cause tripping of power grids or cause damage to satellites. Aditya-L1 has instruments to measure CME and its secondary effects on board. Thus, this mission is very unique.

When it comes to partnerships with private entities to carry out space missions, what are ISRO's plans?

The emergence of private entities to take up space activities in all domains is very inspiring though they are at a nascent stage here in India.

Although there have been many

industries with the capability to manufacture space systems and supply parts, not many were into systems engineering. Our goal today is to nurture and support industries and new entrepreneurs who can envision bigger [things]. We need companies to build rockets and satellites in India for the global market. Using currently available infrastructure in ISRO, we need to help them in case they need facilities, technology transfers and technical support.

The first thing we needed was a policy to foster private entities and to allow them to get involved in space research and missions. Things were not easy before. Rocket building was not allowed in the private sector. Building a satellite was possible, but there were restrictions on owning a satellite and launching it from India because then it becomes an Indian entity, and the Indian government becomes responsible for it. Now, these are allowed after the space sector reforms and the new space policy of 2023. IN-SPACe [Indian National Space Promotion and Authorisation Centre] will authorise private entities to build rockets and satellites, and launch them from Sriharikota or any other Indian launch stations. We need to create policies and guidelines in other domains to promote business, namely space applications and delivery, communication infrastructure support, remote sensing data utilisation and NavIC [Navigation with Indian Constellation] services. Ventures like SatSure and MapmyIndia have come up on the application side very successfully.

When can we once again expect to hear "*Saare Jahan Se Accha* (India looks beautiful from space)"? What is the expected timeline to put humans up there under the Gaganyaan mission?

If everything goes well, it should happen in 2025.

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> *The emergence of private entities to take up space activities in all domains is very inspiring*
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Recently, it was announced that a new space station will be built from India. Could you tell us more about this?

It is a vision that has been given by our Honourable Prime Minister.

After the success of Chandrayaan-3, you could see the euphoria it created. It captured everybody's imagination, and everybody wanted to see more accomplishments such as a space station and human missions to the moon. Now, India is viewed as a country with the potential to succeed in such endeavours, thanks to robust government support.

The Prime Minister asked us to create a roadmap for the next 25 years.

Somanath enjoying a light moment with colleagues in the control room

Photo courtesy: ISRO

He asked: "Could you put a man on the moon?" We said yes. "Can you build a space station?" We said yes. We created a roadmap and presented it to him.

But for all this to happen, we need to do many more things in the coming days.

"

I never even imagined that I would ever become an engineer. It was just destiny

"

We just accomplished Chandrayaan-3, but that's not enough. We need to continuously carry out similar scientific missions over time, to the moon, Mars and Venus. Gaganyaan is a programme for sending Indian astronauts to space and bringing them back. For more than a one-time attempt, we need a long-term programme for sustained human space missions. For that, a space station is essential. They should be able to go up there, spend a long time, and carry out science experiments in zero-gravity conditions. So, we said that we could put up an Indian space station at a very low cost. It does not have to be initially manned; it can be operated by robots. We can send probes to bring back samples and carry out experiments. We are proposing it to be accomplished by

2035, which will be ultimately human rated.

For a manned moon mission, we have the target as the year 2040. For that, we must develop a new heavy lift rocket. Current rockets do not have enough payload capability, and are not capable of reaching the moon very fast.

We must also develop many new technologies. We have a list of technologies that need to be developed in the next 10 years, which will be pursued in different ISRO centres.

What led you to choose space research as a career?

I never thought about space research as a career. I never even imagined that I would ever become an engineer. It was just destiny. I was planning to pursue a BSc in mathematics or physics. Of course, I was interested in science and was a state topper in SSLC. But back then, there was no one to help channel my career.

I never wrote the IIT entrance exam, simply because my headmaster back then had suggested, as it would be impossible for me to get admission and tough to manage the fee payments. When many went for entrance exam coaching classes, I never did.

Someone got me an application form for engineering admission which was then based on pre-degree marks, and I applied. Thanks to the books I read, while in college, I became interested in space. I pursued my professors to teach courses on space technology, which were not offered at that time in my college. After graduating, I joined ISRO. The journey took off, without me deliberately planning for it.

Did you ever think of becoming an astronaut as a child?

No, never.

Never?

Never! I know that being an astronaut is a job with a different set of requirements. It has the glamour and associated high risks. Astronauts can do things defined to them and [things] that they are trained for. They are scientists, flight commanders and engineers. But my passion was to become an engineer with a creative capability to build all that is needed for the astronaut to function, such as rockets, space vehicles, and so on. A profession with a high level of creativity is a unique opportunity presented to anyone, and I wanted only that.

Photo courtesy: ISRO
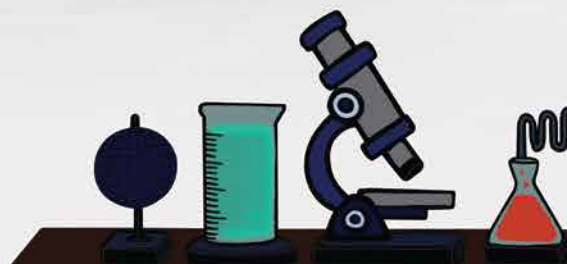

Celebrations at ISRO after Chandrayaan-3 landing

Photo courtesy: IISc Archives/E Arunan

Chemistry
Matters

- Sandeep Menon

Why the oldest department in IISc continues to be relevant

IPC in 1959

As one goes down the canopy-covered Tala Marg in IISc, there stands a building tucked unobtrusively on the right side. The exposed stone bricks, sharp features, and small windows harken back to a time when robustness and utility were qualities that were paramount. Even the letters that read *Department of Inorganic and Physical Chemistry* (IPC) appear devoid of the flair we see in today's world. It stands to reason.

For over a hundred years, the building was home to the first department in the Institute – alongside the Department of Electrical Technology. IPC was initially in the Main Building until it moved here just a few years after IISc was established in 1909.

Over the years, the Department, then called the Department of General and Applied Chemistry, has grown and evolved. A couple of years ago, it moved into a newly built glass-tinted, tall-pillared, gargantuan building with well-manicured walkways, in keeping with the growth of the Department and the aesthetics of the 21st century. The new building also has other departments that fall under the Division of Chemical Sciences.

When IISc started in the early 20th century, chemistry was the science in vogue, leading the charge as the world went through tectonic changes. There was industrialisation, catalysed by developments in chemistry, which aimed at helping people live better lives. In a cruel paradox, chemistry also fuelled wars, including World War I. The deadly dynamite was created by the Swedish chemist Alfred Nobel, who – in penance – bequeathed his vast fortunes to establish the Nobel Prize. Chemistry ruled the roost.

> **When IISc started in the early 20th century, chemistry was the science in vogue, leading the charge as the world went through tectonic changes**

It was, therefore, no surprise that chemistry was the most important subject to be studied even at IISc. And that its first Director was Morris

Travers, a chemist of some repute following his work on discovering noble gases alongside Nobel Laureate William Ramsey. It even earned him the nickname *Rare Gas Travers*.

"It was a chemist who planned and executed the [building of the] institution," AR Vasudeva Murthy, who chaired IPC from 1973-77, once said while recollecting the history of the Institute in an audio recording. "It was chemists who thought of using Indian mineral and forest resources for industrial purposes. To transform natural resources for the benefit of people was a big thing."

Guided by India's most well-known engineer, M Visvesvaraya – then also the Dewan of Mysore and a member of IISc's Council – the Institute also helped advance industrialisation in India. New chemistry departments came up – the Department of Organic Chemistry in 1911 and the Department of Biochemistry in 1921.

The drive to make an impact on society even led to many commercial activities.

Among the earliest large-scale industrial projects was research on sandalwood, led by Sosale Garalapury Sastry. In 1916, it resulted in the production of sandal oil and soap, both of which were mass-produced by the government and soon became emblematic of Mysore State and eventually Karnataka. There was also research on oils, dyes, and fermentation, among others.

In the 1920s and 1930s, with the advent of atomic physics and quantum mechanics, physics became the darling of the scientific world. In IISc, this period coincided with the hiring of CV Raman as its first Indian Director. When he joined IISc in 1933, he set up the Department of Physics the same year and also became its head. During Raman's time, there was a perception that he favoured the Physics Department over other departments, according to BV Subbarayappa in his book, *In Pursuit of Excellence: A History of the Indian Institute of Science*. It also did not help Raman's cause that he lacked administrative tact, Subbarayappa writes.

Photo courtesy: IISc Archives
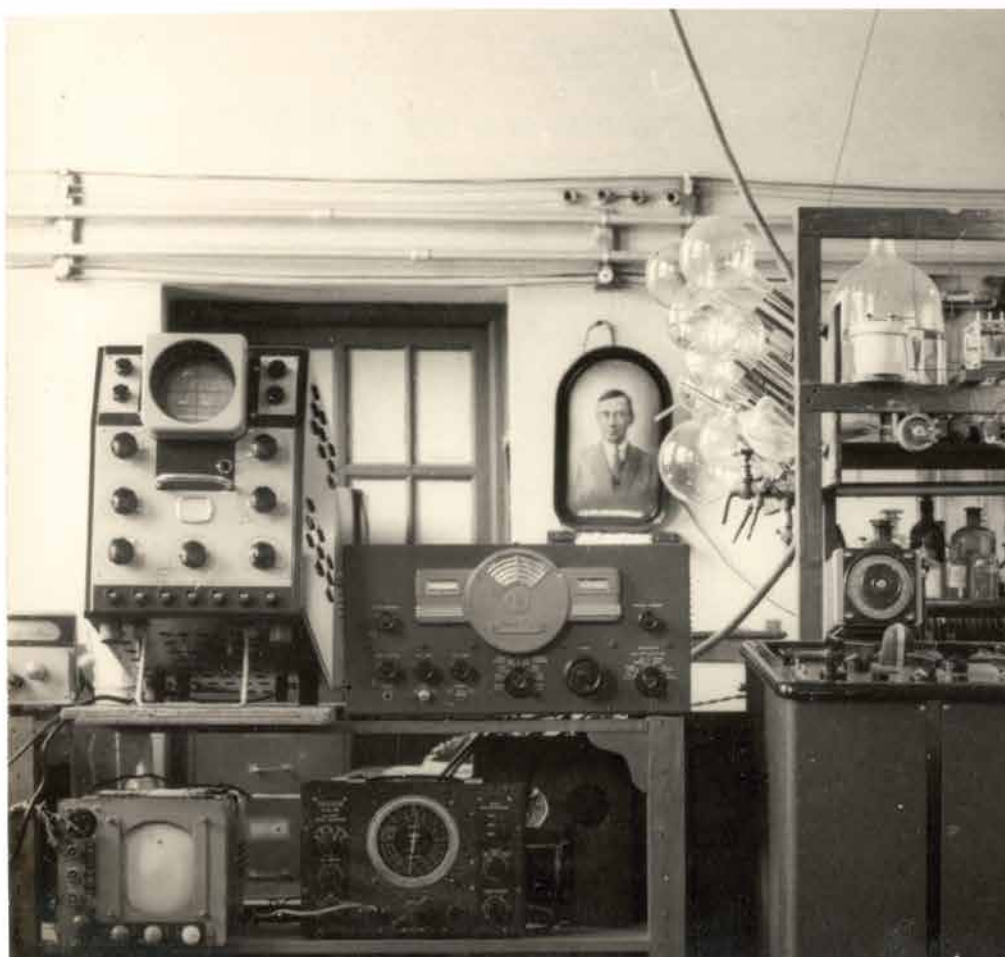
The lab of HW Watson, Professor of General Chemistry

Following Raman's acrimonious tenure and eventual resignation in 1937 – he continued to lead the Physics Department until 1948 – JC Ghosh became the Director in 1939 (IISc had an Acting Director for a couple of years). Though a chemist himself, Ghosh's tenure saw many engineering departments come up. During this period, IISc was also mandated to participate in projects to help Britain's World War II efforts.

> **During Raman's time, there was a perception that he favoured the Physics Department over other departments, according to BV Subbarayappa**

With IISc expanding and moving towards nation-building projects in the years immediately before and after independence, IPC, however, kept its eyes on the ball and continued to produce quality fundamental and applied research. And this has carried on to this day. IPC's contributions are exemplified by multiple innovations.

Powering forward

One such innovation was the development of batteries by electrochemist S Sathyanarayana. *Battery Sathyanarayana*, as he was sometimes referred to, joined IISc at the insistence of AKN Reddy, Professor at IPC, who was building a strong contingent of electrochemists in the IPC department.

Reddy and Sathyanarayana started developing magnesium-manganese dioxide batteries as part of a project initiated by Bharat Electronics Limited with the latter continuing his efforts to the production level. India was only one of two countries – the other being Israel – to manufacture them then.

Sathyanarayana would also go on to be a driving force in the development of nickel-cadmium batteries to help with India's space programme in the 1970s. The Vikram Sarabhai Space Centre (VSSC) started with lead acid batteries, a Soviet technology, but these were heavy and required a lot of space.

"The requirement was to develop sealed nickel-cadmium batteries, with Sathyanarayana as the consultant," recollects N Munichandraiah, Emeritus Professor at IPC. "The batteries had to meet certain mechanical and physical requirements because they were going to go to space in satellites. Two or three satellites operated with nickel-cadmium batteries developed by VSSC in consultation with Sathyanarayana."

When the space application demanded higher energy density batteries, nickel-hydrogen batteries and lithium-ion batteries were developed. IPC played a key role in the development and evolution of batteries from the 1970s onwards and even segued into the development of supercapacitors and fuel cells.

But all along, IPC never lost sight of its commitment to basic research as well. In some instances, it was ahead of the curve. Case in point: IPC's research on hydrogen bonds. When the *Journal of the Indian Institute of Science*

celebrated its centenary in 2014, it brought out a special edition with the most important discoveries reported in it over a hundred years. One of them was a paper from 1943 about hydrogen bonds.

The paper, titled *Hydrogen Bond in Benzene*, was originally published by Nagamani Shama Rao, one of IISc's earliest women researchers, and SKK Jatkar from IPC, in which they pointed out that methane could really be bound by hydrogen bonds.

E Arunan, IPC's Chair, explains its significance: "At that time, people thought hydrogen bonded [only] to highly electronegative elements like oxygen, nitrogen, and fluorine can be involved in hydrogen bonding. However, there was some evidence that hydrogen sulphide or methane could [also] form hydrogen bonds. [At that time], it was dismissed by powerful people, including Linus Pauling, who was probably the most influential chemist of the 20th century."

"In the 1980s and 90s, chemists argued whether methane can form hydrogen bond or not. The paper was forgotten about," Arunan adds. Studies on hydrogen bonds have come a long way since then and the Institute's tryst with the bond has continued. In 2011, Arunan led an International Union of Pure and Applied Chemistry (IUPAC) task group to determine a new definition of hydrogen bonding.

On a side note, Jatkar's work here also gives a glimpse of his excellence as a researcher and why Raman, during his tenure as Director, tried to transfer him – along with MA Govinda Rau – to the Physics Department. Jatkar, however, was not keen on moving, particularly since it would involve shifting his equipment from IPC to the Physics Department.

Missed opportunities

Yet another innovation that came out of IPC was in 1988 when a procedure called Solution Combustion Synthesis (SCS) was discovered accidentally by KC Patil, Professor in the Department.

In 1987, Patil published a paper titled *A low temperature path to ultrafine ferrites* in the *American Ceramic Society Bulletin*. A year later, SCS of

STUDIES IN BINARY SYSTEMS

Part XI.   Hydrogen Bond in Benzene

By (Miss) *Nagamani Shama Rao and S. K. K. Jatkar*

Introduction

In recent years theories relating to formation of associated molecules in liquid systems due to hydrogen bond have been forthcoming. An atom of hydrogen is attracted by rather strong forces to two atoms instead of only one, so that it may be considered to be acting as a bond between them. This is called the hydrogen bond.

The assumption that the hydrogen bond was formed by two covalent bonds is not correct because the hydrogen atom can form only one covalent bond. It is now recognised that the hydrogen bond is ionic in character and is formed between the most electronegative atoms.

By the application of quantum mechanical theory of valence Pauling found that a hydrogen atom with only one stable orbital cannot form more than one pure covalent bond and that the attraction of two atoms observed in hydrogen bond formation must be due to ionic forces. According to Pauling, hydrogen bond is a bond by hydrogen between two atoms. Only the most electronegative atoms should form hydrogen bonds, and the strength of the bond should increase with increase in the electronegativity of the two bonded atoms. Thus fluorine, oxygen, nitrogen and chlorine possess this ability in the decreasing order. Fluorine is well known to form very strong hydrogen bonds, oxygen weaker ones and nitrogen still weaker. Chlorine, although it has the same electronegativity as nitrogen, has only a small hydrogen bond forming character which Pauling attributed to its large size relative to nitrogen.

The C-H-Bond.—Although the tendency for hydrogen to act as acceptor is in the order in the series H-F > H-O > H-N > C-H-, the C-H bond plays a very important part in both dilute and concentrated solutions of strong dipoles. Here again we have the series

A seminal paper on hydrogen bonds published in 1943

nanocrystalline oxide materials was first published in *Material Letters*. It resulted in the synthesis of what were then just called ultra-fine particles. While the first paper dealt with synthesis in which the precursors were solid, the latter was a reaction in an aqueous medium. SCS has been standardised and the materials having interesting magnetic, dielectric, catalytic and optical properties are useful in making nano devices for specific applications.

Today, these particles are well known as nanoparticles and have a wide range of applications.

The method, not patented, had many advantages in terms of cost, time, and equipment, and was then used by many countries to accelerate their work on nanoparticles. "The application of this is in so many things. We did science. Today it is being used, I don't know [by] who and for what, because I did not take a patent," says Patil. India, it would seem, missed the nanoparticle boat.

The same can be said of a silicon project led by Murthy in the 1970s. This too was a project way ahead of its time. But Murthy perhaps realised that we would soon be living in a world run by silicon microchips.

Murthy and his colleagues at IISc even provided the expertise for a silicon factory built by Mettur Chemicals at Mettur in Salem District. The factory supplied silicon wafers to many industries for a time before shutting down. It's impact but a pale shadow of what it could have been.

"Now, Chinese Taipei makes almost all the silicon for the world. It didn't succeed here even though it all started here," says Arunan.

Both the silicon initiative and nanoparticle discovery reveal that though IPC researchers have been doing cutting-edge research through the decades, they have not always been equipped to commercialise their work.

Giving back

AKN Reddy chose a different path to give back to society.

"After almost two decades in the field of electrochemistry, I felt my own work was largely irrelevant to India's poor. I felt I should reorient my efforts towards technologies for rural development," he once explained in a 2018 article by Munichandraiah in IPC's *Elixir magazine*.

In 1974, Reddy left IPC to establish ASTRA (Application of Science and Technology for Rural Areas) at IISc itself, which has since been renamed the Centre for Sustainable Technologies.

IPC has also contributed to chemistry in other ways. The Department was instrumental in helping educate and train students, scholars and future leaders. As Murthy points out, "Who else was there to teach?" This is a role they continue to play to this day, especially with IISc's four-year undergraduate programme which offers a major in Chemistry. Arunan was a vocal supporter of IISc's decision to start the programme.

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"Chemistry is the central science," says Arunan matter-of-factly

⸻ ❞

As science branched across different channels, becoming increasingly interdisciplinary in nature, IPC researchers too ventured into newer territories. And perhaps there lies the answer to a curious question. A century

ago, chemistry was the branch of science in vogue before physics knocked it off its pedestal. One can argue that chemistry lacked fashionable names like Albert Einstein and Richard Feynman, who crossed into popular culture. Maybe even sitcoms like *The Big Bang Theory* and films like *Interstellar* played a role in making physics "cool". Popular culture embracing physics could be one of the reasons for chemistry losing its status as the pre-eminent science. But another is that chemistry seems to have just amalgamated into several interdisciplinary streams.

> **But all along IPC never lost sight of its commitment to basic research as well. In some instances, it was ahead of the curve**

However, chemistry may once again be getting the attention it deserves and may no longer remain the poorer cousin of physics. For instance, the 2023 Nobel Prize in Chemistry was awarded to Moungi G Bawendi, Louis E

Brus, and Alexei I Ekimov for the discovery and synthesis of quantum dots. While Bawendi and Brus are chemists, Ekiov is a physicist.

"Chemistry is the central science," Arunan says matter-of-factly. While researchers from other fields might quibble with the sweeping nature of the statement, prudence would suggest that chemistry, the study of matter, would continue to foster fundamental discoveries and make our world a better place. And given their track record, IPC and other chemistry departments at IISc will play their part.
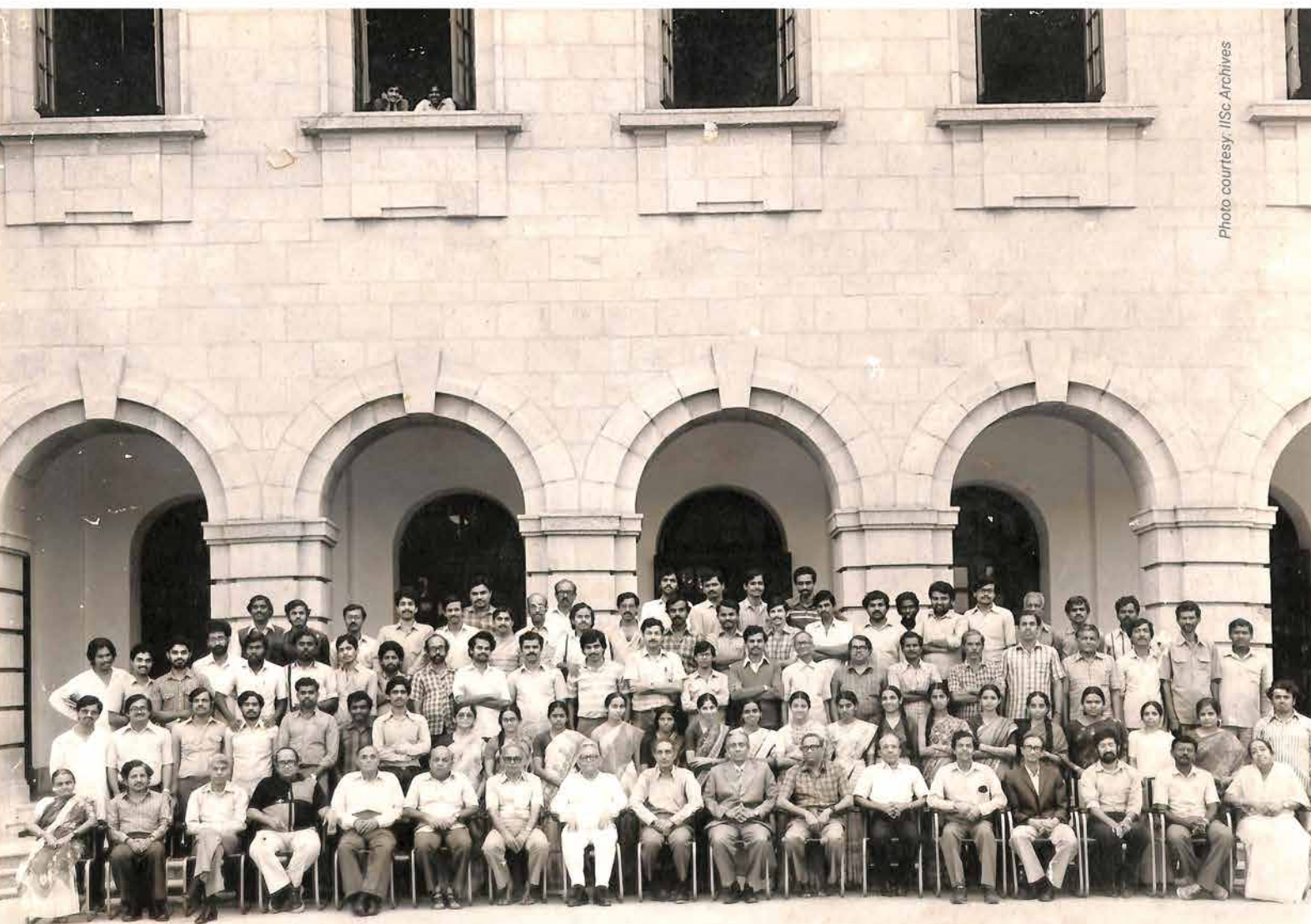

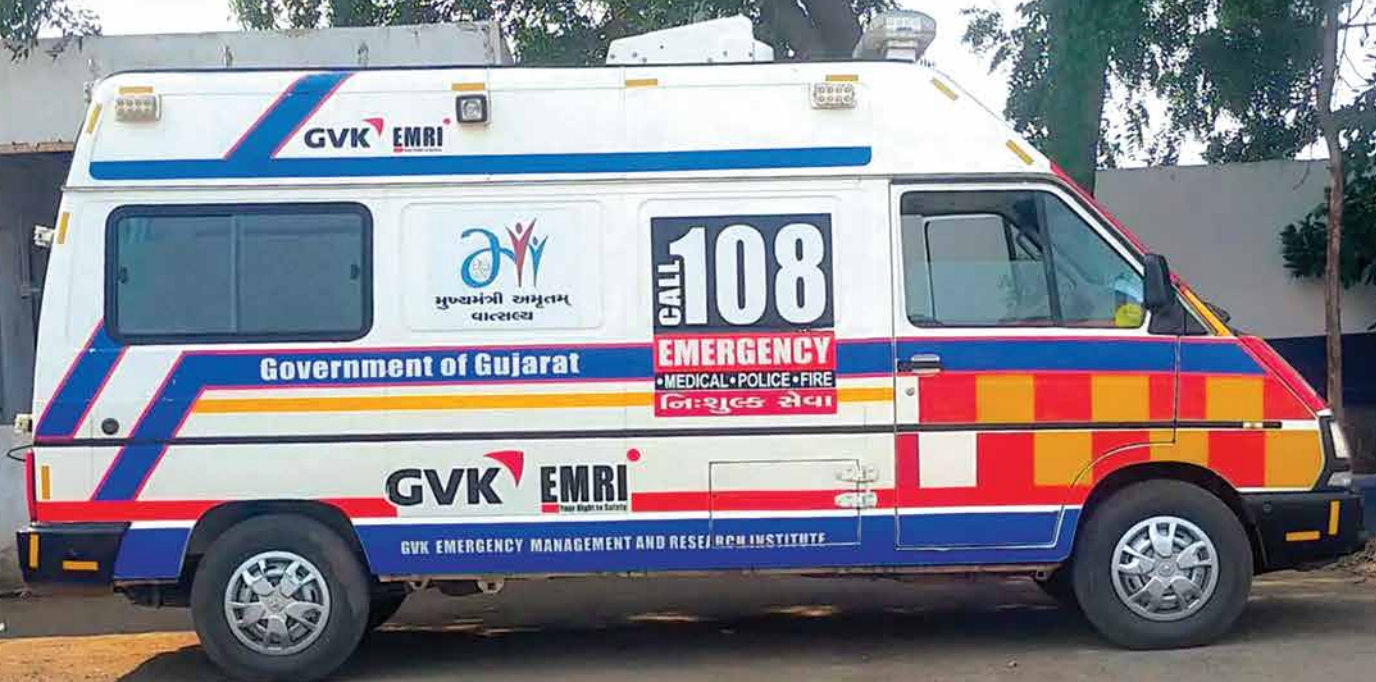
Photo courtesy: IISc Archives

KC Patil (fourth from left) and AR Vasudeva Murthy (eighth from left), seated in the first row, in an IPC department group photograph from 1986

Flashing lights of hope

- Malavika P Pillai

The ambulance run by the 108 emergency service

Photo courtesy: Pixahive

Alumnus Sudhakar Varanasi recounts the history and impact of India's 108 ambulance service

It was a day like any other in the year 2001 when Barbara and her daughter set out on a drive to the suburbs of Bangalore. Unfortunately, their car met with an accident, leaving Barbara bleeding profusely and severely injured. Her daughter, physically unharmed, sat by her mother's side, an overwhelming sense of fear and despair washing over her. She pleaded with the people who had gathered around to call for an ambulance. But the bystanders kept giving just one suggestion: Call the police.

In those days, that was the protocol in effect across India. The police had to intervene before transporting the victim of an accident to the nearest hospital as it was a medico-legal case, and doctors would refrain from providing treatment until the police arrived.

In Barbara's case, when a policeman finally arrived, he came on a motorcycle. He assessed the accident scene but was unable to transport the injured Barbara by himself, so he went back to arrange for a police jeep, leaving her and her distressed daughter in limbo. Barbara eventually lost her life.

Sudhakar Varanasi, a close family friend of Barbara, was greatly saddened by this tragic turn of events. His grief deepened when he learned that it was a consequence of delayed medical attention. It stirred something within Sudhakar. Something had to be done to change the status quo, he thought. It was this reflection that motivated Sudhakar to embark upon a project to revitalise the country's emergency response system.

On 15 August 2005, the 108 emergency services project was formally launched. A new number, 108, was formally introduced as an emergency hotline and a single point of contact for police, fire and medical emergency services.

To this day, the helpline continues to save countless lives. In contrast to the previous emergency number, 100, which had limited lines and was answered by the police directly, 108 was more efficient because it integrated all the emergency services – police, fire and medical emergencies – into one. Thousands of calls every day in every state in India to 108 call centres are handled by trained professionals who can effectively address and coordinate a multitude of emergency situations simultaneously.

> ❝
> *108 integrated all the emergency services – police, fire and medical emergencies – into one*
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"Despite India having separate phone numbers for calling the police (100) and the fire service (101), the country lacked a single, unified and efficient emergency service similar to 911 in the USA or 112 in various parts of Europe," Sudhakar recollects.

Sudhakar first came to IISc to pursue his PhD from the Molecular Biophysics Unit, after five years of education at IIT Kharagpur. After his graduation in 1983, he worked briefly in the Department of Aerospace Engineering as a postdoctoral scholar. "From academia, I shifted to the corporate world after IISc, eventually working as the CEO in a few organisations," Sudhakar says. He was a founding director of Tiger Software before moving on to Satyam Computer Services. The IT boom in India created tremendous opportunities for both the Indian IT industry and thousands of individuals who secured jobs abroad. It was a game-changer, instilling a sense of accomplishment and empowerment in those who had previously felt stifled by economic constraints, explains Sudhakar.

"My professional journey is quite common, shared by millions of individuals in the IT sector. It was during this period that my experience and, perhaps notably, my grey hair became an asset," says Sudhakar, jokingly. "I assumed a senior management role not necessarily because of exceptional intelligence, but because the industry required individuals who could grasp the broader perspective of computers and how to navigate and utilise them effectively," he adds. "It was a period of continuous learning, a process that eventually made me stand out in the corporate world."

But despite his professional success in the IT sector, Sudhakar was drawn to the idea of social service. "I've often grappled with the question of whether it's justifiable to dedicate my life to in-depth research on the minutiae of the physical world. Especially in a country like India, where millions are uneducated, and many live below the poverty line, is it fair to concentrate all my efforts on delving into the deepest recesses of scientific knowledge, publishing papers that only a handful of international scientists might read? Especially in a country like India with many budget constraints? Is it a justifiable use of the resources invested in my education by the Government of India and the substantial subsidies provided here? These questions poked at my consciousness."

Around 2004, Satyam Computers had just grown into a billion-dollar enterprise. Sudhakar proposed the idea of a free ambulance and medical service to his boss, who was totally supportive. Sudhakar was encouraged strongly by his Chairman who provided a large fund from Satyam and his personal friends in the industry. He was asked to find a revenue model to ensure sustainability of this project later.

The amount was significant, but considering the scope of the project – each ambulance alone cost about Rs 20 lakh – they needed more funds. To provide efficient ambulance services over a large area, they had to divide the cities into cells and locate the ambulances in each one. This required 150 to 200 ambulances, which, along with other expenses, exceeded the initial budget.

> **The growing importance of computers and the IT industry in Hyderabad had a direct impact on a fully technology-driven ambulance service**

"We began in Hyderabad, where the company headquarters was located. We had a decent team with a growth mind-set – people willing to admit that they didn't have all the answers but committed to figuring things out. We had to address numerous questions and challenges, many of which were uncharted territory," he explains.

Photo courtesy: Sudhakar Varanasi

Sudhakar and his team approached the then government of (undivided) Andhra Pradesh. The political climate at the time, Sudhakar says, was conducive for new initiatives. The growing importance of computers and the IT industry in Hyderabad had a direct impact on a fully technology-driven ambulance service. With around 30,000 people employed in the IT sector, there was expertise available. This meant that the ambulance service could benefit from the emerging information technologies of that time, the use of computers enhancing the speed, accuracy, and overall effectiveness of the ambulance project. YS Rajasekhar Reddy, the then Chief Minister of (undivided) Andhra Pradesh, saw potential in their proposal and agreed to support them.

Towards the end of the first year, people started taking notice of their efforts. Other states began to inquire about the system. Newspapers reported on many life-saving instances.

"I recall seeing an article about how my cousin in Hyderabad was saved by the service in the middle of the night. The ambulance had arrived within 10 minutes and rushed him to the hospital. 'How is it that Bangalore does not have this service?' wrote one citizen in a Bangalore newspaper. Reporters began to visit us regularly, seeking stories. They'd ask for names of individuals or families the service had assisted, where the incident had occurred or which hospital the patient was taken to. The team provided this information, but they also shared stories of their experiences and the lessons they'd learned. This increased visibility and credibility," recollects Sudhakar.

The service also gained traction in the political arena, with Chief Ministers of other states eager to adopt the service. Sudhakar was insistent on minimal government interference. Financial and legal support were welcomed, but operational independence was crucial, he told them. They agreed.

The learning curve was steep. Sudhakar's team was initially unsure about the medicines that the ambulances needed to carry, whether to focus on urban or rural areas, and how to deal with a variety of emergencies ranging from accidents to snakebites.

There were other challenges too. When they first started the ambulance service, the team realised that male ambulance drivers and technicians were unsure of how to help pregnant women in labour. The team then recruited women medical staff to sensitise and train them. After this, in the first year alone, 54 babies were delivered in ambulances, Sudhakar recalls. "We saw that even small acts of kindness, like holding a mother's hand, could make a significant difference in such situations. It brought a sense of hope to families in distress, who might have otherwise felt helpless."

'Today, we have a fleet of about 30,000 ambulances across the country'

There were many terrible accidents that the team had to deal with, Sudhakar recalls. In one instance, a boy's hand got caught in a mechanical wheel used to extract sugarcane juice. Retrieving the trapped hand from the machine was a difficult and painful process. Fortunately, the ambulance service helped transport him quickly to a hospital, and the doctors could save his life, even though his hand had to be amputated. A few years later, Sudhakar met the boy again, and the boy's parents expressed how grateful they were for him being alive.

The team also invited leading experts, like the head of the emergency medicine department at the Stanford Medical School, to visit and train them. Eventually, they were able to ramp up their service from just road accidents to police, fire and other types of emergency services.

"Today, we have a fleet of about 30,000 ambulances across the country, and all the coordination is managed independently by the 108 service. This includes hiring staff, providing assistance, and distributing essential resources," adds Sudhakar. "What began as a simple idea evolved into a grand operation."

In 2007, Sudhakar moved on from the project and assumed the role of CEO at CoOptions Technologies, where he spearheaded the establishment of a comprehensive platform to provide financial services for three million farmers in remote villages. In recent years, he has taken a keen interest in addressing the growing instances of suicides among farmers. He is specifically interested in investigating the effects of different types of chemical fertilisers and pesticides that are commonly used in agriculture, as well as their impact on the well-being of farmers who handle these substances without adequate protective measures. Additionally, he served as CEO of the Namma Bengaluru Foundation.

Reflecting on how he had started working on the ambulance project in his 50s, Sudhakar emphasises that age need not be a deterrent to contributing to society, if one has compassion and dedication.

In the years that followed, the 108 emergency services initiative was spearheaded by a capable team led by Venkat Changavalli who implemented it across India.

"I believe that all of us have an ability to either take up such larger causes or help and support others who are attempting such projects. India is a big country, the problems are large, and therefore we need large and scalable solutions," explains Sudhakar. "There are two main ways of setting up large scalable projects: use technology and use entrepreneurial skills of people to overcome the obstacles. And I believe India has both these talents in abundance!"

In 2015, a decade after the 108 service was launched, Sudhakar was invited to attend a celebration organised by the team members. One of the guests there announced that the number of lives saved by the ambulance service had just crossed 1.5 million. "I sat there teary-eyed but feeling blessed," recalls Sudhakar. "At that moment, I felt a deep sense of fulfilment."

Malavika P Pillai is a former Senior Editorial Assistant at the Office of Communications, IISc

Photo: Parul Yadav

Hi-Tech
Healthcare

- Ranjini Raghunath

3D bioprinter being used to fabricate tissue-mimetic lung models

Digital technologies are changing research and treatment

In 2018, Vijay Chandru was already thinking about pandemics.

He was back on the IISc campus, where he had co-founded India's earliest genomics startup, Strand Life Sciences, nearly 20 years ago. Now a visiting faculty member at the Department of Bioengineering (BE), he started teaching a course on digital epidemiology, using mathematical models to walk students through "nightmare scenarios" in which an infectious disease spreads quickly among large populations. "I showed them a live simulation of a COVID-like pandemic," he recalls.

Two years later, Vijay watched as the same scenarios eerily began to play out in real life.

COVID-19 was devastating. But it also created the "perfect storm" for the rise of digital technologies, Vijay says. Hospitals offered online consultations. Scientists used machine learning models to scan X-ray images for signs of COVID-19. Digital databases of infections and vaccinations greatly helped policymakers. "Suddenly, many things were happening," says Vijay.

The idea of 'digital healthcare' has been around for a while. For decades, clinicians have been using computers to record and analyse patients' health data. Today, doctors use WhatsApp and Zoom to talk to patients in remote areas. Some of us use smartwatches to track our pulse rate and blood pressure.

It's not just the pandemic that has prompted this shift. The medical profession is grappling with several crises, writes former physician and journalist James le Fanu in his book, *The Rise and Fall of Modern Medicine*. More and more doctors are becoming "bored and disillusioned". Many people are becoming obsessed with "trivial or non-existent" threats to their health. Alternative therapies – mostly unregulated and untested – are soaring in popularity. And hospital visits are becoming too expensive.

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*The medical profession is grappling with several crises*

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In India, there are additional problems: Awareness about health and disease is poor in rural areas, urban areas have better access and good hospitals but at a high cost, and the country's population far exceeds the number of healthcare professionals.

Perhaps digital technologies could address some of these issues, writes GK Ananthasuresh, Professor at the Department of Mechanical Engineering, in the editorial for the *Journal of the Indian Institute of Science's* 2020 issue on digital health.

Ananthasuresh is one of several faculty members at the Institute leading efforts to build an 'IISc digital health initiative'. "The idea came from Vijay Chandru," he recalls. "He wanted to see if IISc could set up a digital hospital."

The motivation is to explore possibilities beyond telemedicine and electronic health records. Several projects have been started under this umbrella – developing AI models for diagnosis, tracking blood biomarkers before the onset of disease, building digital replicas of organs, and even creating artificial organ systems in the lab. Some projects are aimed at finding better ways to treat and manage specific diseases, like diabetes. "When we use digital technologies in healthcare," Ananthasuresh says, "there is no end."
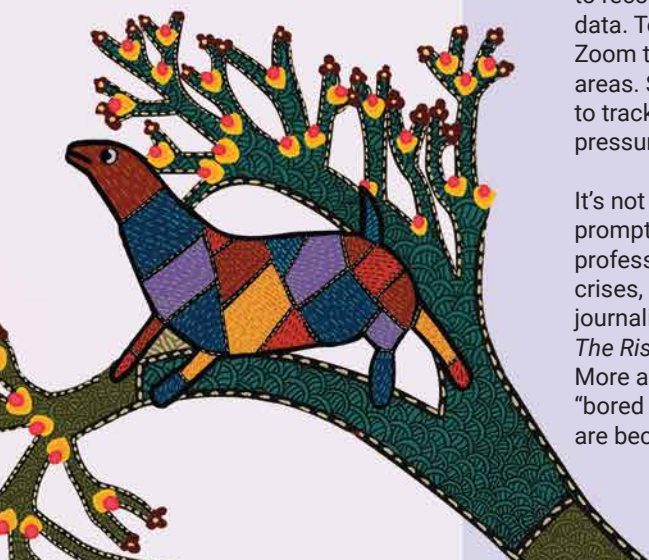
AI in the ICU

In 1949, German physician Wolf-Dieter Keidel beamed a low-frequency sound wave into a patient's chest to obtain an 'acoustic heart shadow' – the earliest attempt at echocardiography, now used widely by sonographers and doctors to find abnormalities in the heart. But today's outpatient departments (OPDs) and Intensive Care Units (ICUs) are so crowded that they simply don't have the time to do a proper echocardiogram or analyse it closely, says Farhan Adam Mukadam, PhD student at BE, who completed his MD at CMC Vellore.

"Every morning, for every patient, a doctor has to look at around 250 data points," he says. "If something is churning this data and giving insight, it can change performance in the ICU and save lives."

That "something" in recent years has been machine learning (ML) models, which can continuously scan images and videos of a patient's beating heart to spot abnormalities. Farhan has been working with KVS Hari, Professor at the Department of Electrical Communication Engineering, to train such models – called neural networks – using anonymised patients' data from the Sri Jayadeva Institute of Cardiovascular Science and Research.

The goal is to get the models to give as accurate a report as a sonographer would. For example, the left ventricular ejection fraction (LVEF) – the quantity of blood pumped with each heartbeat – is usually calculated by the sonographer after looking at an echocardiograph. A value below a certain percentage indicates a poorly performing heart. However, the sonographer has to measure the value repeatedly and accurately, especially to track subtle changes. Such a repetitive task can be done by an ML model. "It's a five-second job for the model," says Farhan.

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> *Machine Learning models can continuously scan images and videos of a patient's beating heart to spot abnormalities*
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But the problem, he explains, is that the large amounts of clearly labelled datasets – images and videos – needed to accurately train these models are lacking in India, and even the ones available abroad are limited to a single "view" of the heart. "T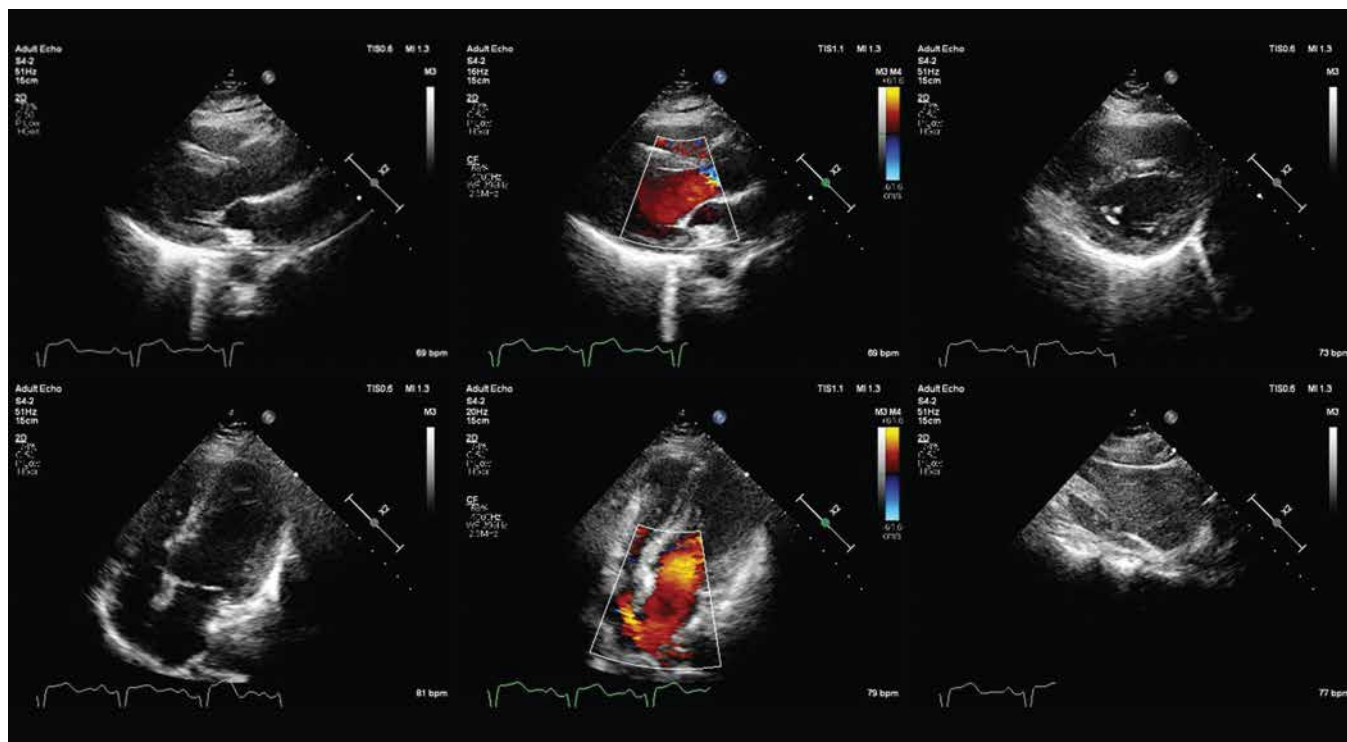here is no comprehensive echocardiography dataset globally," Farhan adds. "If we create our own datasets, we will be able to answer clinical questions both for stable patients in the OPD and unstable patients in the ICU." So far, he has collected and labelled data from close to 6,300 patients – more than half of the roughly 10,000 datasets that would be ideal for training the models.

Eventually, such models might also help predict the risk of developing a disease, like diabetes.

"A few years ago, a really cool study from Israel used machine learning to predict which pregnant women could develop gestational diabetes based on their past health records," explains Siddharth Jhunjhunwala, Associate Professor at BE.

But in India, such past health records don't exist. "These exist in the UK, Israel and the USA, because everybody comes for regular health checkups. For the same individual, one can collect data as they age, to track disease progression," he explains. "[In India], ICMR does cross-sectional data collection … from maybe 2-3 lakh people, at a given time. But they might not go back to the same individual again."

Image: ISc-SJICR Comprehensive Echocardiography Dataset/Project Cordis

Stills of sample videos from a comprehensive echocardiography study

To address this problem, Siddharth's lab has started a pilot study through the IISc Health Centre to collect blood samples from a few hundred middle-aged individuals. The plan is to record about 30 different health risk factors apart from just blood glucose – serum creatinine, lipids, cholesterol, thyroid stimulating hormone and more – every six months, over many years. "If I have all this data available, then maybe by looking at a combination, say, a blood glucose level of 100, plus a cholesterol level that's higher, plus an hBA1C level that's borderline … we could successfully predict the onset of diabetes and its progression."

Siddharth's team also plans to make the data available in a public repository so that other researchers can use it for building ML models, or for more advanced applications like digital twins.

Carbon copy

When Strand Life Sciences was founded in 2000, the idea of digital twins – computer simulations that recreate entire machine parts and processes – was gathering steam. The fledgling startup was interested in something quite ambitious: Building a digital twin of a human organ, the liver.

> *The Strand team used hundreds of differential equations to recreate a computer simulation of a liver in homeostasis*

The project was spearheaded by one of their newest recruits, Kalyanasundaram Subramanian, who was concerned that many drug trials failed because researchers couldn't predict how the drug molecule could harm the liver. At that time, many people were focusing on the drug properties alone, and trying to get their models to predict whether a certain property would cause cell death or other harmful effects.

"We had to take a different approach," Vijay says. The Strand team used hundreds of differential equations to recreate a computer simulation of a liver in homeostasis (stable condition),

track how a drug molecule would disrupt this state, and whether the liver could return to its original condition.

Another challenge was that every drug molecule gets broken down into many smaller components, called metabolites. "It was very difficult to simulate how these metabolites are generated," Vijay explains. The team then decided to combine their simulation with a lab setup in which drug metabolism was tracked in live liver cells. The combination snagged them a "strong" patent in the USA, and several requests from drug companies willing to pay them USD 10,000 per head to evaluate their drug candidates. "It was a completely new idea," Vijay recalls. In 2016, 12 years after they had started the project, Syngene International, the services arm of the company Biocon, bought out their digital liver technology.

More recently, Ananthasuresh's team has been working on building a digital twin of the foot, to understand how foot ulcers and other harmful complications can be mitigated in people with diabetes. "There's a dangerous disease called Charcot's foot in diabetic patients where the bones will collapse and fuse together. They may not even feel pain," he explains. "After a point, it becomes irreversible, and then [the only solution] is amputation."

His team constructed a computer model of the foot and tested how accurately it could estimate plantar pressure (the pressure felt by our soles when we walk), with or without insoles. This helped them develop a special set of customisable insoles in collaboration with the Karnataka Institute of Endocrinology and Research (KIER), with support from the Rajiv Gandhi University of Health Sciences. The insoles use simple snapping arches to dynamically offload high-pressure regions while walking, to avoid ulcer formation.

Ananthasuresh is also working with KIER to build "digital foot kiosks" that can be installed in urban areas like malls and in rural post offices and primary health centres, where triaging can be done. A person simply has to place their foot on the device and by measuring their plantar pressure,

temperature and other factors, the machine could spit out a report on their foot health and inform them if they are at risk of developing ulcers or other complications. Such interventions are direly needed in India, especially in rural areas where people might not even be aware that they have diabetes, Ananthasuresh says.

> *Building replicas that combine both the physical and the digital, called 'organ-on-a-chip', is becoming popular*

In recent years, the idea of building replicas that combine both the physical and the digital, called 'organ-on-a-chip', is also becoming popular, driven not just by the spiralling cost of drug development but also ethical concerns about the use of animal models. Scientists are building 3D platforms in the lab out of soft materials and gel matrices in which tissues are able to grow and divide just like how they would inside the body, explains Kaushik Chatterjee, Professor at the Department of Materials Engineering. His team is currently working on building a lung-on-a-chip, in collaboration with the lab of Deepak Saini, Professor in the Department of Developmental Biology and Genetics.

"You can mould materials into nanochannels, and start flowing liquid through the channels. In the case of lungs, you also need something that expands and contracts. So if you have an artificial membrane – with air flowing on one side, and blood on the other – where gaseous exchange can happen, you are really starting to talk about a lung mimic," Kaushik explains. Such systems can be integrated with digital data feeds and tools to test the effects of different drugs and therapies.

When the prototype is in place, Kaushik's team plans to use it to study the harmful effects of both pollutants and infectious viruses. They are specifically focusing on a condition called fibrosis, where the lungs become stiff and cause breathing difficulties.

Clockwise from top: Simplified parameterised model of foot, plantar pressure obtained with digital twin of the foot, and insoles developed for diabetics

Once they are able to build such organ replicas, the next step would be to try and integrate multiple organs on chips, Kaushik adds. "Say you have a little matrix where you have cancer cells growing in tumour masses. What if, after a cancer drug has passed through this 'tumour chip', it could flow into a 'liver chip' to see whether the liver is getting damaged or not, and then maybe flow into a 'heart chip' to see whether it is causing cardiotoxicity? Now, if you start integrating a number of such 'tissues' together, you can have a 'body-on-a-chip'. Then we can study not just the effect [of the drug] on individual organs. We can, in principle, recreate the whole human physiology."

Time for reform

Back in January 2021, at the height of the pandemic, Vijay was invited to join the *Lancet Citizens' Commission*, a panel formed to analyse gaps in India's healthcare systems and provide a roadmap to achieve universal healthcare by 2030. "It was a response to how ill-prepared we were for the pandemic," explains Vijay. One of the first things the commission did was carry out surveys among citizens and healthcare workers. "A majority of the citizens are actually saying that they *want* technology [in healthcare]," Vijay adds.

Vijay feels that the digital healthcare revolution can also happen at the community level. Two years ago, for example, to track the health of pregnant women in rural Karnataka, the Public Health Foundation of India armed ASHAs (Accredited Social Health Activists) with a multilingual software tool called M-CAT. This tool greatly helped them record door-to-door data more efficiently and also quickly diagnose some common health risks.

Vijay believes that the advent of digital technologies has given the country a chance to revamp its health systems. "Digital health has now become a central topic in healthcare reform," he says. In 2021, the Government of India launched a National Digital Health Mission; among other goals, it aims to create long-term electronic health datasets and introduce more digital services in healthcare, like standardised health IDs – similar to Aadhar – for each citizen.

Digital healthcare initiatives are also receiving a boost from philanthropists who are supporting new centres at institutes like IIT Bombay, Ashoka University and IISc, Vijay points out. "With the hospital coming up here on campus, I think IISc has a fantastic opportunity to drive the agenda for digital health in the country."

Helping
Hands

- Gowri R

Photo: Gowri R

The Pensioners' Association supports retired employees in their golden years

The IISc Pensioners' Association building

As you take a leisurely stroll down Gulmohar Marg, your gaze might be drawn to a quaint two-storeyed complex adjacent to the walkway across the IISc main building, its vintage facade standing quietly amidst the hustle and bustle of the campus. The sign near its entrance reads *Pensioners' Association*.

On a typical Monday afternoon, if you walk into this building, you are likely to meet K Somavathi Devi, a retired employee of IISc, with her curious eyes fixed on a computer screen resting on a desk amidst several neatly labelled files. "Learning doesn't retire with us," she says, smiling, her fingers navigating slowly over the keyboard. "Every day is a chance to explore something new, to challenge our minds." Somavathi is the current Joint Secretary of the Pensioners' Association. At 71, she is eager to learn how to upload photos on a webpage. Her warm smile greets anyone who enters. Speaking to her reveals how there's an entire community of people like her striving to remain active and support each other in their old age.

The IISc Pensioners' Association (IIScPA) is a group of retired employees of the Institute who meet together often to remain connected with each other and with the Institute they once called their professional home. "For us, retirement is not an end but the beginning of a new chapter in our journey with IISc," says Somavathi. "Despite having completed their service at IISc, the pensioners have not forgotten their roots and the meaningful impact the Institute had on their lives while working here."

How it began

Established on 24 December 1980, the association serves as a platform for its members to reminisce about old times, stay connected with their peers and the Institute, and continue to make a difference in their own way. NC Shivaprakash, the current President of IIScPA and a retired faculty member from the Department of Instrumentation and Applied Physics, recalls how the association started. Back in 1972, V Kasturi, a former staff member in the Department of Inorganic and Physical Chemistry, first proposed the idea of establishing an association

Photo courtesy: Somavathi Devi

Members of the first managing committee in 1980. Sitting L-R: HS Annaji Rao, TS Sivasubramanian, VR Gangadharaiah, VK Kini. Standing L-R: C Satyanarayana, MS Venkatachalam, SV Srinivasan

to help retired employees deal with their post-retirement concerns. "Though the concept received support from the then director, Prof Satish Dhawan," Shivaprakash reflects, "it encountered numerous obstacles, which led to a nearly decade-long delay in its realisation." It was only in 1980 that Kasturi's vision came to fruition. A self-appointed committee comprising VK Kini, HS Annaji Rao, TS Sivasubramanian, VR Gangadharaiah, C Satyanarayana, MS Venkatachalam, and SV Srinivasan formed the association. They successfully registered it as a society under the name 'IISc Pensioners' Association' under the Karnataka Societies Registration Act 1960.

In its early stages, the association had only a few members and organised a limited number of welfare activities. However, under the leadership of the late Gangadharaiah, the association became more active. "We owe a debt of gratitude to the IISc administration for their unwavering support to our association and for providing an office space within the campus. Their consistent backing has been instrumental in supporting our retired colleagues," Shivaprakash shares.

The IIScPA is a close-knit community comprising retired faculty and staff members. According to Shivaprakash, the association strives to create a nurturing environment for retired employees, emphasising the

importance of social connections, physical and emotional well-being, and financial security.

All permanent faculty and staff members who have worked at IISc and subsequently retired or opted for voluntary retirement are eligible to become members of the association. Those who wish to become life members are required to complete a membership enrolment form and pay an enrolment fee of Rs 3,500 to avail the benefits and services provided by the association.

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The IIScPA is a close-knit community comprising retired faculty and staff members

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The IIScPA managing committee includes a president, vice president, secretary, joint secretary, treasurer and other executive committee members. Each committee serves for a period of four years. BS Sheshachala, formerly the superintendent of IISc hostels, is currently the secretary of this committee. He used to be involved in organising activities for the Kannada Sangha at IISc; even after retiring, he says that he still has a strong connection to the Institute. "After four decades of my deep-rooted affiliation with the Institute, working for the Pensioners' Association has given me a

special chance to reconnect with current and former colleagues," says Sheshachala. "It keeps me active."

Activities

Among the services that the association provides are supporting members in handling their pension payments and making use of the medical facilities on campus and outside.

"A significant accomplishment of the association has been the provision of medical benefits equal to that provided to the current faculty and staff," explains Shivaprakash.

The association also organises social, cultural, and recreational events to foster camaraderie among its members. In addition, the association has set up a Mutual Contributory Death Relief Fund and a Benevolent Fund. These funds are used to cover medical expenses, support the education of some of the pensioners' children, and provide assistance to bereaved families. These initiatives,

Shivaprakash says, have significantly contributed to enhancing the quality of life for retired employees by ensuring a more secure and stable retirement life.

"To maintain effective communication," explains Shivaprakash, "the office bearers have established a WhatsApp group, and we use email to keep members informed about circulars, notifications, and any issues pertaining to the Institute's administration."

"Working for the IIScPA plays an integral role in making my post-retirement journey more meaningful. My experience with the association has been unique, distinct from my teaching and research years at IISc," reflects Shivaprakash. The association collaborates closely with similar associations at the state and national levels to promote mutual aid and benefit schemes. Its members also organise lectures and seminars on topics relevant to health, financial investments, and other interests of pensioners. In the future, they also plan to set up a library for their members and publish electronic news bulletins.

Some pensioners who participate in the association's activities are quite old, past the age of 80, but still eagerly attend the meetings and events, Shivaprakash says. "You get the privilege of sharing in the nostalgia of the Institute's past [with them]," he adds.

Every year, the association conducts a General Body meeting on National Pensioners Day, which falls on 17 December. These annual events act as a platform for the retirees to come together and engage in heartfelt conversations. Past directors and many faculty members participate in these meetings and help in addressing some of the members' concerns, Shivaprakash adds. Sometimes, these meetings are organised for special reasons. In 2022, the association invited Dr Satish Rao, the IISc Medical Officer, as well as the doctors, nurses, technicians, and other staff of the IISc Health Centre, and treated them to a special lunch to thank them for their service and medical assistance during the various COVID-19 waves.

Photo courtesy: Somavathi Devi

Current IIScPA office bearers. L-R: N Krishna Murthy, KS Krishna Murthy, R Narayana Swamy, GS Hegde, NC Shivaprakash, ES Dwarakadasa, MR Chandrasekhar, BS Sheshachala, K Somavathi Devi, KA Ponnanna

These annual gatherings, apart from other sports and cultural activities, enable them to reconnect with their past and form new connections, all while enjoying their retirement.

The Pensioners' Association Sports Meet is yet another cherished annual event to have some fun together. On this day, the association organises various sports and recreational activities. This year's sports meet, which took place on 8 July 2023, at the Tata Memorial Club, saw increased participation from women retirees. Different activities were organised for different age groups (60-70, 70-80, and 80 and above) and included a variety of games such as the Walking Race, Bombay Blast, Lucky Chair, Passing the Ball, and one-minute challenges like Lighting the Candle and Coin Setting. The sports meet also provides the association members a chance to sit together, share personal challenges, and reminisce about their time at IISc.

> **'Working for the IIScPA plays an integral role in making my post-retirement journey more meaningful'**

"I look back on my association with the Institute with great fondness," shares Somavathi, who had spent 30 years as a staff member at the Department of Mechanical Engineering. She remembers the times when IISc theses were hardbound, printed, and dispatched to reviewers via post. "Today, every task is just a click away. I have worked on both types of systems, and I deeply cherish and value these experiences," she says, smiling. Somavathi joined the Pensioners' Association in 2015, three years after her retirement, and has been an active member of the managing committee since 2017. She comes to the office three days a week to manage its paperwork and correspondence.

"I receive numerous calls covering a range of topics, from income tax filings to insurance form claims and medical emergencies. Managing all these tasks can be overwhelming. We warmly welcome more active participation,

especially from women, in shouldering these responsibilities and enhancing our activities together," she says.

As to what keeps her motivated to work even at her age, she explains that her voluntary service to the association is based on her motto: *Kayakave Kailasa – Work is Worship*. "As human

Photo courtesy: Somavathi Devi

Games organised during the annual sports meet. Top: "Lucky chair", bottom: "Candle lighting – one minute challenge"

beings, it is our duty to lend a helping hand to one another until the end of our lives."

Gowri R is a former PhD student at the Department of Civil Engineering, IISc and former science writing intern at the Office of Communications.

Coming of Age

- Akash Kalita

Akash Kalita giving a seminar

Tracing the growth of IISc's UG programme through the eyes of a student

Hailing from a small village outside Guwahati in Assam, I had no idea about the existence of IISc, let alone its undergraduate (UG) programme. I only learned about it when I was well into my 12th grade after I cleared the first round of the Kishore Vaigyanik Protsahan Yojana (KVPY), a national-level entrance and scholarship exam for students like me who want to pursue higher education in basic science (it has now been scrapped). Even though I was excited about the possibility of joining this reputed institution, there were hurdles.

> ## *I felt like I was standing at the edge of a vast ocean ready to take a plunge. I'm glad I did*

For one, my KVPY interview date coincided with my board exams. After repeated emails and phone calls to the KVPY office, they agreed to postpone my interview date. My interview went well. My second issue was that my KVPY rank did not meet the first cut-off. Thankfully, I got through in the first round of spot admissions, and got an admission call from IISc. When I finally came to the campus as a UG student, it was both exciting and intimidating for a village boy like me – I felt like I was standing at the edge of a vast ocean ready to take a plunge. I'm glad I did.

During my time here, I have also had an opportunity to learn about the UG programme's own journey, one that began with uncertainty and birth pangs, but is now already the most sought-after programme for students who want to pursue research in the sciences.

The Beginning

"The present dismal state of higher education in the country is a matter of serious concern, since this has severely limited the potential of its enormous and otherwise capable youth power," reads the first sentence of a position paper titled *Restructuring Post-School Science Teaching Programmes*, published in *Current Science* in 2008. The birth of IISc's UG programme can be traced back to this paper, which advocated reforming higher science education in India. It was authored by a Joint Science Education Panel comprising representatives of all the three national science academies in India – the Indian National Science Academy, the Indian Academy of Sciences, and the National Academy of Sciences, India.

The paper recommended that science teaching should use a *pyramidal* rather than a *vertical high-rise* approach. "The curriculum must provide a broad-based training of different disciplines of scientific enquiry with specialisation introduced as the student advances in training," it reads. Among the many policy suggestions it made was to replace the traditional three-year BSc course with a four-year programme – with the final two semesters dedicated to research. It also said that graduating students could pursue a PhD directly without a Master's degree.

IISc was the first to propose establishing a UG programme based on the suggestions made in the paper. "It took some time for various discussions to be had. Little obstacles had to be overcome, but by and large, there was a fair amount of support," recalls Padmanabhan Balaram, IISc's Director from 2005 to 2014. Once the approval came through, Chandan Dasgupta, Professor at the Department of Physics, was appointed as the first UG Dean in 2010. Soon, new staff were hired for the setting up of laboratories and administrative work.

> ## *IISc was the first to propose establishing a UG programme based on the suggestions made in the paper*

The next order of business was to determine who would teach the courses. "Our plan was that we will not get any new faculty members. Instead, regular faculty members from the departments would do the teaching," recalls Dasgupta. But, he adds, the administration decided to hire dedicated UG instructors to maintain, develop and teach labs. "The syllabus part and then the admission mode was discussed in great detail." Soon, a few old buildings, including the iconic building built by CV Raman for the Department of Physics when he became the Director, were renovated to set up classrooms and labs. A new hostel block was also built to accommodate the incoming students.

Dasgupta admits that, initially, there was some concern about the quality of students who would apply for the programme. But the programme was able to get the "cream of the cream" even though many of the top applicants also obtained admission in other elite institutions like IITs, he says.

> ## *'It was sort of nice as the first batch of students in IISc entered in 1911, and a new batch of students who are doing something different entered in 2011'*

Finally, in 2011, the programme welcomed its first batch of 85 students. "It was sort of nice as the first batch of students in IISc entered in 1911, and a new batch of students who are doing something different entered in 2011," points out Balaram, who is also a science history buff.

However, not long after it started, the programme ran into rough weather. In 2013, Delhi University (DU) decided to follow suit and start its own four-year programme. Unlike at IISc, it faced opposition from many teachers and students. The issue even snowballed into a political controversy. There were demands to scrap not just DU's proposed programme but other such programmes in the country including IISc's. Not long after, the University Grants Commission (UGC) sent a letter to IISc asking it to close down the programme.

The Institute's administration swung into action and began a series of meetings with the Ministry of Human Resource Development (now Ministry of Education) explaining the rationale behind its programme. It also received the backing of scientists and other intellectuals. Finally, IISc was allowed

The first batch of UG students graduating in 2015, with the Director, Deans and other faculty members

to continue its four-year UG programme, but it had to be renamed as Bachelor of Science (Research). In the years since, more such UG programmes have come up in the country. This year alone, 105 universities have adopted this model. It is an irony that even the National Education Policy 2020 recommends four-year UG programmes, Balaram quips.

Academic life

The coursework is designed in such a way that it is not just multidisciplinary in nature but also interdisciplinary. This gives students a solid foundation in the basics of sciences as well as an opportunity to see how these fields are connected to each other. In my first three semesters, we had courses in all science subjects – physics, chemistry, mathematics, and biology. Apart from that, we had engineering courses, including in computer programming, electronics, earth and material sciences, and humanities courses. Some of them were eye-opening for science students like us. For me, the most interesting of these was one on

governance in my sixth semester. The course had many guest lecturers, including a former RAW agent. But there were fewer compulsory courses from the fourth semester onwards because, by this time, we had to pick our majors. I chose to major in Biology.

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Some of the courses in the humanities were eye-opening for science students like us

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After the first three semesters, we had the opportunity to choose from a variety of electives because IISc has so many departments and centres. We also got to attend some of these courses with PhD, Integrated PhD, and MTech students, which was a bonus. However, there is a flipside to having too many courses to choose from. Sometimes too much freedom, especially at the UG level, means that we end up choosing courses that may not be ideal, says Abhinav Jain, a former student from the first batch. I felt that a few courses were difficult to

keep up with, especially before choosing my major, because they did not start at the foundation level. This view is also echoed by Medha Shekhar from the 2012 batch. "There was no bridge between the 12th level and UG classes," Medha says. She also feels that some courses tried to cram too much content in one semester.

From the academic year 2022-23, the UG administration has made some significant changes in the curriculum. The changes, made after taking into account the views of both the students and UG instructors, allow for more flexibility. For instance, in the second semester, a student can now drop one of the science subjects. And after the third semester, there are no compulsory engineering credits. There has been another major structural change, says Balaji Jagirdar, Dean of the UG programme. "If the students missed taking or dropped one science subject in the second and third semesters, they can now come back in the fourth, fifth and sixth semesters and take those courses, so that they don't miss out on any of the basic courses."

In our final year, when most of our course work is already complete – we are expected to complete a minimum of 131 credits in all – we carry out original research culminating in a thesis. But only about half the students move on from IISc after the first four years. The others stay back for another year to continue their research. This allows them to instead get a Master of Science (Research) degree, an option I too have chosen to exercise. I am currently working in the lab of Srimonta Gayen, Assistant Professor in the Department of Developmental Biology and Genetics. I study how behaviour and environment influence the regulation of X-chromosome inactivation (because female mammalian cells have two X-chromosomes, one of them is inactivated during the early stages of development to maintain gene balance).

The UG programme is set up to ensure that a student is equipped with the knowledge and skills required to succeed in academic life. Nagasuma Chandra, Associate Dean of the UG programme, believes that the structure and quality of the UG programme ensures that a fourth-year student is academically somewhat closer to a PhD student who is in the middle of their research programme. "They've

advanced by a few years already and will not be starting from scratch as a PhD student. They have the research exposure because of the course structure, interactions and research internship opportunities." Besides, as Jagirdar points out, research is addictive. "Once the students enter a research laboratory, they would love to be in it." But not all students choose to do their PhD in the sciences. Some have deviated from this path – they have gone on to study economics, science communication, even filmmaking.

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> *The UG programme is set up to ensure that a student is equipped with the knowledge and skills required to succeed in academic life*
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Life outside labs

"They are everywhere" is a typical remark about us UG students on campus. Remember, we number only about 500 in a campus with a student population of close to 5,000, a faculty strength of nearly 500 and a staff that numbers around 2,000. But we are indeed everywhere – from sports to

cultural events to tech fests – not just as members, but as office bearers too. I myself have been serving as the Carrom Club Convener since July 2021, and it has been a great experience.

We UG students organise Pravega, the hugely popular annual cultural and sci-tech fest. "It was during our third year, and we wanted to do something, and as such, Pravega came into being," recalls Jain. While second and third year UG students typically take up roles as coordinators, first year students volunteer in organising the event. The upcoming 10th edition of Pravega will take place from 26-28 January next year.

I must add that there is a great deal of camaraderie in the UG community. In our first two years, we usually share our rooms with another student. Shared living helps us a lot since this is the first time most students have been away from home. Seniors are always approachable, when we have issues, be it academic or non-academic. I was a bit apprehensive in the beginning, as this was the first time I was living outside Assam by myself. However, I found my moment of calm when a senior said, "*Yaar, Bhaiya mat bulao*, I'm just one year senior to you; take it easy, chill!"

Photo courtesy: Narmada Khare

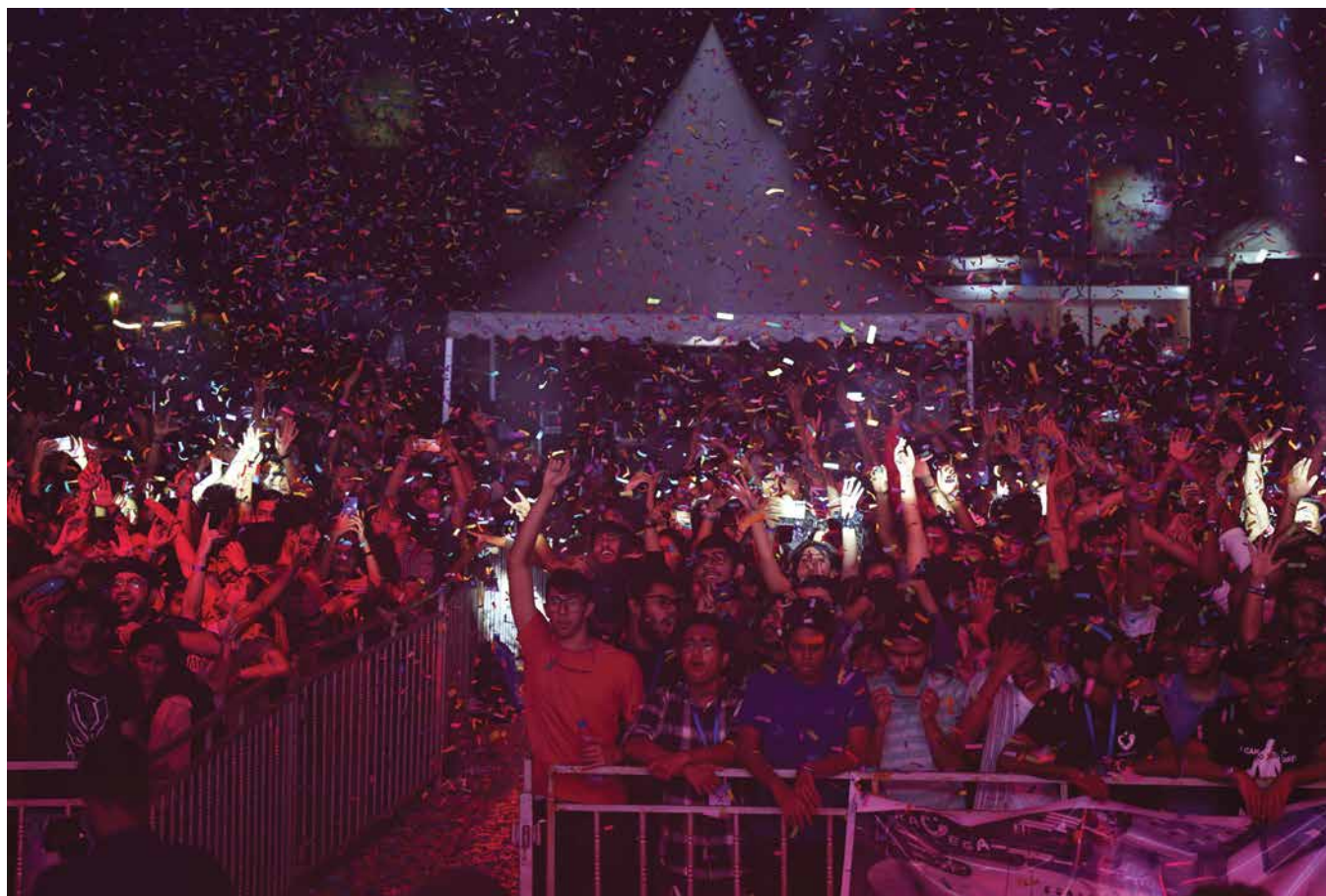*UG students trying to understand the structure of a wasp nest in the lab*

A rock concert during Pravega 2022

But life is not always rosy for students, especially for those dealing with mental health issues. We UG students enter IISc after going through a period of intense studying for our board and competitive exams, and the pressure that comes with it. "I think students are sometimes burnt out by the time they come here. The system has to change for students to feel good in any programme, not just in IITs or IISc," says Chandra. And once you enter an institution like IISc, it can be overwhelming at times given the responsibilities and expectations – from family, faculty, yourself. The situation was particularly difficult for some students – not just in IISc, but across the world – during the COVID-19 pandemic. When I was facing some self-doubts during my first year, I spoke with the then Dean of the programme, PS Anil Kumar, and the conversation helped me immensely. One can also talk to senior students. Besides, IISc has a Wellness Centre that has Wellness Coordinators, Consulting Psychologists, and Consulting Psychiatrists. "One measure that we have been consciously implementing is not to have any UG classes after 5.30 in the evening, and no

classes during the weekends or holidays. This essentially opens up some free time in the evenings for every student to engage in some outdoor activities," Jagirdar says.

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> *I fell in love with genetics during my 12th grade and I am delighted that I was able to pursue research in the field at IISc*
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Expansion

In the academic year 2022-2023, IISc started a BTech in Mathematics and Computing. A new UG complex is also coming up on campus, one that can accommodate over 1,000 students. Jagirdar is optimistic about the future of the initiative. "We hope that the UG programme is going to become a flagship programme of the Institute. This is something which the Institute has to offer to the country in terms of strengthening undergraduate education

in the country." He also feels that in the future there are likely to be more UG-centric placements in industry, especially with the BTech programme gaining steam.

Growing up, I wanted to be an astrophysicist or an engineer. But I fell in love with genetics during my 12th grade and I am delighted that I was able to pursue research in the field at IISc. Besides being exposed to the academic world, I have also experienced significant personal growth as a UG student. It has easily been the most significant phase of my life yet. And I'm not the only one who has had this experience. "What I've seen [in students]," Chandra says, "is a beautiful transition from a very young, sometimes shy, and sometimes innocent [person] to somebody who is mature and confident at the end of four years."

Akash Kalita is a Master of Science (Research) student at IISc and a former science writing intern at the Office of Communications

Humanising
Science

- Bitasta Das

Cloud Seeding. Artists: Taradutt Pattnaik, Sarthak Sahoo, Hitesh Kishore Das,
Ashutosh Mishra, Shubham Acharya. Art form: Rajasthani miniature folk painting

Can complex scientific concepts and mathematical theorems have a dialogue with Indian folk dance?

This was the question I posed as the end-term assignment for the course on 'Mapping India with Folk Art' that I was offering to IISc's undergraduate students in 2015. I asked the students to pick one ground-breaking research contribution in the past 100 years within the disciplines of physics, chemistry, mathematics, biology, earth science and environmental science, and depict it through any Indian folk dance form.

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Rarely are students encouraged to understand the country through the living, dynamic and multifarious art forms of the common people

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"As part of the mathematics group, we decided to portray the Four Colour theorem through Kalbelia, a Rajasthani folk dance," recalls Angana De, former IISc UG student, now a PhD student at Purdue University. "The aim was to depict the incongruity that arises between the colours when the Four-Colour theorem is not satisfied, through erratic [dance] movements. The incongruity would turn into harmonious, graceful dance moves when the theorem was satisfied. We used to discuss and rehearse every night after dinner, for an hour or two, for two weeks. It was a truly unique experience to brainstorm, teach and dance with group members who had never danced before and to bring the Four-Colour theorem to life."

On a Monday morning in 2013, Raghavendra Gadagkar, DST Year of Science Professor at the Centre for Ecological Sciences and the then Chair of the Centre for Contemporary Studies (CCS), asked me, "Would you like to design and teach a course to the undergrads?" CCS was entrusted with the responsibility of building the humanities curriculum of the newly commenced Bachelor of Science (Research) programme. I had just completed my PhD and the prospect of teaching was both exciting and daunting. And so, without any hesitation, I said yes. That was the beginning. This year, I just completed the 10th edition of this course.

Schools and colleges teach students to appreciate India through its history, geography and politics. But rarely do they encourage students to understand the country through the living, dynamic and multifarious art forms of the common people. When I was given this opportunity, I decided to draw on my MA (Cultural Studies) background to design a hands-on course that would be both relevant and engaging for science students. 'Mapping India with Folk Art' brings into the classroom the knowledge of the common people, acquired through their lived experiences.

Bringing paradigms together

The sciences – natural, social and applied – have emerged over the years as the most credible form of knowledge dissemination. In parallel, however, exists people's knowledge or

traditional knowledge that also captures other facets, such as living in harmony with nature, conservation, healing and agriculture. This knowledge is handed down from one generation to the next, with or without the help of written documents. Methods and practices described in science versus traditional knowledge are different. This is all the more reason why the two forms of knowledge need to become more cognisant of the other. In recent years, scientists have begun realising the importance of including the values of traditional knowledge, especially in medicine and ecological adaptation. There are potentially more areas where the soundness and ingenuity of traditional knowledge can enrich queries of science. Through the course, I wanted to get IISc's science students to not only become familiar with the diversity of the country but to also appreciate the values and philosophy behind indigenous knowledge.

Folk art is unique, in the sense that the dexterity and creativity of the artists are not the focus, but the context of their production is. Events, materials and symbolism are important elements of folk art. This makes it an excellent resource for understanding the worldview of the community it belongs to. In the course, we treat folk art as windows to people's way of life.

India is a vast and multicultural country. Art produced by its people is also varied and wide-ranging. Which is why, every year I chose a different folk art – visual, performative or narrative. By mapping the connotations and variations of this art across the country, the students are given an opportunity to comprehend traditions and customs unique to specific regions of India.

"The course allowed me to cultivate a profound appreciation for cultural expression. The vivid and dynamic colours intrinsic to Indian folk art traditions provide a tantalising glimpse into our nation's vibrant and multifaceted heritage," says Amrutha AD, a former UG student. She recalls how working on the group project at the end of the term – which allowed them to think of ways to bridge the gap between art and science – helped her dive deep into rich artistic legacies as well as form strong bonds with her teammates. She adds that it also helped them realise the importance of coming together as a group, emphasising the essence of folk art.

Exams with a twist

Assessments are compulsory for credit courses. I wanted the students to use this opportunity to try and bring different knowledge paradigms closer. Keeping their educational backgrounds in mind, I framed assignments that would help students blend their scientific aptitude with folk aesthetics.

In one semester, for example, I asked them all to work on paintings depicting different scientific concepts using local art forms. All of them came up with exquisite original works that merged the spirit of science and folk art. For example, a Warli painting depicted a fun village scene where a man is thrown in a tub of water by his friends, and water is displaced due to his body's weight, highlighting the Archimedes principle. Another group made a Gond painting showing the evolution of animals. Often folk art is mistakenly seen as unsophisticated and "rural". However, the artworks that the students produced showed that the vocabulary of Indian folk art is rich enough to explain complex scientific and technological concepts.

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The artworks the students produced showed that the vocabulary of Indian folk art is rich enough to explain complex scientific and technological concepts

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Every year, when students turn in their assignments, I feel a sense of awe and fulfilment. As these are all original works at the interface of folk art and

Photo: Souvik Mandal

Four Colour Theorem. Art form: Kalbelia folk dance

science, I have documented every one of them.

Many of the final assignments were public events. At the *Folk Theatre Festival*, students used, among others, art forms like shadow puppetry, Nautanki and Ras-Leela to illustrate Darwin's theory, anthropocentrism, and gender disparity respectively. *Sway with Science* was a dance show where students depicted gravitational waves and the expansion of the universe, CRISPR-Cas9, and Haber process through *Kolkali, Lavni, Dollu Kunitha* – all regional dance forms – respectively. Another year featured *That's Another Story*, where students showed how age-old folktales can have a different ending, given new knowledge and context. *Sciencelore* saw students composing original folk songs like *Baul, Powada* and *Oggukatha* to talk about how science has helped dispel

Folk games foster coordination among the students. At the Teachers' Training Programme, IISc Challakere

superstitions. The visual assignments have been compiled into two books: *Arting Science and Jal Jungle Zameen in the Age of Science and Technology*. Other assignments included cooking curative traditional food, documenting oral histories, and researching folk costumes. One of the assignments given to the most recent batch was to collect folk songs from across India. More than a hundred folk songs have been collected that will soon be compiled into podcasts. The students collected these songs from their grandparents, neighbours and house help, among others.

Fostering critical thinking

"Being science students, such a course provides what we were deprived of in student life: A connection with Indian culture, in a curious and unique way through the folk arts of India," explains Gaurav Sujit Kasliwal, a UG student at IISc, who completed the course in April 2023. "As most of us hail from urban areas, this provided a gateway to reminisce about our culture back home and gave us a new topic to talk over with our pan-Indian classmates, introducing us to new aspects of their culture. The most memorable part of the course was the assignments, which compelled us to research, create, and indulge in performing folk songs. It made us aware of the multiple identities that constitute Indian nationalism."

Amrit Mahendra Joseph, another UG student from this year's batch, explains how he also found the group project "refreshing". "It allowed us to divide our work into aspects that interested each of us – be it writing lyrics, finding music to match the lyrics, playing an instrument alongside a performance or even acting out a performance with the songs in the middle of it."

What has been especially gratifying for me is the popularity of such a course both within and beyond the Institute. I have been asked to give similar courses for the new MSc in Life Sciences programme and the BTech in Mathematics and Computing programme, as well as the Teachers' Training programme at IISc's Challakere campus. I have also been invited to deliver talks and conduct workshops in places like IIT Ropar and IISER Mohali. What started as an experiment in IISc's UG classroom has now spread far and wide.

Siddharth Kankaria, who was among the first batch of students that took this course, is today a science communication researcher and practitioner at the National Centre for Biological Sciences. Reminiscing on its usefulness, he says, "I found the course to be a welcome break from the natural sciences courses in the UG programme. It was a very well-timed introduction to various folk-art traditions practised across the country, at a stage when we were still building our foundations in science." Siddharth points to how current science pedagogy and curricula prioritise science as the only "legitimate way of making sense of the world." "In that context, the course did a fantastic job of exposing us to other ways of 'doing, seeing and knowing'. It also enabled

Narendra Dabholkar's strive to eradicate superstitions. Art form: Powada folk ballad

me to eventually acknowledge that there is a plurality of knowledge systems, expertise and lived experiences that merit space and attention, especially when we are trying to solve complex problems like climate change, pandemics and pollution. But these were benefits that I was only able to appreciate in hindsight, long after I had graduated, and speaks to why it is so critical to include such humanities courses within science curricula across the country."

Humanities, at its core, instils critical thinking. There have been many occasions in the 10 years where students have creatively elucidated humanistic sensibility. Once, they used Chhau art form to critique the displacement of tribals in Niyamgiri hills, Odisha. In another semester, they used folk theatre to highlight the impropriety of the god Krishna stealing the gopika's garments in mythology. Such performances showed me that students are able to use folk art to not just show, but also discuss and debate. This is something that I will continue to cherish for a long time.
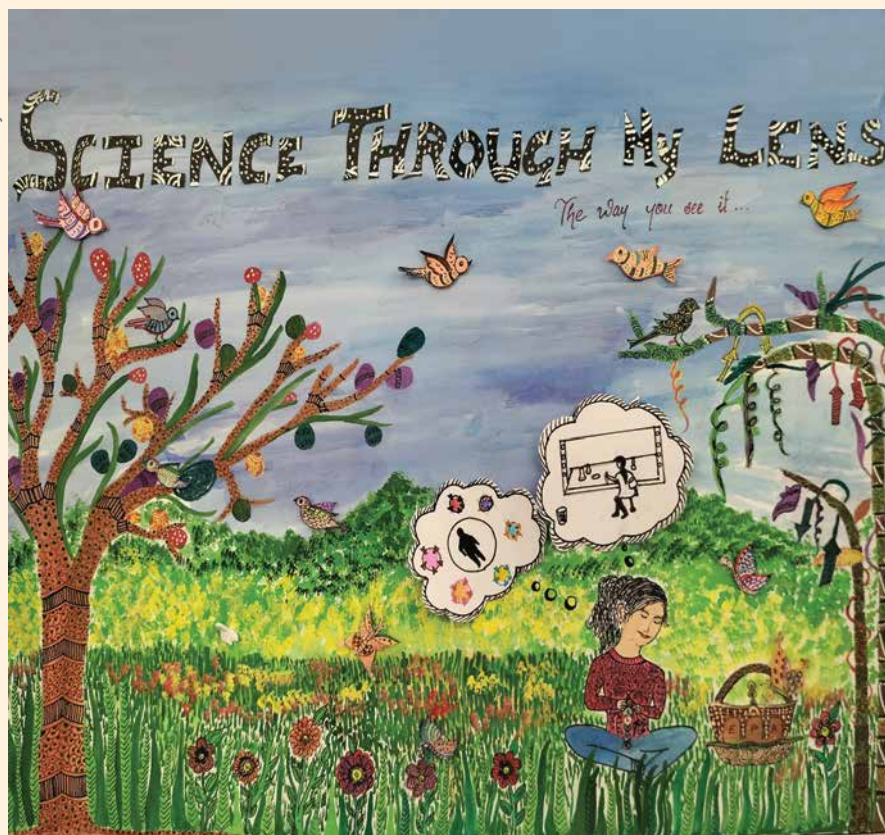
Life of an MSc student. Artist: Joyati Das. Art form: Gond folk painting

Growing a forest of people

- Abinaya Kalyanasundaram

Student conference has been fostering India's conservation community for 14 years

Participants examining moss on the IISc campus during a plant identification workshop at SCCS

Photo courtesy: Abdus Shakur Mohammad/SCCS

"How many of you have been chased by an elephant?" is not a typical question you'd expect to hear at a conference. But it seems to fit right in at this one; many people raise their hands, some laugh. Standing at the front of the hall, Kalyan Varma is unsurprised. "It might seem funny in retrospect, but [it is] no fun when it actually happens, for us or the animal, is it?" he asks. Behind him, the large screen shows a photo of an elephant, clearly distressed, running towards the camera.

It is the fourth and final day of the Student Conference on Conservation Science (SCCS), Bangalore, and Kalyan, a conservation photographer, is leading a lively discussion on the ethics of wildlife photography and storytelling.

Outside the JN Tata auditorium on the IISc campus, the conference venue, the energy is just as spirited as it was on day one. People are attending stimulating workshops in different halls. Corridors are brimming with conversations ranging from how to use camera traps to what pants can deter leeches. Further down in the lobby, stalls set up by environmental organisations sell wildlife T-shirts, badges, books, make-your-own stamp postcards, and other merchandise.

There is a sense of camaraderie and excitement in the air, and it is contagious.

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Working in conservation can be rewarding, but also challenging, distressing, and sometimes isolating

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In its 14th edition, SCCS-Bengaluru, held on 9-12 October 2023, has returned as an in-person conference. After three years of gathering online due to COVID-19, over 600 people from across the country and southeast Asia have eagerly reunited. Conservationists, wildlife biologists, students, writers, artists, journalists, photographers and anyone passionate about conservation science have gathered for four days of intensive knowledge exchange.

"If you aren't at the @sccsbng, are you really in #conservation," reads a post by environmental journalist Bahar Dutt on social media platform X.

Hands-on learning

Working in the conservation sciences can be immensely rewarding, but at the same time challenging, distressing, and sometimes isolating. Days, weeks, even months are spent in labs or remote forests, or in writing grant applications and reports, or in dealing with the emotional toll of incidents like animal deaths and deforestation. Factor in academia's traditional penchant for gatekeeping, and there are not many spaces for a young researcher to meet potential collaborators.

Photo: Abinaya Kalyanasundaram

Opening plenary talk by Bram Büscher who called for a "conservation revolution"

That is what, many participants say, makes SCCS one of its kind; between the plenaries, workshops, student seminars, posters, group discussions, walks, and countless informal breakout sessions, there are several possibilities for building connections.

Each day begins with a technical plenary, in which seasoned conservationists expand on the latest conservation discourses. In the very first talk, Bram Büscher, Professor and Chair of the Sociology of Development and Change group at Wageningen University, the Netherlands, calls for a conservation revolution. "Mainstream conversation is in an identity or existential crisis," he tells the auditorium, making a case for a new kind of "convivial" conservation that proposes "a post-capitalist approach, promoting radical equity, transformation and environmental justice."

Participants experimenting with a drone during the drone-based visual animal tracking workshop

After the plenary, selected students take to the stage to present their research processes and findings, as fellow peers and mentors pose questions and share feedback. As each day progresses, the atmosphere becomes more interactive. The afternoons are time for workshops, prompting a rush to secure registrations at the front desk.

"Many interesting workshops are happening at once; it's hard to choose just one," says Krishna Priya, an MSc Environmental Science graduate from MIT-World Peace University, Pune. She has just walked out of the first part of a drone-based visual animal tracking workshop and is excited for the second half. "I can finally acquire the tools to process the 16 TB of footage from my desert fox denning study!"

Many like Krishna Priya are drawn to these workshops to network and get tips from field professionals. There are plenty to choose from: DNA metabarcoding, software tools like R and Quantum Geographic Information System (QGIS) for spatial data analysis, and bioacoustics – a legacy workshop that's been around since 2011.

Some workshops are also designed to impart other crucial skills for field research, such as using behavioural science to strengthen calls for conservation action, incorporating traditional folklore in conservation studies, and so on.

In the Qualitative Research workshop, participants role-played complex social situations such as children arguing with parents to go out with friends or to marry someone of their choice. "We wanted to highlight that power is everywhere and manifests in many ways," explains workshop convenor Budhaditya Das, Assistant Professor at the School of Human Ecology, Dr BR Ambedkar University, New Delhi. It is the second time he is organising this workshop, this year in collaboration with Venkat Ramanujam Ramani, a Postdoctoral Research Associate at the Ashoka Trust for Research in Ecology and the Environment (ATREE). "We picked these relatable case studies so participants could easily step into the shoes of the person they were arguing for." Such role-play activities may not be able to capture more nuanced situations, like a tribal person facing conflict with tigers, but they can still nurture a sense of empathy in participants, he says.

> **Many workshops explored conservation through creative means, like drama, art, storytelling, and games**

Budhaditya believes that the practice of conservation needs to involve people in both application and knowledge creation. "And that is where social scientists come in. Over the years,

SCCS organisers have consciously included social science theories, ethos and frameworks into the conservation conversation," he says.

This year, many workshops also explored conservation through creative means, like drama, art, storytelling, and games. "SCCS has become much more inclusive with workshops and presentations on wider topics like citizen science and local biodiversity," says Divya R. Back home in Chennai, she is a young professional in the government sector and also volunteers at programmes for NGOs such as Nizhal. She says the workshops on conservation games, nature journaling, and tree identification equipped her with skills to continue her work.

Some participants who met at SCCS have gone on to launch joint conservation initiatives.

"In 2014, as a Master's student in Wildlife Biology at AVC, Tamil Nadu, I got to meet senior scientists whom we had only read about in papers," says Anuja Mital. She met the conservationist Gopakumar Menon, who was working on small-clawed otters at that time and has now started the Koile Meen project to raise awareness about freshwater stream conservation. "We went on to start a collective for freshwater conservation called L-IFE (Learn-Indian Freshwater Ecosystems) and organised many talks during the pandemic."

A workshop on games in conservation in progress at the Centre for Ecological Sciences, IISc

Life-changing collaborations

Throughout its run, SCCS has been a springboard for many a student's careers. Some even consider it a rite of passage.

"You start as a Bachelor's student eager to meet role models, then you become a student being trained by [one of] them, and finally you attend to recruit students for your [own] projects!" remarks Rohit Chakravarty, a bat researcher currently working with Nature Conservation Foundation (NCF), who has been attending the conference regularly over the last decade.

A year after that, Anuja ran into wildlife biologist Sneha Dharwadkar. "Our shared love for all things reptiles has only grown over the past eight years and led to us founding Freshwater Turtles and Tortoises of India (FTTI)," she says.

There are also poster pinup sessions, networking events and sessions like "Birds of a Feather", where groups discuss topics chosen by the crowd, whether it is about conserving grasslands or tackling a toxic supervisor. Most fun of all are the morning tree and bird walks and a night time loris walk around the IISc campus.

> **SCCS has been a springboard for many a student's career. Some even consider it a rite of passage**

"A personal win for me this year was leading a tree walk for Janice Pariat," says Sayee Girdhari, Project Coordinator for SeasonWatch, a citizen science project that follows seasonal changes in common trees of India. Janice is a renowned nature writer and author of the novel, *Everything the Light Touches*, and was one of the popular plenary speakers this year. "She brings so much acceptance and heartfelt emotions into everything she does. She inspired me to open up and speak not just as a botanist, but as someone who personally loves trees," Sayee says. In her work, Sayee engages with many people to encourage tree monitoring and contribute to SeasonWatch. "But facts and science do not sway opinions, emotions do. This emotional and personal approach to outreach was a significant takeaway for me," she says.

A safe space for all

SCCS was first started in Cambridge in 2000 and has now grown into a worldwide cohort of sister conferences at different venues – New York (USA), Australia, China, Hungary, Norway and Bangalore. The Bangalore edition began in 2010.

"The idea emerged when a few of us were doing our postdoc in Cambridge in the mid 2000s. We saw how the Cambridge edition allowed early career researchers – including PhD and Master's students, and researchers – to come together," says Kavita Isvaran, Associate Professor at the Centre for Ecological Sciences (CES), IISc, who was part of the organising committee for the first two years, and then again in 2016-17. She is now on the advisory board.

When Kavita and others returned to Bangalore, they discussed setting up an edition to cater to the global south with a larger group of people from diverse institutions including IISc, National Centre for Biological Sciences (NCBS), NCF, ATREE and many more. "We finally started it in 2010. SCCS Cambridge helped us get an initial seed grant for

funding, and after the first two years we were completely independent," says Kavita.

They tailored a different model for the Bangalore version. "Our two unique points, when we began SCCS-Bengaluru, were accommodating a larger number of participants, and organising many and diverse capacity building workshops – unlike other SCCS [editions], we have about 40+ workshops," she says.

An organising committee with volunteer members plans intensively over 10 months. Separate working groups, comprising a subset of organising committee members and external members, plan different sections – plenaries, student presentations, and workshops. "We try our best to ensure a good balance between topics – natural sciences, interdisciplinary/social sciences, and humanities – and a balance in gender, across academia and practice, and geography too," explains Samira Agnihotri, a participant and resource person in previous conferences, and a member of the current organising committee.

Over the years, the conference has evolved in scale and format. In 2018 and 2019, for example, pre-conference modules were organised to engage students from underrepresented groups or those hailing from rural colleges and institutions in India.

> **Initiatives like SCCS underscore how the collective strength of people working together can be powerful**

During the pandemic, the conference went online. Taking advantage of the anonymity this provided, an online safe space was created for queer-identifying conservationists in 2021. "Over 40 people attended, showing the need for such a space," recalls Ishika Ramakrishna, a doctoral fellow at the Centre for Wildlife Studies, and co-host. This Queer Circle has now evolved into a supportive community of about 100 across India and remains open to all. "We recently received a grant to keep this space functional in between conferences, and to take it further as training programmes for NGOs. We're very excited," she shares.

Photo courtesy: SCCS

The SCCS organising committee and volunteers posing with the lantana elephants by The Real Elephant Collective, at the JN Tata Auditorium

This year, another circle for neurodivergent individuals was initiated, which was well-received. SCCS also hosted a mandatory session on Prevention of Sexual Harassment (POSH) and introduced a collective named Conservationists and Ecologists Against Sexual Harassment (CEASE). "Despite institutions having mandatory Internal Committees as per the POSH Act, we felt the need to create awareness about what constitutes sexual harassment, especially since the nature of work in wildlife biology and conservation often involves travelling and staying in relatively remote areas with poor connectivity," explains Samira.

Although raising funds every year can be a challenge, SCCS-Bengaluru has several benefactors who continue to contribute every year, she adds. "Many people come together to make this phenomenon a success – volunteers, well-wishers, resource persons, mentors and students. We are like a large, extended family."

Power of people

The sentiment of family echoes throughout the conference and is especially underscored in the final plenary by Rita Banerji, award-winning conservation filmmaker, and founder and project director of the Green Hub initiative.

"Engaging more youth in conservation, with local narratives and local voices – that's how everything came together in the Green Hub project," she tells the packed auditorium. Started in the northeast and now also in central India

and the western Himalayas, Green Hub offers fellowships to youth from local communities to document their own stories via video – a feat, Rita emphasises, only possible because of a large network of individuals who step in as mentors.

"Can we grow a forest of people, then? Can we believe that *this* is what will bring about the change, and not get deterred by the scale of destruction, by the felling of trees or the building of buildings or the drying of lakes?" Rita concludes. The applause is resounding.

Initiatives like SCCS underscore how the collective strength of people working together can be powerful. Dutch primatologist Frans de Waal once wrote that he is "convinced that it is these cooperative tendencies that have brought us [humans] as far as we have come."

As the conference winds down, people gradually trickle out of the building, hugging each other, saying their goodbyes, and promising to meet next year. Some congregate for final selfies around the four elephants standing sentinel at the entrance, crafted from recycled invasive lantana weed by adivasi artisans from around Mudumalai and Male Mahadeshwara Hills, under the patronage of the socio-environmental enterprise called The Real Elephant Collective. These life-sized sculptures have journeyed across the Nilgiris and even to the UK, raising awareness about indigenous integration, invasive species control, and wildlife coexistence. *These* elephants are more than happy to pose for photographs.

Electronic city was not built in a day

- Pratibha Gopalakrishna

R.K. BALIGA

> **The story of Rama Krishna Baliga, a government bureaucrat who laid the foundation for Electronic City, which eventually led to Bangalore becoming the "Silicon Valley of India"**

Ragavendra R Baliga has fond memories of his father, Rama Krishna Baliga. "There's an article my father wrote for my medical school journal after he retired. [In that], he said, 'I envision the belt from Bangalore city to Hosur to be bubbling with activity.'"

Rama Krishna Baliga (RK Baliga) was born in Mangalore on 29 December 1929. His father, Bantwal Vaikunta Baliga, was a lawyer, social activist, and freedom fighter, who also served as a speaker of the legislature for the State of Mysore.

After completing a Bachelor's degree in Electrical Engineering from Annamalai University in 1951, RK Baliga came to IISc for his Master's in Power Engineering (this degree was called DIISc back then). Baliga was also active in extracurriculars. While at IISc, he was the treasurer of the Gymkhana for one year. After completing his Master's, he worked as a research assistant for six months.

In 1953, on the recommendation of the then Director of IISc, MS Thacker, Baliga was invited by General Electric (GE) to work with them for a year. Therefore, when he was 24 years old, Baliga sailed to the USA from Bombay via London on the ship *Mooltan*. "The Institute was key, because that is where he got the leverage to go to the USA, get exposure and come back," says Ragavendra.

During his tenure at GE, Baliga worked at their different offices across the USA – in Erie, Pennsylvania; DeKalb Illinois, and Schenectady, New York. While working in DeKalb, Baliga wrote an article for *General Electric News* titled *My homeland – India*, highlighting the rich heritage and culture of his home country. He also did an evening course in economics and advanced engineering. "He was a consummate learner," recalls his son. The nature of his work at GE ranged from control development engineering to production, testing and quality control of motors, turbines, and generators.

After one year at GE, in 1955, Baliga moved to Westinghouse Electric Corporation, the US company that built the fastest elevators for New York's Rockefeller Center, and also designed the now famous "We can do it!" poster, which originally hung in Westinghouse factories to encourage women to take up wartime jobs. There, he worked on switchgears, large generators, motors, and air conditioning units, while also gaining sales experience. Years later, in 1969, Westinghouse International profiled Baliga for their *Graduate Student Communicator* magazine, where he said, "The role of the young Indian engineer of today is, of course, predicated upon the technological advances that have been made in the last decade. Such a man must be completely up-to-date in his field."

In early 1956, Baliga moved to Oakland, California, to work in Kaiser Engineers Overseas Corporation for two months. He then sailed back to India after being assigned as a project engineer to MS Tata Iron and Steel Company, Jamshedpur. Three years later, Baliga worked at a subsidiary of Union Carbide called National Carbon Company Limited in Kolkata for about a year. On 10 May 1959, he married
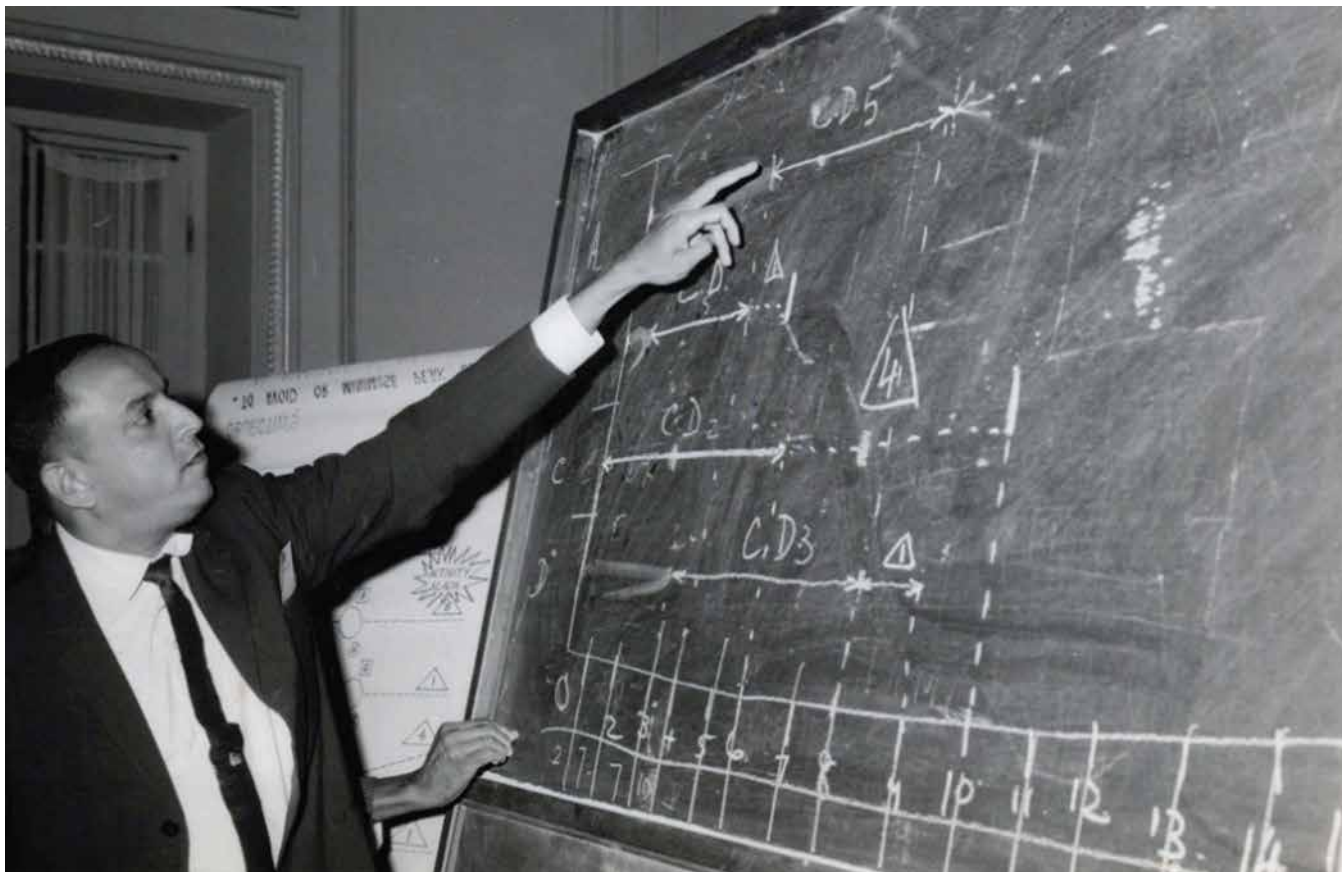
RK Baliga teaching at Manipal Institute of Technology in 1960

Chitra Pai, now Shanthi Baliga, an educator and social worker. They eventually had three children – Ragavendra, Narendra and Lathika.

Baliga returned to Karnataka in 1960, and started teaching engineering to students at Manipal Institute of Technology, where he also set up the Department of Electrical Engineering. In the same year, Baliga went to Paris for six months to get a certificate course in Management and Production. Following this, he worked at Bharat Electronics Limited (BEL) for 15 years. As chief engineer, he was responsible for developing the residential colony of the company consisting of more than 1,400 houses. Later, as President of BEL's co-operative housing society, he developed another colony of 1,500 houses. In 1972, Baliga was sent by BEL to Nippon Electric in Japan, for three months.

Work-life balance

Despite his extensive experience, Baliga was not a workaholic, Ragavendra says. As President of BEL

Fine Arts Club, he organised drama and music festivals in 10 different languages, which encouraged industry workers and their families to showcase their respective cultures. Baliga's family would take walks outside the BEL campus. Whenever they passed by IISc, which was close by, his father would say to Ragavendra: "This is where I went to school."

❝
Baliga had one rule: The entire family had to have at least one meal together
❞

Venkatraman Balasubramanian, a friend of Baliga's son, Narendra, recalls that RK Baliga was "soft spoken and gentle, but also energetic and mentally strong." He fondly remembers that Baliga wrote a character certificate for him that he still has in his possession. Whenever Venkatraman went to meet Narendra and ran into his father, they would chat about the latter's travels and learnings. "I enjoyed his company whenever I met him," remembers

Venkatraman. "Some of the conversations were all about his adventures, his enthusiasm, and his vision to start something."

When Baliga turned 45, he built his own house at Palace Cross Road. "Two houses down was Satish Dhawan's house and one house down was S Ramaseshan's house – both ex-directors of IISc," Ragavendra recalls. At home, Baliga encouraged his children to be whatever they wanted. "There was no pressure to be like him," Ragavendra says. Baliga had only one rule: The entire family had to have at least one meal – preferably dinner – together. Dinner table conversations centred on ideas to make a better society. "I think this is true of all the people of his generation. They were not [concerned only] about personal profit, or becoming billionaires. It was also about [contributing to] society … about the greater good."

In the evenings, Baliga taught MBA students at Bangalore University. He was also a guest faculty member at the National Productivity Council. He joined the Rotary Club in Bangalore, where GVK Rao, the chief secretary of Karnataka

was also a member. "He had direct access to [GVK Rao] at that time," says Ragavendra.

Building a city

Baliga also became the President of the Institution of Plant Engineers, Karnataka Chapter, in 1976, and organised its fourth national convention, called Plantex-76. He invited officials like GVK Rao, TA Pai (Minister of Industry and Civil Supplies), and SM Patil (Chairman of Hindustan Machine Tools) to the event.

Six months after this convention, the Government of Karnataka established the Karnataka State Electronics Development Corporation or KEONICS as a public enterprise with the aim of turning Karnataka into an 'electronics state'. It was set up in Bangalore with a capital of Rs 1 crore, and Baliga was appointed its Chairman and Managing Director. KEONICS assisted small and medium-scale industries, both public and private, to develop technology and products related to consumer electronics, radar, aerospace, defence, medical electronics, computers, and industrial electronics.

Their pamphlet from back in 1976 mentions the numerous activities taken up by the corporation, which included providing vital resources like raw materials, testing and development centres, and finding markets for products both at "home and abroad". The corporation also designed and manufactured the air traffic control desk for the HAL airport, as well as instruments like the iontophoretic-cum-neuro-exciter used by dentists, and dialling units for teleprinters.

Photo courtesy: Ragavendra Baliga

*RK Baliga speaking at BEL Fine Arts Club*

The 1970s were a time of rapid developments. Electronics was a burgeoning field, with the television having been introduced just a few years earlier. India was independent, and there was a huge push to manufacture electrical and electronics equipment, for economic growth and for the sake of self-sufficiency. Computers were in their nascent stages and the IT revolution was yet to come.

In 1979, at the 13th meeting of the KEONICS Board of Directors, RK Baliga put forth an ambitious proposal for setting up Electronic City. The project laid out every detail related to development and implementation, including financial resources, water supply, transport and housing. It was approved by the Board, and the then Chief Minister, Devraj Urs, signed off on 300 acres of land in Konappana Agrahara village, 20 km south of Bangalore city, on the way to Hosur.

It is not exactly clear when or for how long Baliga had the idea for Electronic City. Ragavendra suggests that because of his experiences, and his travels to the USA, France, and Japan, his father was able to envision an entrepreneurial city. A *Vijay Times Connect* newspaper article from 2 November 2006 concurs, stating that "his idea for Karnataka as an electronic hub was developed during his visits to France and Japan." Indranil Ghosh, author of the book *Powering Prosperity*, wrote that RK Baliga "dreamed of making Bangalore into the Silicon Valley of India – an ambition that was met with derision in India as well as in the US. But he was not deterred." Ghosh continued that it is hard to exaggerate how big an achievement this was for Baliga – one that owed a lot to the foresight of the then Chief Minister as well. India was deeply bureaucratic in the 1970s, making business creation extremely difficult.

With the green signal to move forward, KEONICS charged ahead to build Electronic City. A 1981 KEONICS Annual Report mentions that the response for the company's advertisement for allotting sites had been encouraging, and several large electronic industries had shown interest. In an article in a 1983 issue of *Sunday* magazine, RK Baliga said to journalist Tirthankar Ghosh: "Our aim is

Image courtesy: Ragavendra Baliga
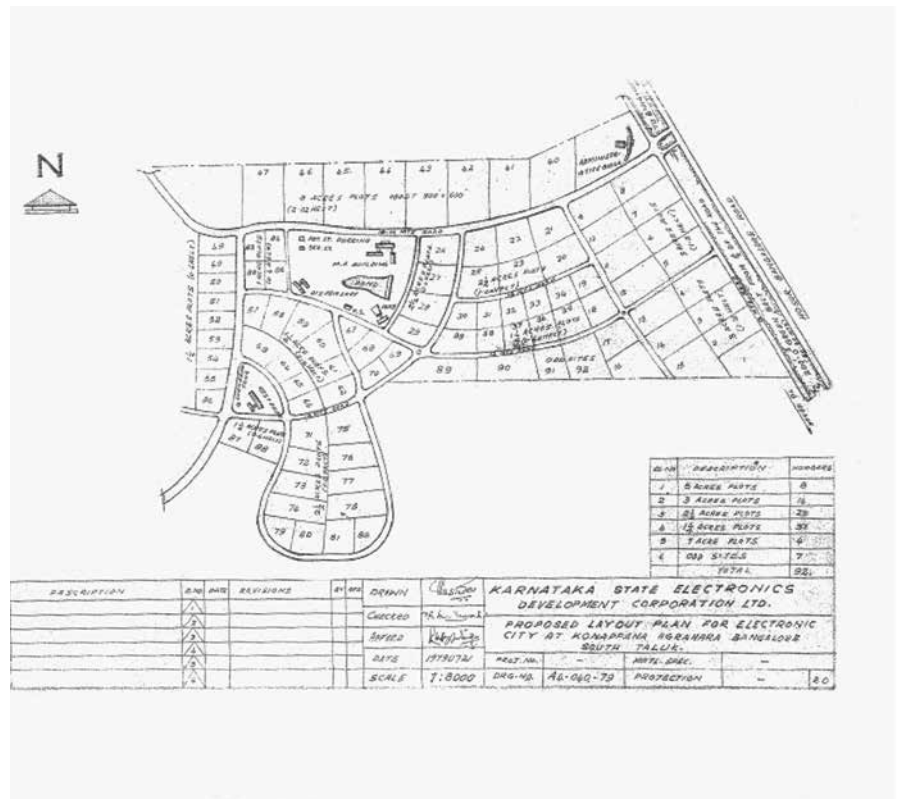
Proposed layout plan for Electronic City from 1979

to create around 10,000 jobs in the electronic industry in the state. You see, we do not have an industrial culture like Japan or the USA. Whatever strides we have made are from 1956 onwards, when India started industrialisation." In the article, speaking of the future, Baliga said that he had a dream of establishing mini electronics cities in other parts of Karnataka as well.

In 1984, Baliga left KEONICS and served as the Chairman of Hindustan Teleprinters Limited for three years. He introduced electronic teleprinters for the first time in the country, in place of the outdated electro-mechanical teleprinters. He continued to engage with other organisations like the Rotary Club and the All India Public Sector Sports Association. On 26 October 1988, he passed away at the age of 58 due to diabetes-related complications. "Even though he had left BEL 12 years before, three busloads of people from BEL came for his funeral," recalls Ragavendra.

In 1991, India went through an economic crisis mainly caused by over-dependence on imports. In response to this, the new prime minister P Narasimha Rao and finance minister Manmohan Singh laid out

economic reforms that ushered in a new era of liberalisation for India. These reforms boosted the growth of Electronic City further which, by then, had almost 90 companies. This was also the time when the software sector was starting to take off. Dinsha Mistree, a lecturer at Stanford Law School wrote a paper in 2018, where he talks about the ease with which a foreign software company could register itself with the state government of Karnataka – within an afternoon, instead of the usual time of several months.

Today, not only does Electronic City house about 158 industrial technology companies, it has also transformed into an IT hub with over 200 companies like Wipro, Infosys, Hewlett Packard and more. The area alone provides jobs to over three lakh people. The Bangalore-Hosur highway buzzes with activity, just like how Baliga had envisioned.

Ragavendra hopes that his father's story serves as an example of how someone with vision and conviction can make a major contribution to society. "He would tell us: 'Try to help a lot of people, but don't expect anything in return.'"

Living with
Parkinson's

- Subramony Mahadevan

Subramony Mahadevan, a former faculty member at the Department of Developmental Biology and Genetics, was diagnosed with Parkinson's disease in 2009. In this personal essay, he reflects on his experiences of coping with the condition. This essay was first published in the Deccan Herald *on 9 September 2023 and is being republished in* CONNECT *with permission.*

One of the great perks of working at the Indian Institute of Science, Bengaluru, was the serenity of the campus. On crisp winter days, I preferred to walk rather than drive the 3 km from my Malleswaram home to my lab, where I taught genetics and molecular biology. The only indications of the impending doom were that even a small stone on the way could trip me, I could not catch a flyer while playing cricket, and beating a rhythm with my hands became excruciatingly difficult.

My Parkinson's disease (PD) was diagnosed serendipitously at 55. One bright spring morning in 2009, a colleague noticed me walking down the road on the campus. We had planned to have tea at the Faculty Club. She asked me why I was dragging my left foot and holding my left arm stiffly. I might have had a stroke, she thought, and suggested that I see a doctor. I was taken aback and fixed up an appointment at the Institute's Health Centre. The moment I walked into the doctor's consultation room, she gasped and said, "Oh my god, you are showing classic symptoms of PD." She wrote a referral for a neurologist at a hospital nearby and said, "See him today."

The consulting neurologist confirmed the diagnosis. The news was obviously devastating for my wife, Usha; I remained calm as the full impact of the doctor's pronouncement had yet to sink in. Soon, second and third opinions confirmed PD, a brain condition that causes slow or involuntary movements, rigidity, trouble walking, and imbalance.

It is a progressive condition with currently no cure. So my life is split into On-time and Off-time. On-time is when the medicine is working – I can walk, sit and talk normally. Off-time is when the medicine wears off. I look slow – like a 45 rpm LP record playing at 33 rpm. I move with great difficulty – walking from the main road to my flat can take half an hour.

> *It is a progressive condition with currently no cure*

First decade

L-DOPA is currently the best medication available for PD, but since my symptoms were mild, my first doctor felt we should save it for a rainy day. He prescribed medications to allow for low levels of dopamine (the hormone that helps with smooth movements) to function optimally and to ease tremors and stiffness. My discomfort increased as the days went by, but my colleagues and graduate students assured me that my mind was as sharp as ever.

I was getting somewhat disillusioned with my current neurologist and sought another on the recommendation of one of my PhD students. I now felt I was in the presence of a professional whose

Subramony Mahadevan's life is split into On-time and Off-time
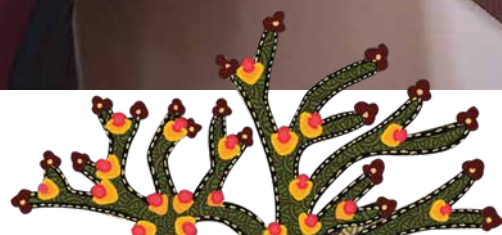
bedside manner was as good as his reputation. Despite his busy practice, he went through my family history and prepared a medical record in case I was to move out of Bengaluru and consult other doctors. He introduced me to L-DOPA as he felt the rainy day was fast approaching. This was two years after my diagnosis.

I could manage my academic life until July 2019 when I was set to retire, but I had stopped driving. Over the next year, I could go grocery shopping but only during the On-time. My weight began dropping. Speech became strenuous. Stiffness and full-body fidgeting, dyskinesia as it is called, increased. More medicines were added to keep the On-time longer. Overall, I was functional at home, but going out alone was risky.

Another type of intervention became necessary, and we zeroed in on Deep Brain Stimulation (DBS), an invasive procedure to implant electrodes into the brain. They often call it the pacemaker for the brain. It specifically alleviates the motor symptoms of PD. We set 20 May 2022 as the D-day, or DBS Day as I put it.

Brain pacemaker

One day prior to the surgery, an MRI of my brain was taken. It was to act as a sort of Google map of my brain. On surgery day, a stainless-steel frame was fixed to my tonsured head like a crown, except that there were no precious stones but only screws to keep it tightly fixed to the scalp. Of course, I was given local anaesthesia. But the screws went into my ears without any anaesthetic and the doctor told me with a straight face that if the pain in both my ears was the same, things were fine. Once the electrodes were positioned correctly, I was given a general anaesthetic and the surgeon gathered the wires into two bundles and connected them to the battery implanted below the left collarbone under the skin. One of the local anaesthetic shots was injected over my right eyelid and I could barely open it after the surgery. I remember I looked like Harry Potter in one of his disguises while escaping from Lord Voldemort.

The battery was not turned on until a week after, as the doctor wanted all inflammation near the insertion points

to recede so that there was no interference with the electrical signals. At the same time, my medicines were cut down as he wanted to determine the best levels for me. These were difficult days. I needed help for everything including brushing my teeth and tearing chapatis as my fingers had no strength. Even turning over in my bed while sleeping was impossible.

It has been over 15 months since the Rs 19 lakh surgery started pumping 4 millivolts in my brain every day. Overall, the setup is not too much of a bother. If

I go to metro train stations, I carry an advisory from my doctor not to allow a hand-held metal detector over my body as it can 'interfere' with electrical stimulation. I do need to recharge the battery buried in my chest for at least an hour every week. For that, I hang a 'power pack' on my chest and sit still for the inducing fields to do their work.

DBS is supposed to extend the On-time and reduce medication. Has it helped or was it an expensive error of judgement? The answer is not a simple 'Yes' or 'No'.

Photo courtesy: BH Shivakumar/Deccan Herald

Subramony Mahadevan at his home

Life after DBS

DBS has improved my appetite and stabilised my weight, which I was losing at an alarming rate because of dyskinesia. It is another thing that I end up gobbling up the sweetest items in the house and I am hyperactive during On-time, which my wife doesn't find too amusing.

But the Off-time seems to be getting longer and more crippling by the day. That is frustrating as in the middle of writing an article or making coffee, I have to stop, pop my pill and wait to switch 'On'. The medicines kick in within 10 minutes on an empty stomach, like after waking up in the morning. After lunch, it can take 30 minutes. Just as fuel is wasted if an automobile stops and restarts frequently, these disruptions result in loss of concentration and motivation. I have grown impatient, irritable and angry because of the disruptions, which are in direct contrast to the qualities my students and colleagues used to admire me for. My tolerance for 'low standards' in people has plunged as also for inanimate objects such as slippers that disappear when you need them. I am aware of my mood swings and I make it a point to apologise to my wife. Sometimes, my son, who lives in the USA, intervenes. But my doctor insists that I am doing fine!

> **Stepping out in the city alone is a no-no. Dug-up roads, speeding buses – I am up against a lot**

One dose of medication ideally keeps me 'On' for about three hours and I am advised not more than five doses a day. Transferring money online, keying in an OTP, and taking showers are strictly On-time tasks. But admittedly, I tend to overspend my On-time on social media, catching up with PG Wodehouse fans, school friends, and fellow PD patients.

During Off-time, my doctor has asked me to lie down, though sometimes, I manage to stand in the kitchen and do the dishes with my wife. I also use this downtime to compose email messages, finish a prose piece, and plan my day in my head.

But a mistake during Off-time can cause much hurt and embarrassment. There were some ghastly photos of my face after I fell on a wash basin. Instead of sending them to my doctor-brother to assess the damage, I put them up on my WhatsApp status because my hands were shaking. I was flooded with queries from well-wishers.

Whether I am 'On' or 'Off', my wife never leaves me alone in the house. She consults at a bioinformatics company and if she needs to be away for work for a few hours, she arranges a caretaker for me. Stepping out in the city alone is a no-no. Dug-up roads, speeding buses – I am up against a lot. I did risk it all to get some snacks one day and my wife, understandably upset, admonished me. I like my clothes sun-dried, but to be on the safe side, I can't go to the terrace to fetch them.

Caught off-guard

The discomfort that I go through during the Off-time is a lot more than my inability to move. The mind also slows down and everything feels like I am stumbling through a fog. JK Rowling's magical world of *Harry Potter* is the best analogy to describe my plight. It feels like I am being tormented by dementors who want to suck the happiness out of my life. I have to use all my energy and recall every happy moment in my life to conjure up a *Patronus* charm to fight them.

Gait-freezing is the most difficult part. It is the total inability to take a step forward. This is dangerous at my age. I am 69. It can lead to a loss of balance, a fall, and subsequently a fracture. Many things contribute to gait-freezing in my case. One of them I have named the 'Cinderella Syndrome', that is, any kind of anxiety that forces me to do something to a deadline, like hurrying to catch a flight. Going into a crowd, stopping and making a turn, and crossing a door or elevator are other such scenarios.

I can overcome gait-freezing when I am not in a rush and even take the stairs. I guess it is all in the state of the mind, and I have devised a strategy. I call it 'kick the trash-can'. I have a mid-size plastic trash-can that is light yet steady. When my gait freezes, I gently kick the trash-can. My aim is to kick the can and not walk! This way, by fooling my brain,

I can walk around the house slowly.

Sometimes, I don't even realise when the Off-time kicks in. It often happens when I am engrossed in a stimulating activity, like watching a movie or researching online. This ignorance is bliss only if I don't move. When I do, I end up falling on the bed or parapet. My body is a museum of bruises and concussions. My reading glasses need fixing every now and then, and sometimes, my teeth too.

> **It has been over 15 months since the Rs 19 lakh surgery started pumping 4 millivolts in my brain every day**

Once, my students had come home to discuss Darwin's theory of evolution which was deleted under the NEP (National Education Policy). I froze mid-discussion. They understood and left. I was shy of giving lectures and attending seminars for reasons like this, but I have managed to fight off these inhibitions now.

Being prepared counts. For watching the Asia Cup matches, I kept my medicines, a glass of water, and my walker next to me because these games were past my wife's bedtime. Grab bars and safety sheets have also been fixed in the bathroom to minimise slipping.

There are day-to-day variations in my response to medication and my general outlook to life. Still, every morning, I wake up to greet the day happily and with hope. I have learnt to live fully in whatever little time I am active, and I keep negative thoughts at bay. When I got a letter of acceptance for my article from J Biosciences, I was on cloud nine! Similarly, I was delighted when I got an email from *Deccan Herald* about publishing my journey with Parkinson's.

Humour is another way to cope, and I find solace in PG Wodehouse's writing, especially his short story: *The Man Who Gave Up Smoking*.

I think the day I am unable to laugh at myself, I can safely conclude that instead of kicking the trash-can, I have kicked the bucket!

With inputs from Barkha Kumari, Deccan Herald