CONNECT

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First Life
Tracing the origins

Love and Lanes
Campus memories

Women and Research
Why representation matters

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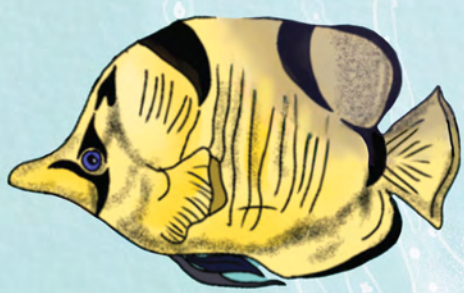

EDITORIAL

Dear readers,

In the first issue of this year, we're diving deep into an existential question that has intrigued humanity for centuries – how on Earth did life originate? It is wild to think that all life on this planet – from bacteria to blue whales – may have evolved from one teeny tiny cell, billions of years ago. How did this cell just 'come alive'? For our cover story, we dug into competing theories, fascinating experiments, and the many reasons why we still do not have a definitive answer.

In honour of International Women's Day (March 8), we're making space in this issue for stories from and about women. We looked at how the exclusion of female models and participants from clinical trials has set back women's healthcare. We spent time with scientists across disciplines to find out how they have navigated subtle biases, and what they are keen on changing for the next generations of women. We chronicle the adventures of a faculty member who is on a mission to climb treacherous mountains in between teaching and studying cryptography. We also spoke to a telephone operator who worked here in the 1980s – connecting departments and people before the age of mobile phones – and shadowed a hostel warden who exemplifies that emotional presence provides an invaluable safety net for women students.

As always, we have some breezy campus stories. Read student accounts of how to turn passion projects into flourishing businesses, recollections of couples who found love, and how our campus streets got their gorgeous canopies. Some students also reveal their favourite hangout spots (it's not just Sarvam).

And finally, we are excited to pilot a new page from this issue: the 'Fun Corner'. Take a break from your experiments and emails, and head to the last page for some wordplay!

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Pet Projects

- Shreya Gangwal

Photo courtesy: Shefali Srivastava

Students talk about their side hustles

A Pokemon-themed terrarium handcrafted by Shefali Srivastava

It never crossed Shefali Srivastava's mind that her love for gardening and the creative use of leftover diyas one Diwali would turn into a successful and relaxing side hustle amid academic stress. It was only when her friends began asking to buy her creations that Shefali realised that her passion for plants could be more than just a hobby. She started by crafting small, vibrant pots; planting succulents, and adding delicate clay figurines – little works of art that brought life to any space. Soon, she was selling her mini plant pots and handcrafted terrariums to her peers, even offering custom designs. "It started as a fun thing, but then people appreciated and started buying them, and that gave me so much motivation to continue," Shefali shares. Now a fourth-year PhD student, she has been creating and selling pots over the past year at IISc and has turned it into a successful side hustle.

Across campus, students are channelling their passions into meaningful projects. Some have turned their childhood hobbies into thriving businesses, while others have found new interests through collaboration. Whether it's crafting, digital design, content creation, or teaching, students are embracing opportunities to apply their skills in ways that enrich their lives and the community around them. Many are finding that their efforts bring them a sense of personal fulfilment and purpose along with being financially viable.

From passion to impact

Vidhu Catherine Antony, an MTech (Research) student in the Department of Electronic Systems Engineering, rediscovered her love for crafting through quilled earrings – little accessories made by intricately rolling strips of paper. She used to make them in her Bachelor's years but had stopped to focus on her studies. However, after joining IISc, she picked up quilling again and found that it helped her navigate stress at work and health issues. Her intricate paper jewellery has since become well-known on campus.

"Some people don't realise how much effort goes into making a single pair," she explains. "It's not just rolling paper; it's about making something unique and durable." Creating a simple piece requires two hours, with additional steps of varnishing and drying over days to finish the product, whereas some complex designs may require up to a month for completion.

> ***Making a single pair of quilled earrings is not just rolling paper; it's about making something unique and durable***

She also experiments with different materials and techniques to keep her designs fresh, incorporating beads, metallic foils, and resin among others to create new and unique designs. She has expanded her quilling art to unexpected designs like tabla sets and chess pieces that one wouldn't easily guess were made of paper. The income from her endeavour enables her to pay her course fees and become financially independent.

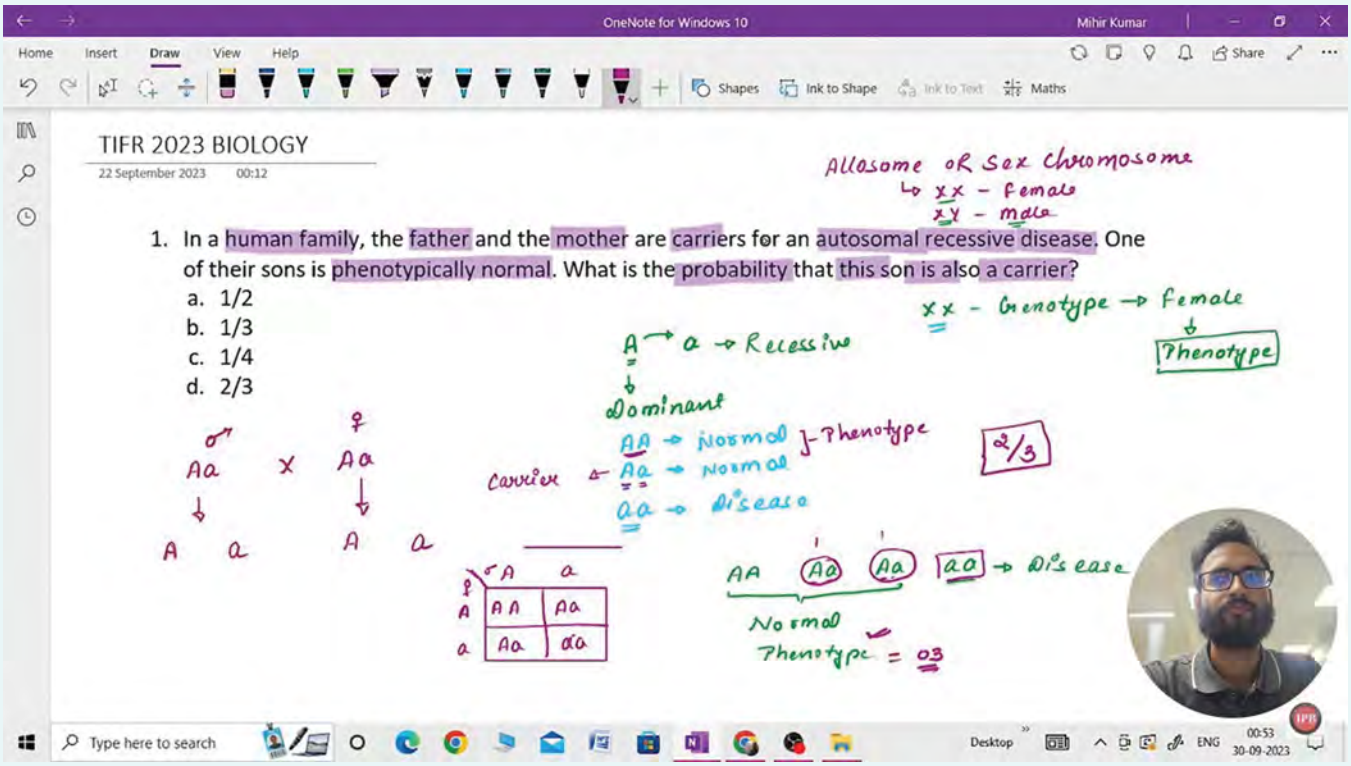
Mihir Kumar, a YouTube content creator, uses his channel to simplify complex scientific concepts. He used to teach coaching classes but shifted to a digital medium when he started his PhD and couldn't engage with students directly. Though he doesn't charge for his content, helping students grasp difficult topics is payment enough. "The best part is when someone tells me my video helped them understand something they were struggling with," he says. His focus is on teaching content that students find difficult while preparing for competitive exams and he helps them by going through the syllabus of the exams as well as through problem-solving. The students writing to him in gratitude motivates him to keep going.

While Mihir prefers to create online content, Aarthi R, a PhD student at the Centre for Ecological Sciences, pursues her passion for education offline. She merged her love for teaching with her interest in interacting with children and ventured into tutoring. She realised that she loved to teach when she found herself enjoying the process of breaking down concepts to her classmates, and that has grown into something bigger. "When the kids are curious to learn, it makes me want to learn more on the topic as well," she admits. Hearing the children's perspective of the world has also allowed her to expand her horizons and increase her confidence and a sense of accomplishment outside of academia.

Photo courtesy: Vidhu Catherine Antony

An intricate quilled tabla drum set made by Vidhu Catherine Antony

Image courtesy: Mihir Kumar



A screenshot of Mihir Kumar's YouTube session solving a question of disease inheritance in family trees

There are also those who found their calling in helping others. Prince Singh, Gautam Revanker, and Maharudra Kharsade volunteer with a campus nonprofit club called Science for Rural India (SFRI), teaching science to rural children. "It's not about making money, but about making an impact," explains Prince, an Integrated PhD student in Biological Sciences. They conduct hands-on experiments, encouraging curiosity and excitement for learning. Their sessions are designed to be interactive. "Instead of just lecturing, we use models, simple experiments, and storytelling to make science exciting," says Gautam, a PhD student in the Department of Mechanical Engineering. They work on showing simple science experiments to the children which can be performed with household items, making the process more exciting for children. "The goal is to make science accessible beyond the classroom," Prince explains.

Samuel Itang, an international PhD student from Nigeria at the Centre for Ecological Sciences and a graphic designer, has turned his creative skills into a business, designing logos and posters for companies, using minimalist designs. His designs have been featured in successful ad campaigns, something that brings him immense pride. "When I see a design I made on a big platform, I feel so full of myself," he laughs. "It's a great confidence boost." To further refine his craft, Samuel has learned various new software tools to keep up with design trends and make the work more customised for himself.

Balance and community

For all their efforts, fruitful and fulfilling as they are, the biggest enemy remains time. The challenge, students say, is to balance these ventures with academic pursuits. Shefali sets aside two hours in the evening for her crafting work before returning to her lab work. Vidhu accepts only a manageable number of orders to keep her passion from becoming a source of stress. For Mihir, weekends are when he finds time for his creative quests. The SFRI volunteer group distributes the school visits among people to avoid it becoming too taxing for any individual.

Many have found that their side hustle provides an essential mental break from academic rigour. "Being around kids is a great stress buster for me," reveals Aarthi. "No matter how exhausting my

Photo courtesy: Prince Singh

Prince Singh, Maharudra Kharsade and Gautam Revanker at a teaching session for Science for Rural India (SFRI)

day has been, when I start teaching, it lifts my mood. Their curiosity and excitement about learning remind me why I love doing this in the first place."

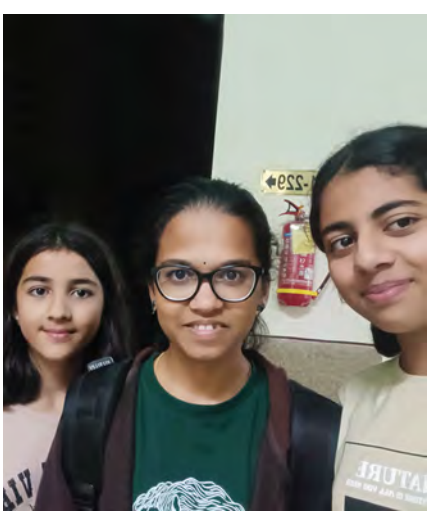
Photo courtesy: Samuel Itang

Samuel Itang designs minimalist logos and posters for companies

Samuel feels his art acts as an emotional outlet. "When I'm designing, I almost forget I'm a scientist. I turn on some music and just focus on creating. It helps me clear my mind, especially when life gets overwhelming," he remarks. Some of his best design ideas came when he was stressed. "It's funny – sometimes when I'm under pressure, I end up creating something new that I wouldn't have thought of otherwise." For him, designing is a way of de-stressing by doing something productive.

A strong support system has been crucial for many students in pursuing their passions amidst academic pressure. "Being part of the hostel community gave me a platform to showcase my work and connect with like-minded individuals," Vidhu says. In the early days when she was nervous about selling her work, her peers were kind and appreciative. Vidhu recalled a particularly touching moment when a friend insisted on paying extra. "They told me, 'You make the world a better place. Please use this to spread more love.' That kind of support means everything," she says. "IISc as a community is really great," Shefali reiterates, explaining her positive experiences with members of the New Girls Hostel WhatsApp group where she posts her products.

Photo courtesy: Aritra Biswas



Aarthi R (centre) with the students she tutors

Early support from friends was also valuable for Samuel to learn graphic design. His friend aided his education in designing. Mihir credits his parents and schoolteachers for supporting his interest in teaching.

> ***It's funny – sometimes when I'm under pressure, I end up creating something new that I wouldn't have thought of otherwise***

Developing life-skills

Beyond the personal satisfaction that comes from their projects, many have also developed valuable skills. Mihir's experience with creating YouTube content has strengthened his ability to communicate effectively. "Initially, I was awkward on camera, but after making so many videos, I've learned how to communicate more clearly and confidently." Through continuous practice, he has become more articulate and confident, which has translated into improved interactions both online and offline.

Samuel, through his graphic design work, has honed his adaptability and client management skills and prides himself on his ability to fulfil client deadlines. Through his role in rural science education, Prince has significantly improved his communication and leadership qualities. Managing different student groups and coordinating lessons has built his confidence in leading activities and engaging with diverse audiences. These experiences have also deepened his ability to think on his feet and handle unexpected challenges in real-time.

As more students embrace passion projects, they discover that these experiences are more than hobbies – they are opportunities for growth, self-expression, and meaningful contributions to the world. Each student's project is unique, yet they all share a common thread – turning their creativity and skills into something that has an impact on the wider community. Instead of letting doubts and hesitation stop you, Aarthi says, "Just try it once, whatever your passion, it might end up turning out great for you."

Shreya Gangwal is a PhD student in the Centre for Ecological Sciences, IISc and a former science writing intern at the Office of Communications

(Edited by Sandeep Menon)

Origin Story

- Parth Kumar

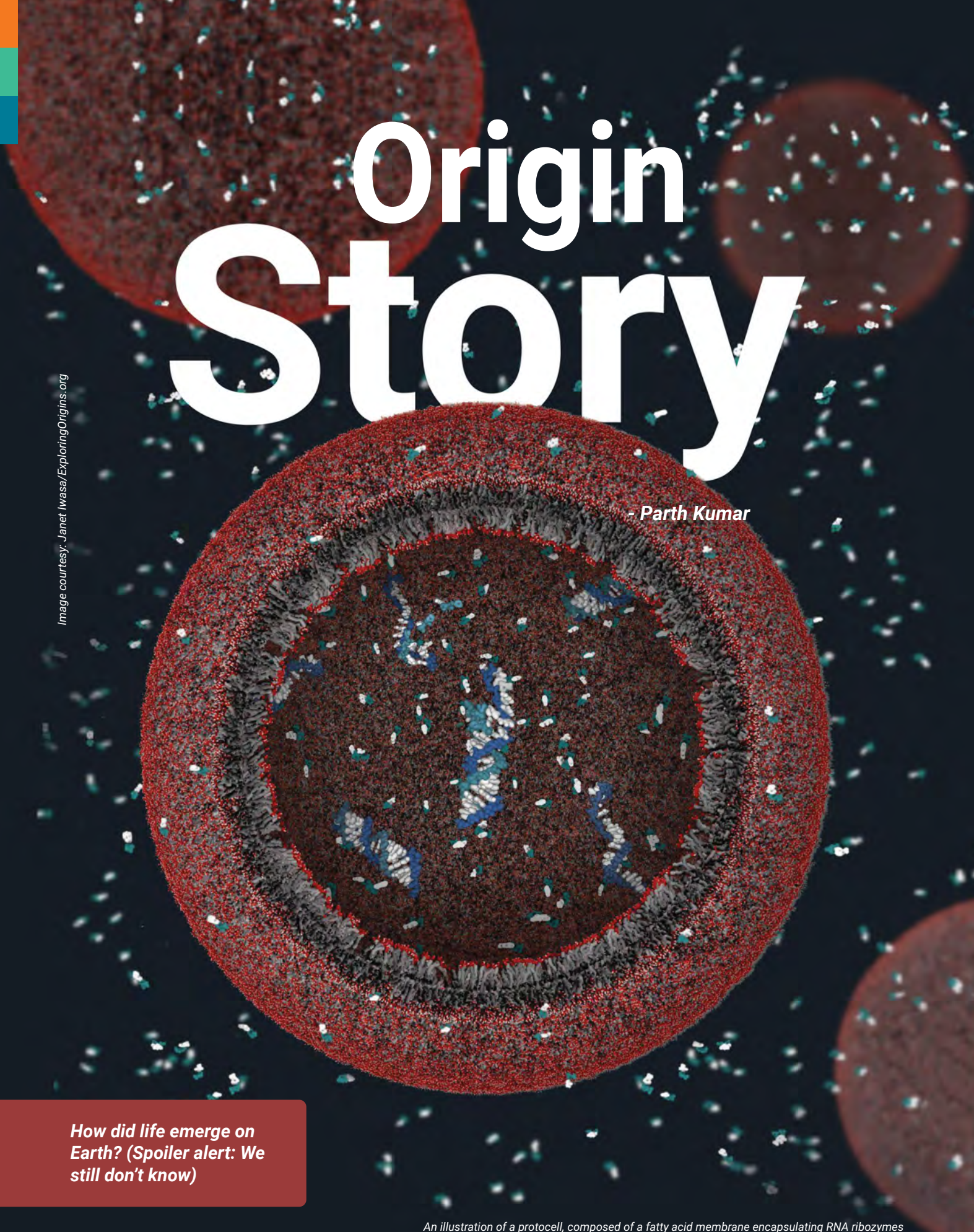


Image courtesy: Janet Iwasa/ExploringOrigins.org

How did life emerge on Earth? (Spoiler alert: We still don't know)

An illustration of a protocell, composed of a fatty acid membrane encapsulating RNA ribozymes

On a cold winter evening in 1952, in a dimly lit lab at the University of Chicago, Stanley Miller, a 22-year-old graduate student, stared at the murky brown sludge in the shake flask in front of him, his stomach sinking. Days of meticulous work had led to this unappealing, tar-like mess. He fretted over how to explain his failure to his graduate adviser, Harold Urey.

It had been a brash experiment. Miller thought that mixing a bunch of inorganic gases in a specially designed glass apparatus and passing electricity through them would create organic molecules. But the murky mess did not look anything close to what he had expected.

Common sense told him to start over, to scrub the flask clean, and abandon the experiment altogether. But something – curiosity, desperation, or perhaps sheer stubbornness – held him back. Miller reached for a beaker of water, dissolved the brown tar, and prepared to run it through a paper chromatography column. It was a last-ditch effort, more from habit than hope.

As the chromatogram developed, Miller leaned in closer. Then he froze. His breath caught in his throat. What he saw defied expectations – something no one had ever glimpsed before in a lab. The chromatogram clearly showed the presence of amino acids, the building blocks of proteins.

Perhaps he did not know it at the time, but Miller stood at a precipice where centuries of curiosity about the origin of life had converged. For a long time, humanity has been grappling with the profound question of how life emerged from lifelessness. Scientists have strived to find out how complex molecules like proteins and DNA first emerged and coalesced to create lifeforms. Fast forward to 2025, and we still don't have a clear answer. People from various fields like biology, chemistry, astronomy and even philosophy have approached the question of the origin of life from different angles. Pulling at this thread has also led us to question what constitutes "life", and if life is possible elsewhere in the universe.

"This historical question, in my opinion, is not something that can ever be settled," says Shashi Thutupalli, Associate Professor at the National Centre for Biological Sciences (NCBS).

One obvious reason is that it happened way, way back in time and none of us was around to see it. We can only guess what the Earth would have looked like four billion years ago – which is when many scientists think life might have emerged – but we can't faithfully replicate those conditions in a lab with complete confidence.

Photo courtesy: Special Collections and Archives, UC San Diego

Stanley Miller in his lab at the University of California (UC), San Diego

This hasn't stopped scientists from trying. Today, a lot of them work with precursors of biomolecules and even primitive cells to understand prebiotic chemistry, how molecules may have interacted to form reaction networks, and how the first ordered structures may have emerged.

For a long time, humanity has been grappling with the profound question of how life emerged from lifelessness

"We can only improve the confidence in our guesses as we collect more and more information and evidence," Shashi adds.

The chicken and the egg

For a long time, scientists seeking to pinpoint the origin of life focused on figuring out which biomolecule emerged first. We now know that the cell is the fundamental unit of life, and everything happening in that tiny compartment is under marching orders from the nucleus. But the real boss is the DNA inside the nucleus – the genetic material that holds the instructions to make proteins, which do all the work in the cell. DNA is copied into mRNA or messenger RNA, which is then "translated" into a protein by ribosomes – and this process is known to happen only in this order.

Molecular biologists call this the "central dogma" of life, but it raises an important question. Proteins, in the form of enzymes, are needed to make and copy DNA, but how can a cell make proteins if DNA is not made first? This is a confounding chicken-and-egg problem, with no definitive way to say which came first: DNA or protein.

Scientists caught a break in the 1980s when Thomas Cech and Sidney Altman at Yale University showed that a third entity called RNA could catalyse reactions, just like enzymes. RNA differs from DNA in that it has ribose sugar (instead of deoxyribose), which has an extra oxygen atom. Although this makes RNA quite unstable, it also gives it the ability to act like an enzyme. This means that on early Earth, RNA likely both acted as a carrier of genetic information and catalysed protein production. This is often regarded as the 'RNA World' or the 'Genetics First' point of view.

That's what the molecular biologists say, but others – physicists, geologists, astronomers and even information theorists – don't really buy into it. RNA is a fairly complicated polymer made up of small repeating units called nucleotides, which have a complicated structure themselves.

"The question always is [then] where does something like RNA itself come from?" posits Shashi. "It's a little bit like kicking the can down the road."

Without explaining where RNA came from, the 'Genetics First' theory seems

like making castles in the air. It's hard to believe that RNA was able to polymerise without an amenable chemical environment, since the bonds between RNA nucleotides are fragile and get easily broken by water. By the time RNA emerged, 'life' was probably already quite complex and was sustained by networks of chemical reactions.

"The creation of life on Earth must have started with small molecules and simple chemical reactions interacting to form networks," says Subinoy Rana, Associate Professor at the Materials Research Centre (MRC), IISc. "About 4.7 billion years ago, the temperature and resources available may not have been favourable for the generation of genetic material first."

This other possibility is called the 'Metabolism First' theory. We live, breathe, eat and reproduce thanks to a series of chemical reactions which break down complex molecules and synthesise new ones. All of these chemical reactions together constitute our metabolism.

So then life probably began not with DNA, RNA or proteins, but with simple chemical reactions catalysed by networks of small molecules or rocks rich in iron sulphide minerals in hydrothermal vents deep under the sea. Imagine that there was a cycle of reactions, the product of one acting as the starting material for the next, ultimately looping back to the molecule it began from. This is a nice, closed, chemical system acting somewhat like a copying machine. Something like this could have rapidly given rise to a large number of molecules.

A lot of chemistry happening in the cell today is probably a vestige of these primitive reactions. The Krebs Cycle, for instance, is the reaction at the heart of breaking down glucose to fuel the cell, and many offshoots of this reaction are important in building proteins and other complex molecules. Some scientists think that a reverse version of the Krebs Cycle may have kickstarted life, with simple materials like carbon dioxide and hydrogen gas creating complex biomolecules, without the need for any enzymes.

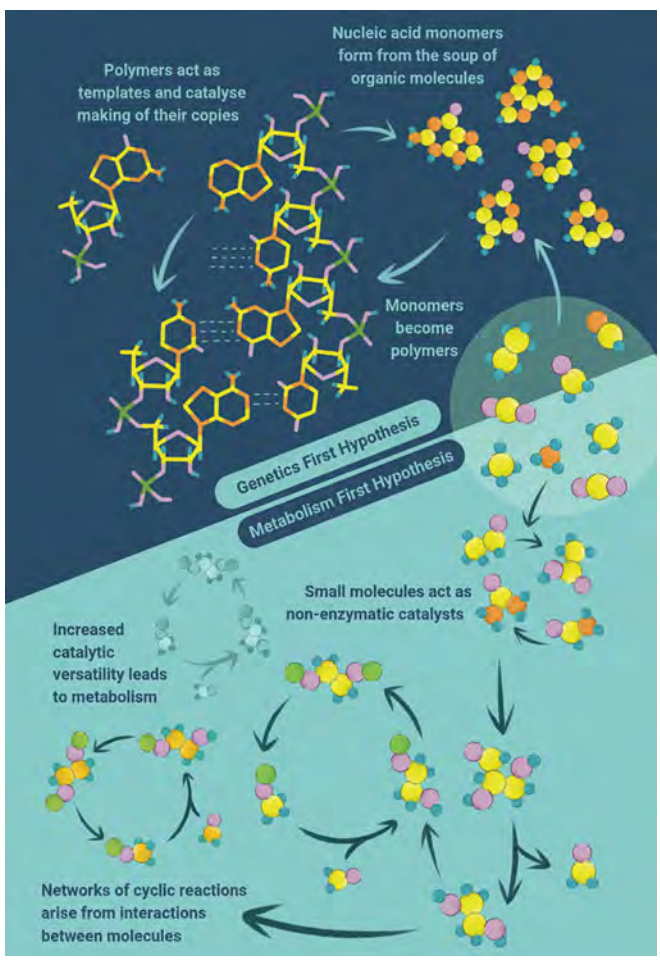


Illustration: Anushka Jain

Depiction of the two key theories surrounding the origin of life: 'Genetics First' and 'Metabolism First'

Naturally, molecular biologists aren't very happy with this theory. They find it hard to digest that metabolism could have just suddenly materialised without DNA and RNA, which currently regulate a lot of the cell's chemical reactions. And of course, this still doesn't explain how RNA came into existence.

A possible solution lies in what scientists suggest may have been an 'autocatalytic set' – a collection of mutually catalysing chemical reactions. The product of one reaction catalyses a second reaction, creating a molecule which can, in turn, catalyse the first reaction. This is a self-sustaining system and offers the possibility of rapidly generating more complex molecules, polymerising and even stabilising the first RNAs which could then control the chemical reactions – unifying the 'Genetics First' and 'Metabolism First' theories.

Which theory a scientist supports seems to depend on the way *they* approach the problem. "Given that I come from the physics way of thinking, where processes of self-organisation and pattern formation readily happen in physicochemical systems, I believe that there are things which look like metabolism even before those patterns start to get encoded in some material," says Shashi. "But who knows what really happened, right?"

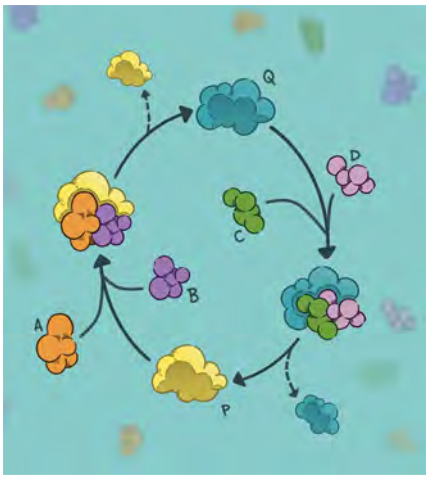
A warm little pond

It's hard to say what the Earth would have looked like four billion years ago, but scientists have made reasonable guesses. For starters, it would have been incredibly hot and there would have been no oxygen (because photosynthesis had not yet begun). The atmosphere was likely teeming with other gases like ammonia, methane, hydrogen, and water vapour. How did life emerge under these toxic conditions?

It was a question that intrigued naturalist Charles Darwin shortly after he published his famous book on the origin and evolution of species. Unsurprisingly, he was among the first to ponder on the question – something he had not explicitly addressed in his book. Darwin felt that at that point, science was not advanced enough to shed any light on how the first 'cell' came about. In a letter to his friend Joseph Dalton Hooker, a famous botanist, he said, "...it is mere rubbish thinking, at present, of origin of life; one might as well think of origin of matter."

But something probably changed a few years later because he wrote another letter to Hooker in 1871. "This is when I think modern views began to crystallise," explains Padmanabhan Balaram, former Director of IISc. "[Darwin] imagined that maybe life originated in a warm little pond which was filled with all kinds of chemicals. He realised that many elements were needed for making living organisms."

Illustration: Anushka Jain



Depiction of the autocatalytic networks hypothesis. The product of one reaction catalyses a second reaction which produces a molecule that can catalyse the first reaction, creating a self-sustaining loop

Our understanding today is that Darwin's warm little pond was more like a hot, boiling soup which eventually provided just the right conditions for life to evolve. But several pieces of the puzzle are still missing – life can't just come out of nowhere, since only living organisms can give rise to living organisms. The first 'living organism' – likely a single cell – was probably the result of a bunch of organic molecules coming together.

In the 1920s, Alexander Oparin and JBS Haldane popped into the scene with the idea of chemical evolution or abiogenesis – that life on Earth originated from simple inorganic molecules which reacted to form more complex organic molecules, somewhere in the boiling primordial soup. These could be either amino acids (the building blocks of proteins) or nucleotides (the building blocks of DNA and RNA), which eventually would have somehow polymerised to RNA and proteins.

This sounded sketchy and unlikely until Miller decided to take a bunch of inorganic gases in his huge glass apparatus and pass an electric discharge through it, attempting to simulate the extreme conditions on primordial Earth. It was good fortune that Miller decided to analyse the brown sludge instead of throwing it out. What he found were the amino acids alanine, glycine and aspartic acid – some of the building blocks of proteins – proving Oparin and Haldane's hypothesis once and for all.

What is life?

Miller's discovery and subsequent publication in *Science* in May 1953 was a huge breakthrough – it made the front pages of both the *New York Times* and the *New York Herald Tribune*, which are credited with popularising the phrase "the origin of life."

When most of us think about life, we think about our existence as living, breathing humans. But the origin of life isn't about the origin of human beings – that's what Darwin talked about in his book – it's about the origin of the cell. By looking at shared genetic material between organisms, researchers have traced our genealogy all the way back to a hypothetical organism they call LUCA – the Last Universal Common Ancestor, the original progenitor cell from which all life today likely emerged.

"LUCA is where biological evolution starts, and it already had all the biochemistry that is needed – but where did LUCA come from?" wonders Balaram. Understanding the origin of life – specifically, LUCA – appears to be a twofold problem. "A cell is a complex mixture of chemicals. A lot of chemistry or biochemistry put together gives us these magical cells, which seem to work wonders afterwards. Where did all these chemicals come from? That's chemical evolution, what Oparin and Haldane spoke of. Then you have this organisational problem of how you put all of that together. This is now the empty space of evolution."

To understand how simple organic molecules floating around in a primordial soup crossed the threshold from chemistry to biology, we first have to define what we mean by life.

Swan necked flask used by Pasteur

Image courtesy: Wellcome Images/Wikimedia Commons

Something out of nothing

Humans have been quite creative in coming up with explanations for the origin of life. Some believed that life hitched a ride on comets and asteroids in the form of spores which germinated once they hit the Earth. Others, like naturalist Georges Cuvier, were adamant that life kept getting wiped out and rebooted, courtesy of divine intervention or cosmic disasters – something he called the theory of "catastrophism."

The weirdest of all – and shockingly widely accepted – was the theory of "spontaneous generation," that life could just magically poof into existence. People observed that wounds of injured soldiers, when left untreated, got badly infected and even infested by maggots seemingly out of nowhere. There were all sorts of "recipes for life" – mice emerging from dirty laundry, flies from rotting meat and even frogs from mud – all resulting from overenthusiastic scientists drawing rash conclusions from innocuous observations.

This was the subject of an intense back-and-forth between scientists until French chemist Louis Pasteur came along. He boiled a nutrient broth in special flasks with long, curved necks that let air in but not dust and microbes – and no life appeared. He proved that rotting food wasn't conjuring up new life, it was just bad at keeping life forms like bacteria out. Once and for all, spontaneous generation was relegated to the great trash heap of bad scientific ideas.

Some scientists have taken a stab at this. In the mid-1940s, physicist Erwin Schrodinger delivered a series of lectures titled "What is Life?" which were later condensed into a book. Living systems, he suggested, should have the capability to reproduce and the "offspring" should have characteristics of the parents – genetic inheritance.

But it is not that simple. It's easy to come up with a laundry list of attributes – growth, metabolism, reproduction, evolution and so on – and say that a living thing should show all of them. There are always exceptions to every attribute that we can put down. For example, we intuitively think that an autocatalytic reaction network of molecules is not 'living,' but it turns out that it has most of the attributes listed above. So is it living or non-living?

However, there are some attributes that scientists now largely agree could lie at the heart of defining what life is. One of these is compartmentalisation.

The 'origin of life' isn't about the origin of human beings, it is about the origin of the cell

In a 2001 *Nature* paper boldly titled "Synthesizing Life", Jack Szostak, David Bartel and Pier Luigi Luisi at the Massachusetts Institute of Technology (MIT) suggested that early Earth probably had crevices or pores in rocks where molecules and reactions were cordoned off into compartments formed by the assembly of lipid molecules, or in aqueous droplets called coacervates. They added that this vesicle formation likely occurred between layers of clay minerals, which not only helped protect the molecules and reactions but also catalyse the latter. This, they successfully argued, was crucial for creating the first living system.

Why is compartmentalisation such a necessary feature of life? Even the most primitive cells have at least one boundary – the cell membrane – separating them from the environment. More modern cells have many small compartments called organelles inside which different sets of molecules form and react. The advantage of this separation is that they don't interfere with each other.

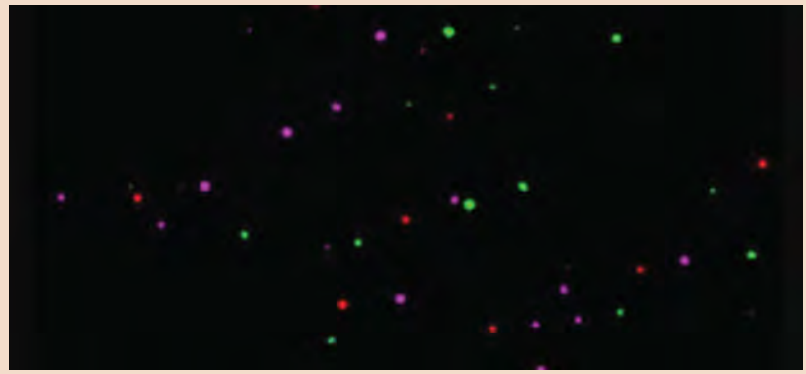


Image courtesy: Abhay Srivastava

Fluorescence image of three different coacervates interacting with each other

Encapsulating life

The cell membrane – an elegant bilayer of lipids with a water-loving head and a water-repelling tail – is a good starting point to think about what primitive compartments were like. In water, these lipids self-assemble into membranous structures called vesicles, sheltering a cavity where primitive reactions could have occurred. When they grow too big, vesicles can bud off and split into two – similar to how a cell divides. But vesicles aren't stable in the presence of ions like magnesium, which are critical for catalysing many biochemical reactions.

Enter coacervates. Similar to modern cell organelles, these are dense clusters formed by chemical interactions via a process called liquid-liquid phase separation (LLPS). This is similar to what happens when you put oil in water – you can see them as two separate, unmixed phases. Unlike vesicles, coacervates lack membranes but can still encapsulate biomolecules and reactions, making them intriguing candidates for primitive compartments.

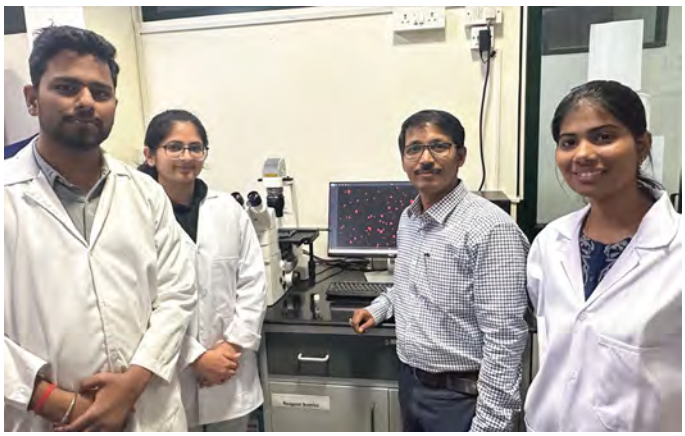
Shashi's lab has recently shown that autocatalytic RNA reactions can take place inside coacervates. Subinoy's team is similarly engineering protocells and prototissues using vesicles and coacervates. Beyond origin-of-life research, these structures are also finding applications in catalysis, sensing, bio-imaging, and drug delivery. Coacervates prove that compartmentalisation isn't just a relic of the past – it's a tool for innovation.

"We have observed that compartmentalised structures give rise to much higher rates of reactions – something called a proximity-enabled reaction," explains Subinoy. Reactions happen when molecules are close together and prone to colliding with each other. "Increased local concentrations in small compartments make many reactions that aren't feasible in the lab feasible in a cell, without the need for a complicated new enzyme." Scientists like Subinoy are exploring such self-assembled compartments to create artificial enzymes that we can use today.

Over the years, scientists have also turned to emergent properties as another important attribute of life. This revolves around a fundamental idea that "the whole is greater than the sum of its parts," something theoretical physicist Phil Anderson emphasised in 1972 in a *Science* article called *More is Different*. This is a common paradigm in biology anyway – cells come together to form tissues which have properties individual cells don't. Origin-of-life researchers expect that molecules which came together to form the first cell also demonstrated emergence. Emergent traits are not something you have designed into the individual molecule itself. They are unexpected properties that emerge from the interactions between molecules floating around in the soup.

Shashi reinforces this idea with an example. "I can build a robot which exhibits the properties of life. Imagine that I program it to get into a factory and make a copy of itself – I wouldn't call that living, because I had to tell it what to do," he says. "If the robot were to do this of its

Photo courtesy: Abhay Srivastava



Subinoy Rana (second from right) with lab members

own volition, that's an emergent property, and that's one step closer to being called 'life.'"

Mysteries remain

On a bright December morning in 2024, Juan Manuel García-Ruiz, a geologist at the University of Granada in Spain, was in his lab staring at a simmering mixture of gases. The setup was familiar to Stanley Miller's from over 70 years ago – a huge glass apparatus with two electrodes jolting the gases with artificial lightning. But García-Ruiz was not just trying to replicate the experiment – he was searching for something Miller might not have seen.

When he and his team peered into the vessel after the reaction was done, García-Ruiz probably expected the complex soup of organic molecules that formed. They isolated more amino acids than Miller had originally created, and even the five nucleotide bases found in DNA and RNA. But he also had a pleasant shock: tiny microscopic bubble-like compartments – protocells – had formed inside the flask.

The team was stupefied because not only were building blocks present, they were spontaneously assembling into structures that resembled primitive cell membranes. The main thing García-Ruiz had changed from Miller's experiment was adding silica – something that would have been found in the clay pockets of early Earth. This simple change had triggered the switch from chemistry to biology.

This new experiment challenged several accepted ideas about the origin of life. We used to think that the first protocells would not have been assembled until around 3.8 billion years ago, when environmental conditions became just right. But García-Ruiz's experiment indicated that this form of 'life' could have emerged as early as 4.6 billion years ago, during the Hadean era. Was the boiling soup of 4 billion years ago then not the right environment? It's the most recent example of how our understanding of the origin of life changes every single day, with every new experiment.

"Science is something in which you ask a question and try to find an answer by experimentation – and your explanations may change over time," says Balaram. "What somebody knew and understood about the origin of life 300 years ago may seem incredulous today, but it was wonderful at that time."

Who knows where we will be in 300 years?

Parth Kumar is a second year BSc (Research) student at IISc and a former science writing intern at the Office of Communications

(Edited by Ranjini Raghunath)

Image courtesy: NASA/Goddard/University Of Arizona

Mosaic image of asteroid Bennu

Life Beyond Earth

Was the origin of life unique to Earth, or could it have happened elsewhere? NASA's OSIRIS-REx mission recently returned with samples from the asteroid Bennu, revealing a treasure trove of biomolecules. Scientists isolated all five nucleotides found in DNA and RNA, 14 different amino acids, and a lot of ammonia and formaldehyde, which are key ingredients for complex chemistry. This confirms that the building blocks of life can form in space, reinforcing the idea that life's origins may not be limited to our planet.

This isn't the first time that space has shaped our understanding of life's beginnings. Decades after Miller's famous experiment, meteorites were found to contain amino acids and other organic compounds, proving that similar processes occurred in space. The Murchison meteorite, which fell in Australia in 1969, carried lipids that, as American biologist David Deamer demonstrated, could form vesicles in water. This suggested that early Earth could have had the right conditions for compartmentalised structures.

These discoveries raise an even bigger question: If life's building blocks are so widespread, could life itself be common across the universe? Astrobiologists are searching for the answer by identifying planetary environments that might support life, and by using biosignatures to detect traces of life. From the subsurface oceans of moons like Europa and Enceladus to ancient Martian riverbeds, the search for life is expanding beyond the Earth. If Bennu carried the same molecules that seeded life on the Earth, then perhaps life isn't a rare accident – it's an inevitability written into the chemistry of the universe.

Finding Love

- Sandeep Menon

The fact that IISc has produced several scientists over the past century is well documented. The less heralded though is that the Institute has provided a quiet backdrop for several people to find themselves and their significant others amidst the daily toil. These are some of their stories …

Photo courtesy: Meena Dayal

Dayal Padmanabhan and Meena Dayal met at IISc in the early 1990s

A campus marriage story

In 1990, Meena Varadaraj stepped into the High Voltage Engineering (HVE) office, fresh from completing her PUC. As her parents embarked on a search for a suitable groom, one familiar face emerged from the crowd – Dayal Padmanabhan, who worked in the Soil Mechanics lab at the Department of Civil Engineering. Their paths often crossed at IISc, thanks to common friends, and before long, they realised that marriage was simply a matter of time.

"For eight months before our wedding, we met every single day. It gave us time to talk, to truly understand each other," Meena reminisces.

The Institute, undergoing a hiring spree, was filling up with young professionals. Soon, vibrant groups of boys and girls formed, converging in cafeterias and coffee joints. Amid these lively gatherings, Meena and Dayal carved out their own moments. With no mobile phones or instant messaging, their time on campus was their only opportunity to connect.

Dayal, then living with friends in the city, was far from his family in Pondicherry. Seeing this, Meena began bringing him home-cooked lunches – a small yet meaningful gesture that spoke volumes about their growing affection.

"The girls would tease us whenever we were together," Meena recalls, with a smile. "We'd go for coffee with our groups, meeting at the Coffee Board or Kabini. Once, we both skipped work to catch a movie – only to run into my colleague at the theatre! We had to beg her not to give us away," she laughs.

Their journey took a new turn after they married in 1993. While Meena continued her career at IISc, moving from HVE to the Department of Physics and later the UG Office, Dayal's passion for cinema took centre stage. He had been ghost-writing for film directors, but his big break came in 2002 when his Tamil dialogues in Upendra's H_2O gained recognition. In 2004, he took the leap, leaving IISc behind to pursue filmmaking full-time. Today, he is a highly successful producer and director in the Kannada film industry.

"The time we spent on this campus was special," Meena reflects. "It's where we met, fell in love, and built our life together. Even our daughter spent her early years here, attending the Baby Care Centre until she was 10. Looking back, these memories feel like a beautiful chapter of our lives."

Photo courtesy: Meena Dayal

Dayal Padmanabhan, Meena Dayal and family

Photo courtesy: Nagarathna N

Nagarathna N and SV Gopalaiah at the start of their journey together after meeting in the early 1980s

A lifetime of happiness

It was the early 1980s when a young Nagarathna N walked into the Department of Electrical Communication Engineering (ECE) as part of a project administrative team and met SV Gopalaiah, a young faculty member in the department. Gopal had little to do with the project that Nagarathna was working on but the two kept crossing paths. The most frequent facilitator was the telephone, steadfastly rooted to the office rooms in anathema of the ubiquitous power it would soon become.

Nagarathna was the liaison between the phone calls and Gopal, frequently seeking out the latter. Oftentimes, Gopal would rush to speak to the caller, and when he was not around, Nagarathna would take the messages from Gopal's friends and family. It was a strange intimacy, Nagarathna getting a glimpse into the life of Gopal through the calls and messages. The two became friends and soon veered onto a path that resulted in a 42 year-long marriage and two children.

On the face of it, their story is just another meet-cute that leads to a happy ending. It is a yarn that has been spun repeatedly. But it is easy to forget how different the society was in the 1980s. The Institute was agnostic towards their relationship and their friends stood behind them. But some were unimpressed.

"In those days, things were not as open-minded," Nagarathna admits. "To some extent, there were a lot of people who were not comfortable with a boy and girl hanging out. Indirectly, they would discourage me, a little comment by one person on behalf of another, or a senior colleague suggesting that Gopal might ditch me and go. But we never cared, we ignored it."

The talk died down after they tied the knot in 1983.

"We stayed on campus for over 11 years. The children were free to go around. The Gymkhana would screen films, and all the kids would go there and one of the parents would accompany them. It was great," Nagarathna says.

Their relationship also left a deep impact on each other's careers. It was at Nagarathna's urging that Gopal pursued higher education. Her knowledge of the administrative labyrinth, as she was looking into student matters at the Institute, proved invaluable. "He was doing research while working. I was in IISc, and I knew how to help with admin stuff."

They charted their journey through the campus, Gopal retiring from ECE after a long and fruitful innings while Nagarathna taking voluntary retirement after having worked in the Centre for Electronics Design and Technology (CEDT, now DESE), the Deans' office and the Centre for Atmospheric and Oceanic Sciences (CAOS).

"Our time in Institute was a great one," Nagarathna admits coyly. "The campus was good to us. There were so many connections and friends ... it was wonderful. IISc gave me a wonderful career and a personal life too. I am very grateful forever to IISc."

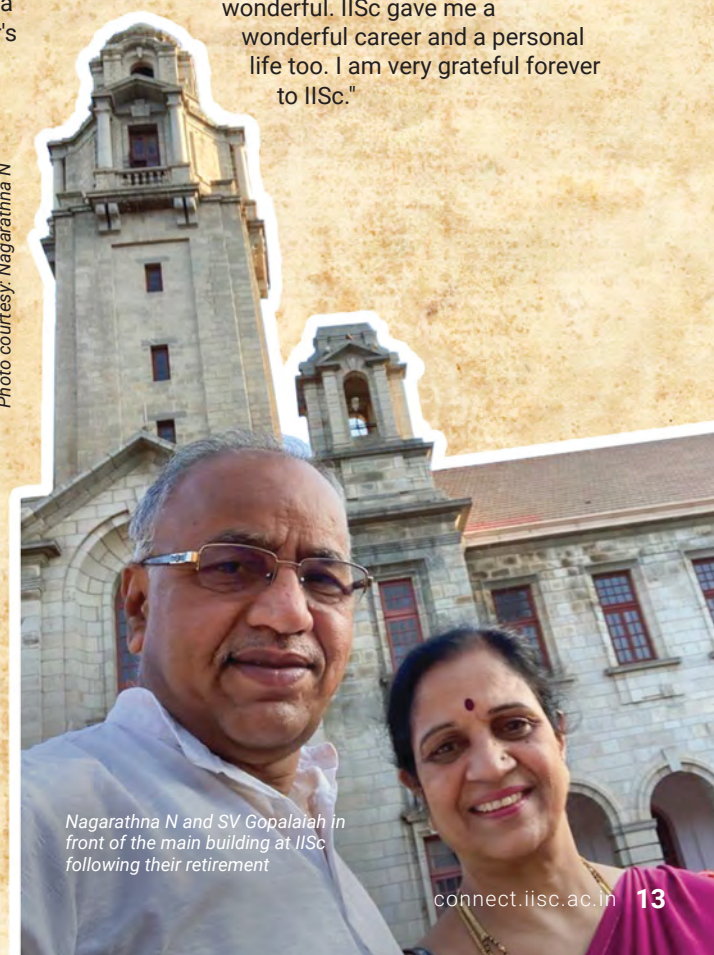


Photo courtesy: Nagarathna N

Nagarathna N and SV Gopalaiah in front of the main building at IISc following their retirement

Photo courtesy: MR Ravi

MR Ravi and Sangeeta Kohli during their time at IISc

Fighting for love

In 1990, the Department of Mechanical Engineering purchased computers to set up a lab. The Chairman summoned MR Ravi to help set up the laboratory after hearing about his proficiency with computers. Soon, a committee was formed, driven by students, to come up with protocols for optimal use of the systems. Ravi was a major part of that committee, as was Sangeeta Kohli, the only female PhD student in the department at the time.

"I was in IISc from 1984 as a Master's student and then continued for PhD, and Sangeeta joined as a PhD scholar in 1988. We had seen each other but met and started to have closer conversations only in January of 1991. We shared our issues and started relating to each other, and it became more than a friendship," admits Ravi, smiling through the computer screen sitting alongside Sangeeta, three decades later.

Within a year of being together, Ravi left to pursue post-doctoral studies in Europe with memories of shared time at the labs working on their projects, at the junkyard scouring for one thingamabob or the other for Sangeeta's project, learning to develop photography films and printing pictures in the dark room, and walks along Gulmohar Marg. "We had only had 7-8 months together. It was an intense time with work and everything," recalls Ravi.

They met again only in 1993 when Sangeeta graduated, their relationship progressing through correspondence, transitioning from letters to emails as the years went by. Upon leaving IISc, Sangeeta joined IIT Kanpur as a full-time employee, while Ravi joined as a visiting faculty in IIT Bombay. The next few years were spent navigating a career path to find their way back to each other. On a personal level too, there was much to conquer.

"We didn't know, when at IISc, if we were going to get married," admits Ravi. "There were always issues ... my family, being an orthodox Tamil Nadu family, were not in agreement and I didn't want to go ahead until I convinced them. Sangeeta's mother was okay, and her father had passed away. We even discussed giving it up." Finally, Ravi got the nod from his family, reluctant as it might have been. "Eventually, we decided to go ahead sometime in 1995 and finally got married in 1996."

Within six months of their marriage, though, everything smoothened out as Ravi's family fell in love with Sangeeta. Years later, Ravi's father admitted his folly and apologised for his reluctance towards his daughter-in-law too.

Married but living separately for over a year and a half, with Ravi now in IIT Delhi, Sangeeta decided to quit her job and join her husband. It was a tough call to give up a coveted position. Their quest to find jobs was made more complicated as they had similar specialisations. Sangeeta spent the next two-and-a-half years working part-time at an NGO and raising their firstborn before joining IIT Delhi in 1999. It was a gamble by Sangeeta, but one she felt she had to make. She even uses her life as a message for future generations.

"We were clear that we didn't want to stay apart for too long," she explains. "It is important to make short-term sacrifices. I made a hard decision to resign from a good position and I have never regretted it. I know friends who retired from Kanpur but always stayed apart [from their significant other]. Somehow, I am grateful that I got the inspiration to prioritise my family. For our son, it was important that we both were in the same place. Such things are more difficult these days because we are attached to our careers. Let us not hold on to careers at the cost of our family. In the long run, it is not satisfying."

Watching their smiling faces, it is hard to disagree.

Photo courtesy: MR Ravi

MR Ravi, Sangeeta Kohli and their son

Photo courtesy: Anindita Bhadra

Anindita Bhadra and Ayan Banerjee acting in their first play together at IISc called Parashmoni

Roles of a lifetime

The IISc campus is filled with memories for Anindita Bhadra. It is not the same campus that she walked into as a PhD scholar at the Centre for Ecological Sciences at the turn of the millennium. It has changed, evolving with time. She remembers sitting beneath the JN Tata statue in front of the main building and spending an entire night playing Laterals (a game where one makes a statement, and others must ask questions to learn about the backstory) with her friends and future husband, Ayan Banerjee.

Anindita was in her first year at IISc when the Bengali Cultural Association in the Institute, Spandan, was putting together their yearly Saraswati puja festivities. She was asked to partake in a play which was to be the headliner of the merriment. It was during the acting rehearsals that she met Ayan, who was five years into his PhD at the Department of Physics.

"That is where we met for the first time," Anindita says. The rehearsals offered the two time and opportunity to meet. They would wander the campus, walking to and from practising their craft. "Eventually, these walks and chats matured into a relationship," Anindita says. "Ayan used to live in S Block, so we would go on long walks down that road. It was lush green all around. We would also hang out at Tea board or Coffee board. Sometimes, we would sit in the Gymkhana ground. We were also often together doing theatre rehearsals."

When the couple decided to get married in 2003, the first person Anindita informed of her impending nuptials was her mentor, Raghavendra Gadagkar. Ayan was finishing his doctoral work at the campus and was looking towards post-doctoral studies in Germany when the two decided to tie the knot. As it happened, Ayan stayed back and took up a research job in the city.

"RG (Prof Gadagkar) and I were very close. Ayan and I wanted to take up the married apartment option (at IISc), so we decided that we would get our marriage registration done here before going back home for the wedding. We needed a witness signature to start the registration process, and I got it signed by RG," Anindita admits.

The couple moved into the Bhaskara studio apartment at the KV campus, and had their son while Anindita was completing her doctoral research. Once she finished her projects and coursework, at Gadagkar's suggestion, Ayan and Anandita applied to faculty positions at IISER Kolkata, where they have now been working for over 15 years.

(Edited by Abinaya Kalyanasundaram)

Photo courtesy: Anindita Bhadra

Anindita Bhadra and Ayan Banerjee at their home in Kolkata

‘I don't want to be “Durga”. I want to be Anindita’

- Ananthapathmanabhan

Anindita Bhadra, Professor at the Behaviour and Ecology Lab, Indian Institute of Science Education and Research (IISER), Kolkata, does not believe in glorifying women as multitaskers. A former PhD student at the Centre for Ecological Sciences, IISc, Anindita studied hierarchy in social wasps and later shifted to researching the behaviour of stray dogs in India. She set up the first-ever dog laboratory at IISER Kolkata, where she observes dogs in their natural environment to understand their behaviour – such as awareness about territories, gender dynamics in a group, and dog-human interactions. Later, she launched India's first citizen science programme to better understand stray dogs. Now, she is working to understand the impact of mass-feeding of dogs by humans in public places, among other things. She speaks to CONNECT *about her journey and views on being a woman in science, and advises aspiring scientists to "ask more questions." The text is edited for clarity and style.*

Photo: Rohan Sarkar

Anindita Bhadra at the IISER Kolkata campus

Could you recall your first visit to IISc?

A very typical Bangalore day in November 1997. Early in the morning, we reached the campus around 8.30 am and we were asked to wait at the main security gate, which has changed now. Then, somebody came from CES (Centre for Ecological Sciences) to receive us. From there, we could see the avenues in the distance, and the back of the tower, the main tower. I was absolutely taken in by the sights and the light drizzle and cold wind.

What were your favourite spots on campus other than the lab?

Jubilee Garden, which no longer exists, unfortunately. From CES, we used to go there for some of our coursework projects and I did one of my projects there. Later, I found myself going back there on and off, just to sit in one place, read, and walk in the wilderness. Then, there's the tea board and the coffee board, which again, unfortunately, no longer exist. We had a standard routine of post-lunch coffee at the coffee board and then a last one before the tea board shut down at 2 am. We had to run there and get a small snack if we were working late into the night.

The other place, again which no longer exists, was the path that goes towards the newer side of the campus. In fact, my would-be husband and I have spent a lot of time there. We would just walk down that path, stand in one spot, and talk. You could just go there and fall silent, with the crickets calling all around you and the trees rustling. During a sunny day, you could cycle down, make a round, and come back.

Sometimes, I don't even feel like going back because that nostalgia has no connection now; all those places have become so transformed; some for the better, of course.

The last time I went, I saw that what used to be Janta Bazaar is now a complete shopping complex. It has, of course, become much more expanded and posh. But I guess a lot of us older people don't get the same vibes in IISc anymore. That is something we miss.

> ***The first thing that RG told us was to never accept anything as given just because it's in the textbook***

At CES, you were working with Raghavendra Gadagkar (RG), a behavioural biologist. How did working with him shape your philosophy of science?

He has been a profound influence on my life and my way of thinking. Because mostly, in our standard Indian system of education, science is taught and studied like any other subject. You don't really go through this process of asking a lot of questions and exploring. The first thing that he told us was to never accept anything as given just because it's in the textbook. And to always ask questions, and keep asking questions, which I think has been a really deep influence in my life. I keep saying that to all my students in class. I have also inculcated this in my life when bringing up my kids.

Rather than saying that this is not going to work, he would always say, "I'm sure we can find a solution to this problem. Let us not worry about it first."

I really look up to him as a role model; nobody can be like him. I have high esteem for the way he does research, the way he teaches, and the way he looks at science, philosophy, and life in general.

You started your work by understanding the "Politics of the Social Wasp *Ropalidia marginata*". How does someone study the politics of wasps?

I was trying to understand, when the queen wasp is removed or dies, how does another wasp take over as the new queen? We already knew that if you experimentally remove the queen, then one of the workers suddenly becomes very aggressive.

She will go around and beat up everyone in the nest. If you don't put the queen back in five to seven days, this worker will become the queen.

We can only identify this "potential queen" once we remove the queen, but how do we know her in the queen's presence? I was trying to add to that puzzle.

How did you crack the puzzle?

Several of my seniors concluded that there's no way to tell the potential queen apart from other workers because they all look and behave the same. I turned the question around and said, "Well, *we* don't know who the potential queen is. But do the wasps know?"

So I did a set of experiments to answer this question, and eventually what we showed is that the wasps actually know that there is an heir designate (potential queen). I called her a cryptic successor – cryptic to us but somehow known to the

Photo courtesy: Geetha Gadagkar

Anindita with her mentor Raghavendra Gadagkar at the Being Social conference, IISc, in June 2013, which she organised on his 60th birthday

wasps. I also showed that the queen uses a pheromone to make her presence known to her workers.

Later, you shifted your research area from wasps to dogs. How and why?

After my PhD – I submitted my thesis on my son's first birthday – there were other experiments on which I was working, which were not part of my thesis. RG told me, "Whenever you submit your thesis, you can join as a postdoc."

The day after submitting my thesis, I joined as a postdoc. I was also thinking of the next steps. I was very sure that I would not be working on social insects because I told RG, "I keep looking at the literature and I keep finding faults with other people's work. Now, if I have to go and apply to those labs, I cannot say I find their work fantastic because often I don't."

This was the time when the IISERs had started in 2006, and I submitted my thesis in November 2007. So RG said, "You could think of applying to the two IISERs (Kolkata and Pune) as they are also taking fresh PhDs in contractual positions." That is what got me thinking, and I came up with proposals: One was on dogs, the second was on crows, and the third was on human babies and their cognition.

> ***If, as a policy, we can prevent people from interfering too much with dogs' lives, it's going to solve a lot of problems***

We had a lot of discussion and decided that finding enough students interested to work on crows would be difficult, and crows are difficult to access. In India, we will not easily get ethical clearance for working on infants, for those who don't have a psychology or psychiatry background.

And anyway, dogs are my favourite animals, so we boiled down to dogs.

In a recent study (December 2024), your group has looked at understanding ways through which dogs mark their territory. How did the idea occur to you?

We know that dogs mark territories. In the case of stray dogs, there is a lot of noise in the environment because of humans. For example, when we park a car and leave it there, a dog might find shelter under our vehicle, near the tyres or something like that. Later, when we come back, kick or shoo the dog away, and take our car to go somewhere else, the dogs in the new area might sense the smell of a different dog in their territory. There are a lot of such disturbances. My student has observed that one dog will come and mark the territory, then another dog will come and mark over it. Then the first dog will come and mark again. We got interested in this behaviour and decided to collect data as it happens.

Photo: Milind Kolatkar

Anindita at work in the lab in 2007

How was this experiment done on stray dogs?

My students would wait to see a dog urine-mark in its territory and collect the urine by soaking a clean white cloth with it. They would then introduce this cloth to either the dogs in the same territory, or a neighbouring one. We wanted to see – if the white cloth has marks from dogs from different territories, will the dogs behave differently?

And what did you find?

We found that male dogs have "more ego"; they are more active in their response towards other males from other territories. That is the hierarchy. Female dogs respond more to other females than males. So, we are saying that yes, the marking does have signatures of the group and of the gender.

Given the growing issue of stray dogs going violent and becoming a public menace, what can we do about this?

At the end of the day, if as a policy, we can prevent people from interfering too much with dogs' lives, it's going to solve a lot of problems. But people are going to kill me if I say that aloud. I get into fights all the time over this. In fact, right now, we are doing one study where we are trying to look at whether people mass-feeding dogs affects the animals' social interactions. My feeling is that they do. I hope in another year or so we will have some results.

How so?

Simple ecological perspective. If there is a lot of food, animals are going to come, and if you keep increasing the amount of food, then there are more animals to feed. They'll never migrate. You'll have a lot of dogs in one place, and the dogs have nothing to do. They don't go out to the gym. They don't have to look for food. They just sit and fight among themselves. What else do they do?

Let's move away from research and onto another topic that has been in the spotlight: Women in Science. What are your views on the present situation in India when compared with the global scenario?

It is equally bad. In some cases, we are better in the sense that at least here we don't have the problem of dealing with unequal pay for women in our sector.

Whereas, I know colleagues in other "developed" countries who do have this problem. We have an institution, Government of India regulations, then we have – I think – very good support in terms of maternity and childcare leave.

But when it comes to prejudice such as girls and women leaving science because of all kinds of societal pressures, we are in a bad position. If you look across the country, I think women professors in India are somewhere around 13%.

Whereas, if you look at school pass-outs, it is 50:50 for girls and boys; then, girls taking up science reduces in the 12th grade and falls further when you go to graduation. And I have heard over and over again that maths is something that girls are bad at, and biology is something that girls are good at, or girls cannot do physics.

These prejudices can tailor the girl's mind to avoid certain subjects.

Next, when it comes to science, often families would say, "How can you now go off to do a PhD somewhere else? If you are doing a PhD, and you get married, what about your family, your husband's family?" Sometimes, someone else puts pressure on you to have children, or women themselves want to have a child, and the biological peak age coincides with the peak age of the PhD, then often women make the sacrifice and drop out.

When you have female faculty chatting over tea, you will most often hear them talking about childcare and elderly care.

Whereas, with the male faculty, you will mostly hear them talking about cricket, politics or about their research, collaborations and grants. It is just that the social burden and responsibility falls more on the women in our country than on the men.

I feel really irritated by this praise that if we can manage everything, we are called "Super women", "Super Moms", "Durga". I don't want to be "Durga". I want to be Anindita. I'm fine and I only have two hands. I will multitask if I want to, but I do not like it if I am made to.

> ***"Just because I am a scientist, I am not secluded from society … You cannot just absolve yourself by saying 'I am a scientist, so I don't think about politics'"***

What is the solution?

I always say that the solution is to catch the young and mould their thinking. That is why we need to do more and more outreach with school kids and influence them. Give them good role models to look up to.

At a policy level, institutions should have a much stricter policy on handling situations of discrimination or subtle creation of pressure by a supervisor saying: "You have to come on the weekends, I don't care if you're married." Or a supervisor having a relationship with a student. I do not care if it is consensual; it is not allowed because there is an imbalance of power.

Photo courtesy: Anindita Bhadra

Anindita with school children at a 'Nature-watching like a Scientist' workshop at IISER Kolkata

On a lighter note: To me it feels like (few would disagree) you are doing a lot. Still in your blog "KathayKathay," you have mentioned that you have a "lazy mind." Why do you think that? I am curious.

(*Laughs*) When I say lazy mind, it is more in a figurative way, where a mind is free to wander and do nothing. Even when actively doing something. My mind is free to do other things. Let me clarify, when I say lazy mind, I did not refer to my brain. Mind is something more abstract, right?

That's another conversation altogether, we should talk about it some other time. For now, only a few scientists are comfortable talking about politics, especially in public. What are your views on the political responsibility of scientifically literate folks?

Yeah, we have a strong responsibility towards society. Just because I am a scientist, I am not secluded from society. You cannot take politics out of society, and often politics and policies influence the kind of research a country moves towards. I am not saying scientists should go into active politics, and if they want to, they are most welcome. Unfortunately, power, money, and everything is in the hands of politicians. You cannot just absolve yourself by saying that I am a scientist, so I don't think about politics. We should think and talk about it more; speak our minds without fearing that action will be taken against us.

It might be a cliché question to end with, but still, what advice would you have for young people who aspire to be good scientists?

Never stop asking questions and never stop challenging beliefs.

Will that advice be any different to a female science aspirant?

No, no, no. I think females should ask more questions than males because they will be told: "you cannot do this, you cannot go there." I think the main thing is to believe in yourself. Once you do that, you will go wherever you want to go.

(Edited by Rohini Subrahmanyam)

The STEM Ceiling

- Pratibha Gopalakrishna

Scientists on how they are navigating biases and challenges

Photo courtesy: Sandhya Visweswariah

Sandhya Visweswariah with her lab members

Sandhya Visweswariah grew up in different parts of the world before beginning her academic journey in India. She completed her early schooling in England and her O levels (equivalent to 10th standard in India) in Zambia. Then, Sandhya came to India for her undergraduate studies at Osmania University, Hyderabad, her postgraduate at IIT Kanpur, and her PhD at IISc.

After doing industrial research at AstraZeneca and realising it was not her cup of tea, she joined the Department of Molecular Reproduction, Development and Genetics (now the Department of Developmental Biology and Genetics) at IISc as an assistant professor in 1993. Her 32 years at the Institute researching cell signalling and communication have been immensely satisfying. "I have had great students and colleagues throughout my career which has made it possible for me to do the science that I've done," says Sandhya.

As a woman faculty member, Sandhya has faced her share of hurdles and gender bias. One irksome experience that she has consistently dealt with is being addressed as "Dear Sir" in emails even within IISc. Initially, she brushed it off. After some time, however, she started to reply: 'Please do not write Dear Sir since I do not read those emails. There are women faculty on campus. Write Dear Sir/Madam or just write Dear Professor.' "Sometimes, I've even replied 'Does this apply to me? I am not a Sir,'" she says, laughing. Such oversights are not as common in other countries where researchers and staff receive regular training on communication etiquette, she points out.

Sandhya also tries to recruit more female students and researchers into her lab. "The ratio of men vs women swings on and off but there is a conscious effort from my side to try to maintain a 50-50 ratio."

Sandhya is one of many women faculty members across India and IISc who have had to contend with challenges that arise outside of the research that they do. In recent years, there have been increased efforts to boost the number of women pursuing STEM careers, sensitise researchers on the need to avoid gender bias and "manels", and provide institutional

support and policies for women faculty members and students. For many women, however, gender bias is still an everyday battle, hampered by the rigidity of social norms that are slow to change.

"Unfortunately, the role of a woman in India is still considered to be a good wife and a mother in many sections of society," Sandhya says. While this may be true for women in other countries also, many have greater choice, freedom and flexibility in professional settings with supportive resources and facilities like daycare centres. Things are improving here too, she says. Daycare facilities at IISc, for instance, were started about seven years ago. Initiatives have been started to support women researchers like stopping the tenure clock for women faculty who have children during their tenure, and extending maternity breaks for students.

Sandhya feels that similar initiatives are needed across all Indian institutions. Scientists and administrators must also realise that hiring more women brings something diverse and valuable to the scientific community, she adds. "If the calibre of the two candidates is the same at the time of recruitment, pick the woman," she says.

When Madhavi Latha Gali joined the Department of Civil Engineering at IISc in 2004, she was its first female faculty member. After completing a PhD in civil engineering at IIT Madras, a postdoc from IISc, and a year-long stint as an assistant professor at IIT Guwahati, she came back to IISc to share her learnings with aspiring civil engineers. "It was not as easy when I joined as it is today," she recalls.

Back then, there were no exclusive toilets for women in the department. There were only men's toilets. "I had to really fight to get a women's toilet for the geotechnical engineering building," she says.

Today, Madhavi, who is the Chair of the Centre for Sustainable Technologies (CST), is happy to note there are almost as many female students as males in the department. "I would say the ratio is 40-60," she says. Over the years, she has tried to make her lab more inclusive for her female students, for example, by making helpers assist women students in experiments that require heavy lifting so that they can keep pace with male students. Her door is always open for female students to share their concerns, she says. "Being a woman, I make sure I understand what they need."

Sending female students outside for fieldwork also poses challenges, especially when it might require a few days' stay on site. "The conditions at the site are not typically conducive for female students to stay," she says. These can be remote construction sites with less accessibility to resources and poor safety.

> ***"Being a woman, I make sure I understand what female students really need"***

Madhavi herself has travelled extensively for fieldwork to inspect various project sites including rock slopes, underground mines, and tunnels. She says she's experienced subtle biases that seem innocuous but stand out all the same. For example, when she was in Jammu to carry out a site inspection for the Chenab railway bridge project, she was constantly told to "be careful" and several people tried to assist her when she was climbing hill slopes. Madhavi realises that most of them were probably not doing this deliberately, but were simply unaware of their own biases.

Photo courtesy: Madhavi Latha

Madhavi on site at the Chenab railway bridge project, Jammu and Kashmir

Photo: KG Haridasan

Purvi Gupta in her office at the Department of Mathematics

Purvi Gupta enjoyed solving problems right from her school days.

After obtaining a Bachelor's degree from Saint Stephen's College, Delhi, she joined the integrated PhD programme in Mathematics at IISc but moved to Ann Arbor, Michigan to pursue her doctoral studies after obtaining a Master's degree from IISc.

As an assistant professor in the Department of Mathematics, IISc, Purvi reflects on how her understanding of what it means to be a mathematician has evolved over her journey. "In the beginning, you imagine you're going to prove many new theorems, and have a new idea every day," she says. But, nowadays, a large part of her day is devoted to understanding others' work. "There is so much that we don't understand," she says. Purvi also enjoys teaching maths and giving talks.

It is during the latter that Purvi recalls facing some instances of subtle discrimination. For instance, after giving some talks, she has received comments about her physical appearance rather than about the talk itself. "In any other context [this] is already unwelcome, but in a professional [setting], it is even more so," she says. Sometimes, Purvi calls people out for their inappropriate comments. She also points out that some people mean well and do not realise what they say is unprofessional. "The gap in their understanding of these things is so wide that I don't necessarily think it's their fault," she says.

Having open conversations about such things can help, she feels. She says that students today are more aware about the language related to discrimination, which wasn't the case earlier. However, their understanding of these matters may not always be based on lived experience. Nevertheless, she finds it heartening when students walk into her office and use the right words and etiquette.

Purvi has also observed how analytical and theoretical disciplines are assumed to be male domains. Several studies show that students tend to take women professors less seriously than their male counterparts and the difference is starker in such disciplines, she points out. "I think the bias is then compounded by the fact that you don't see [many] women in these fields. It's sort of self-fulfilling," she says.

One factor that may cause women to drop off from their careers, Purvi says, is social responsibilities. Even in fields like mathematics that do not involve experimental work, a lot of mental space and time is greatly needed to theorise.

> ***Students today are more aware about the language related to discrimination***

On a positive note, Purvi says that many of her colleagues do want a higher representation of women at various levels in the Institute. "For instance, celebratory messages are exchanged if, some year, an unprecedented number of women enroll in any of our programmes."

Photo: Abinaya Kalyanasundaram

Shefali Srivastava, Integrated PhD student in Physics

Looking back, Shefali Srivastava feels that she was rather lucky to have a family that supported her academic journey, including her grandparents. “My grandfather has a PhD in philosophy and my grandmother has a double MA. They are very well-read,” she explains. After her Bachelor’s degree at Banaras Hindu University (BHU), Shefali came to IISc to pursue her Integrated PhD. She approached Prerna Sharma at the Department of Physics for a project and has continued her PhD in the same lab. “She encouraged me a lot … and said, ‘we will do physics that is different from what you do and see now.’”

Shefali is grateful for having a female PI (Principal Investigator) and supportive lab mates. It is particularly helpful when she gets painful menstrual cramps every month. “If I don’t take painkillers and try to work, I faint,” she explains. Taking this into account, she plans her experiments such that for the first two days of her cycle, she can rest. She has support from Prerna, who does not ask for her reports during those two days. “I am privileged because my PI is a lady.”

She recounts stories of other female students who feel shy or awkward to divulge this information to their PIs. She questions the overall taboo around talking about menstruation, even within the family. “It is 2025. You should be able to talk about this, right?”

While there is talk of menstrual leaves in the workplace, Shefali feels that there should be a general humanitarian leave for female students who are doing their PhD and lab work. Other PIs should also understand that certain behaviours like mood swings or inability to focus may be because of hormonal issues. Simple steps would help, Shefali points out, like setting up more sanitary napkin dispensers in all departments.

One thing that Shefali is not worried about though is safety. When she walks back to the hostel from the lab late at night, she sees a security guard present every few hundred metres. “I am [also] glad that guards check IDs for entry into the campus,” she says.

Issues that women deal with in labs and academic spaces are derivative of larger social gaps present in Indian science, according to Aashima Dogra, an independent science journalist and editor. Early on in her career, she noticed that most stories she worked on had the same template with men as heroes. Aashima and Nandita Jayaraj, her colleague and ‘partner-in-crime’, set out to search and share lesser-known stories of women researchers on a science media platform they started, which recently spun off as the book *Lab Hopping: Women Scientists in India*.

Aashima believes that the poor representation of women in STEM is only one part of a larger problem. “When young women enter these labs, the odds are stacked against them,” she points out. In their work, the duo come across several stories, incidents, and confessions from scientists and students about how academic labs are run, and the kind of challenges, large and small, that women face. “It's not necessarily true that a male scientist will run a bad, non-inclusive lab and a woman scientist always runs a great inclusive lab,” Aashima says.

One way to fight invisible systemic barriers, according to Aashima, is for the PIs to be vocal about being inclusive. This could be through watching out for opportunities that women are passed over for, conducting bystander training for students on witnessing harassment and how to report it, and ensuring that lab members are aware of the Internal Committee Against Sexual Harassment (ICASH) composition and guidelines at the institute.

> ***One way to fight invisible systemic barriers is for the PIs to be vocal about being inclusive***

More importantly, PIs should also follow up on their inclusivity initiatives and efforts over extended time periods. Crucially, institutions must also step in by enforcing inclusivity guidelines, collecting diversity data, and providing support and understanding to many women researchers, who struggle to juggle research with societal expectations. As Aashima points out: “For example, a promising PhD student might have three children, hence may require some extra flexibility in the lab to thrive in their research.”

(Edited by Abinaya Kalyanasundaram, Ranjini Raghunath)

Photo courtesy: Aashima Dogra

Science journalist and editor Aashima Dogra

CONNECT ASKS

What is your favourite spot on campus?

I really like the library, especially the first floor. There is some story there (*laughs*) but I don't think I will share it now. I feel good at the library, it is serene and quiet. I go there and sit and read and also do my work there.

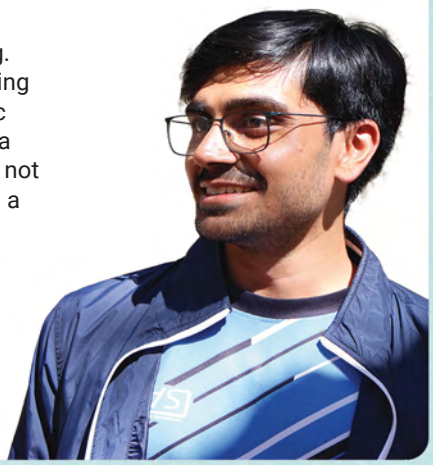
Simpa Biswas
PhD student, Department of Organic Chemistry

Jubilee gardens! I love the silence and the natural untouched scenery. It used to be a garden earlier and has now overgrown into a forest. It's very beautiful. I visited it in the first few days I was on campus, last August, and I love going there often.

Shashwat Chauhan
BSc (Research) student

The rooftop of the IDR building. You can see a nice view standing there – the greenery of the IISc campus and then outside it is a concrete jungle. The terrace is not open but the seventh floor has a good view. My lab is in the building so I go there often.

Ratnangshu Das
PhD student, Robert Bosch Centre for Cyber Physical Systems



I like going for a run in Gulmohar Marg, around the mini forest. You get to see people around, so it's nice, especially in the evenings and nights when there are fewer vehicles. I started running in my second semester, so it has been more than a year now. The track is also a nice place to run but I feel bored there sometimes. I also usually hang out at Sarvam complex, after lab, at night with friends.

Sochannao Machinao
PhD student, Department of Physics

I like the athletics ground. I go running, round and round the tracks. Other people are also running, and I like it because seeing them run keeps me motivated too (*laughs*). Another place I like is in front of the main building, because there are trees on both sides, it feels nice.

Laldawmsang Pulamte
Integrated PhD student, Department of Mechanical Engineering

Behind the statue of the Main Building, there is a walkway with flowers on both sides. If you go there early in the morning, around 4 or 5 am, you can hear a lot of birds. You can just go sit down and close your eyes, it is so peaceful. If you go late at night, you can hear crickets and other insects too, I love it. I keep odd hours, so once when I was returning from the lab around 3 am I heard it for the first time, and since then it has become my favourite place.

Shreya Banerjee
Integrated PhD student in Chemical Sciences

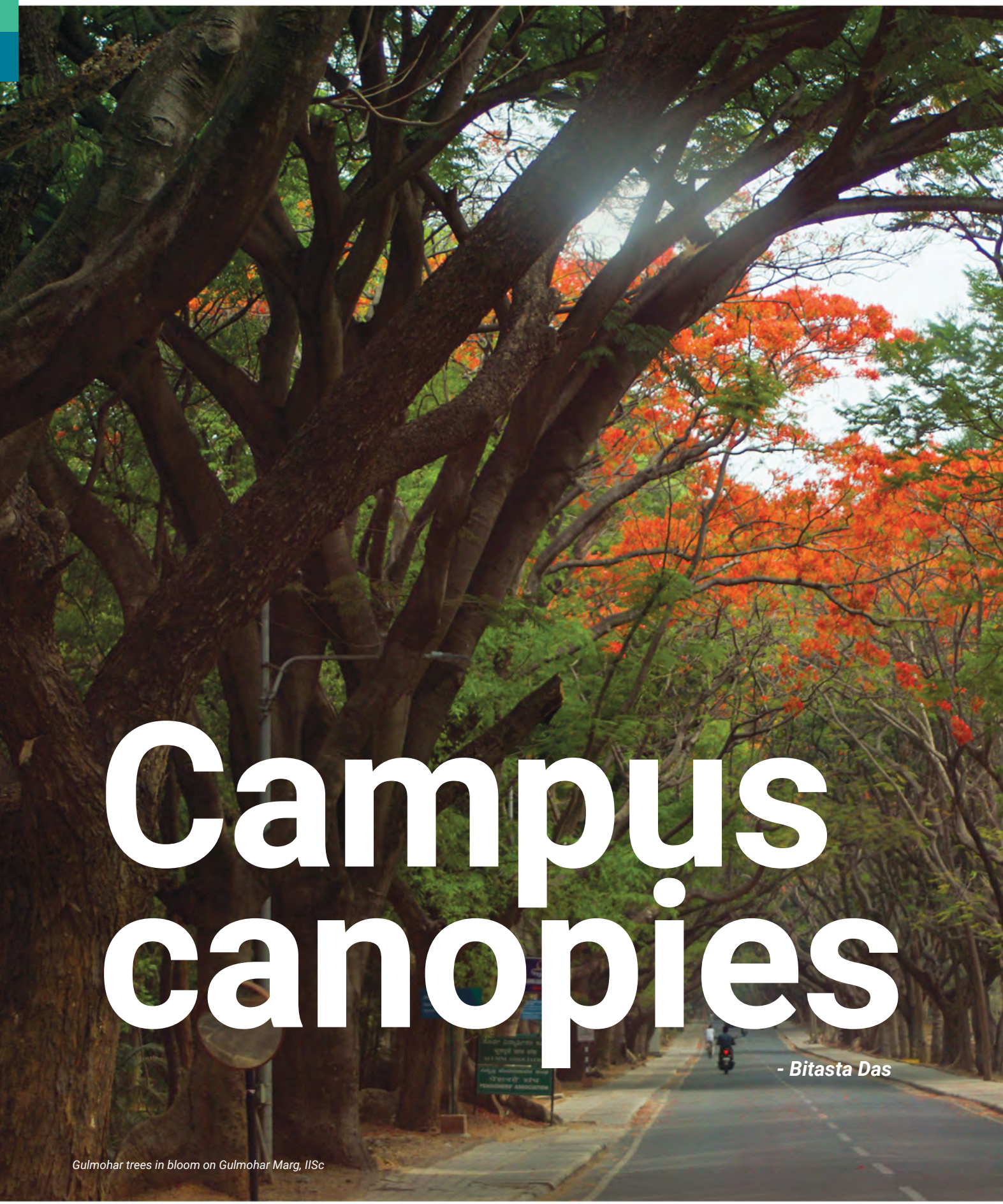
The garden nursery is a nice place to hang out in. There are a lot of snakes around there, it is interesting.

Rishi Dutt
BSc (Research) student

Sitting opposite the Main building, next to the statue, is an all-time favourite. Then there are the huts around the Sarvam complex. We also like the Janta Bazaar terrace; we take tea and go up and sit there. We also like the way to the aerospace building, from the biological sciences building. It is really good, no people around there, and also the canteen there is good. We like walking in Gulmohar Marg when it starts flowering, about now in March and April.

Sneha V
PhD student, Interdisciplinary Sciences

Heeba Anjum
PhD student, Interdisciplinary Sciences



Campus canopies

- Bitasta Das

Gulmohar trees in bloom on Gulmohar Marg, IISc

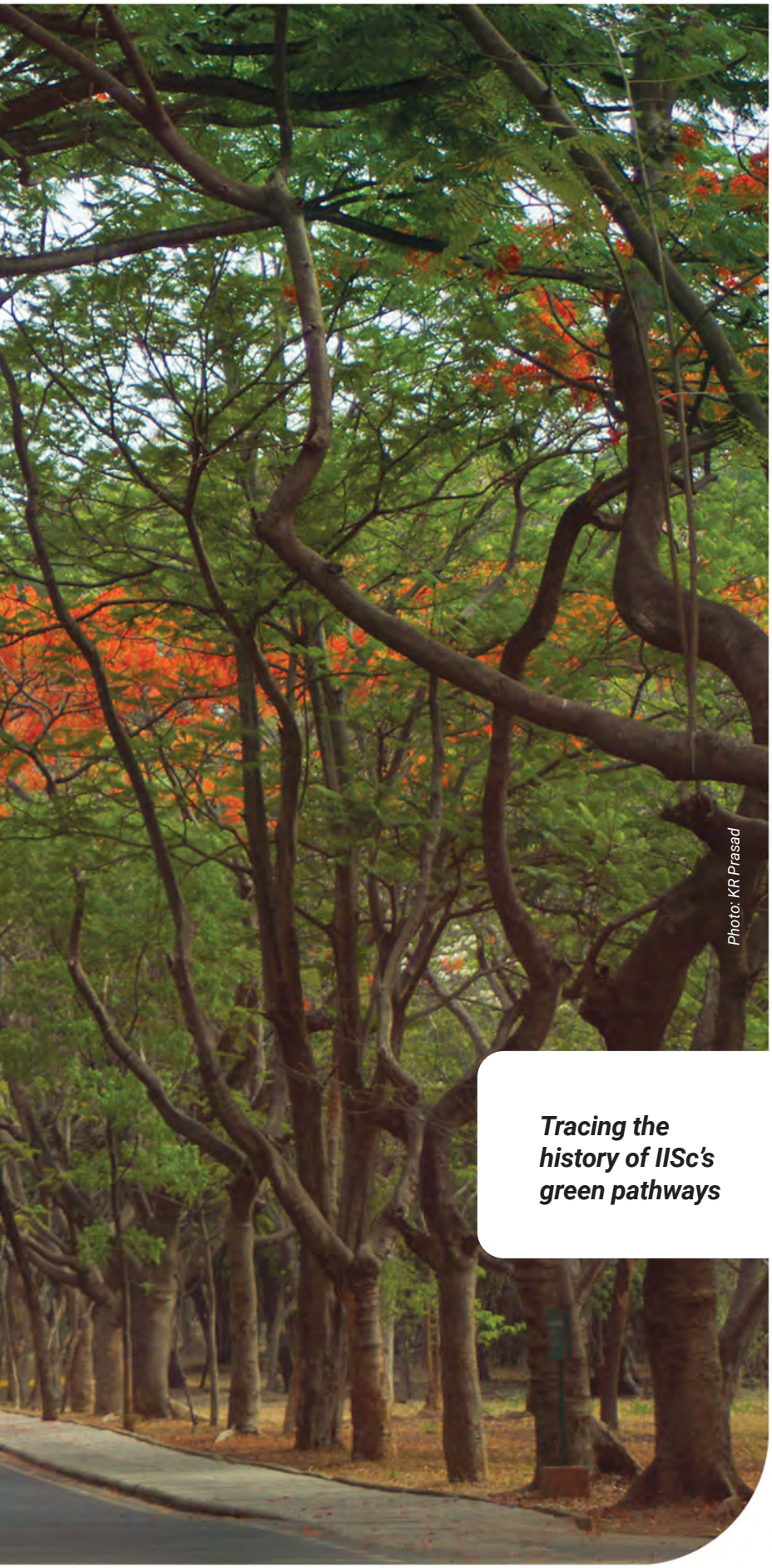


Photo: KR Prasad

Tracing the history of IISc's green pathways

While casually strolling through IISc roads, one simply needs to look up – to be immediately immersed in the sight of the soaring avenue trees. Vibrant-hued seasonal flowers bloom on them as they merge into canopies, creating a breathtaking vista throughout the campus.

The vibrant greenery of the campus is not only a captivating sight but also a botanical treasure trove. IISc is home to an array of rare and magnificent flora, be it in the wild and untrimmed spaces, the well-groomed department gardens, the thriving "miniforest" or the towering trees that line the lanes. But the campus roads didn't always look like this.

"It was an A-shaped area of rough jungle country, sparsely covered with scrub and trees, and about half a square mile in area," writes IISc's first Director Morris Travers in his autobiography *Morris W Travers: Scientist and Pioneer: An Autobiography*. He was describing his maiden visit in 1907 to the site where IISc now stands. "It was a beautiful site, but it would have to be completely cleared of jungle vegetation and replanted. This was done later." The terrain must have posed a significant challenge to navigate, as he later writes that he bought two horses named Marvel and Peter Pan for making his visits to the site.

A century on, IISc's campus is a verdant landscape, celebrated as Bangalore's green lung. Spread over 440 acres, the vegetation includes numerous small and large trees, both wild and cultivated, belonging to local as well as exotic species. Some trees on the campus are over two centuries old and predate the Institute's establishment.

Sowing the seeds

As the Institute took shape, it became increasingly adorned with plants and greenery. Travers writes, "In Bangalore, a couple of coolies had looked after the garden, but now I succeeded in securing a head 'mali' who really was a gardener. He had been trained under a German, Krumbiegel, superintendent of Lal Bagh (Red Garden), the city garden, a very able horticulturalist and botanist. My new head mali knew the scientific name of every plant in the garden. The

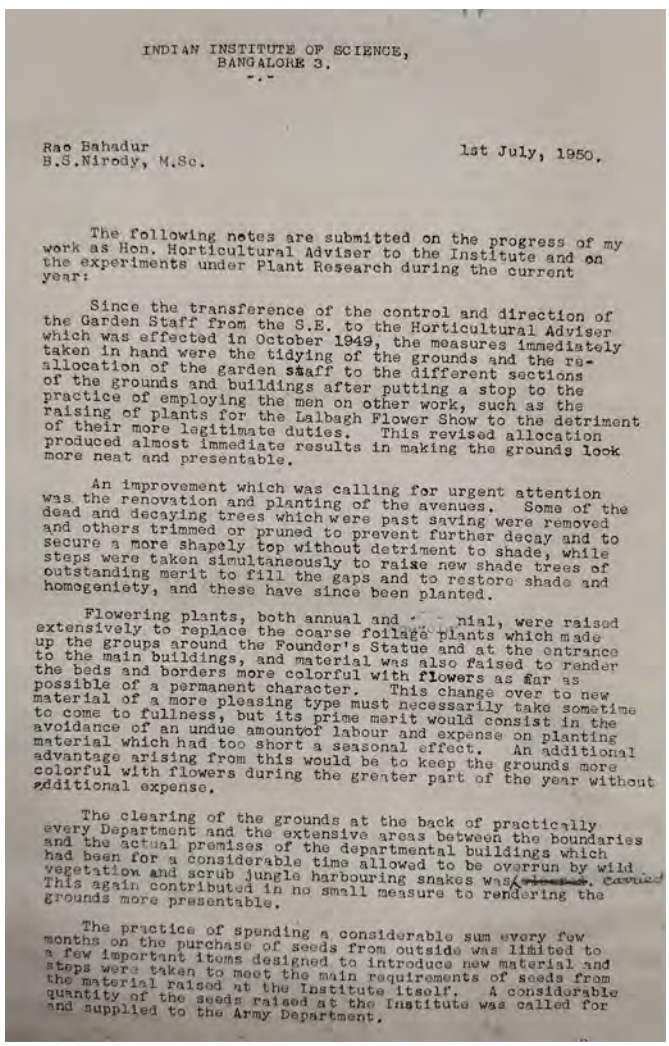
procedure by which he passed the information to me was a little complicated. I wrote down in my pocket book the name as he pronounced it, with a description of the plant. Then, when I met Krumbiegel, I gave him my notes, and as he, as a German, pronounced Latin differently from me, I had to ask him to write the true name down for me."

The Institute had already begun to set a budget aside for the care of the gardens during the initial years of its inception. The Annual Report from 1911-12 reveals that the budget estimate under "Salaries and Expenses of Sanitary and Medical Department including Care of Grounds" was Rs 1,501, which was earmarked for compensating the "Gardener, Malee, Watchman, Sweepers, etc."

The German botanist and garden planner, Gustav Hermann Krumbiegel – whom Travers referred to in his autobiography – is credited to have made a significant impact on the microclimate of Bangalore. He not only developed the Lalbagh Botanical Garden and several other spectacular green spaces in the city but also planted the seasonal blossoming flower trees on the streets of Bangalore. Besides these, he has played a pivotal role in shaping the avenues of IISc as well. "He was the first person to introduce the major trees that we see today, like the Gulmohar, Jacaranda, Ficus, and so on," says B Sridhar, former horticulturist of IISc. At the request of the Institute's management, Krumbiegel helped plan the landscape of the IISc campus during the initial years.

In the 1940s, systematic planning and extensive plantation commenced when the "Building Committee" was reorganised to form the "Building and Gardens Committee". This was also the time when Rao Bahadur BS Nirody joined the Institute as an honorary horticulturist. He was a great plant enthusiast with immense knowledge about growing and nurturing them. In 1950, a large-scale plantation drive was conducted under his guidance and 180 woody trees were planted on the campus as part of National Plantation Week. His report to the Director on the plantation activities on campus describes the detailed work that was undertaken at that time, including discontinuing the practice of deputing IISc's employees to Lalbagh, planting avenue trees, replacing coarse foliage with flowering plants around the founder's statue, raising seeds in-house, and so on.

Photo courtesy: IISc Archives, Office of Communications



INDIAN INSTITUTE OF SCIENCE,
BANGALORE 3.
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Rao Bahadur
B.S.Nirody, M.Sc. 1st July, 1950.

The following notes are submitted on the progress of my work as Hon. Horticultural Adviser to the Institute and on the experiments under Plant Research during the current year:

Since the transference of the control and direction of the Garden Staff from the S.E. to the Horticultural Adviser which was effected in October 1949, the measures immediately taken in hand were the tidying of the grounds and the re-allocation of the garden staff to the different sections of the grounds and buildings after putting a stop to the practice of employing the men on other work, such as the raising of plants for the Lalbagh Flower Show to the detriment of their more legitimate duties. This revised allocation produced almost immediate results in making the grounds look more neat and presentable.

An improvement which was calling for urgent attention was the renovation and planting of the avenues. Some of the dead and decaying trees which were past saving were removed and others trimmed or pruned to prevent further decay and to secure a more shapely top without detriment to shade, while steps were taken simultaneously to raise new shade trees of outstanding merit to fill the gaps and to restore shade and homogeniety, and these have since been planted.

Flowering plants, both annual and [illegible]nial, were raised extensively to replace the coarse foliage plants which made up the groups around the Founder's Statue and at the entrance to the main buildings, and material was also raised to render the beds and borders more colorful with flowers as far as possible of a permanent character. This change over to new material of a more pleasing type must necessarily take sometime to come to fullness, but its prime merit would consist in the avoidance of an undue amount of labour and expense on planting material which had too short a seasonal effect. An additional advantage arising from this would be to keep the grounds more colorful with flowers during the greater part of the year without additional expense.

The clearing of the grounds at the back of practically every Department and the extensive areas between the boundaries and the actual premises of the departmental buildings which had been for a considerable time allowed to be overrun by wild vegetation and scrub jungle harbouring snakes was [illegible], carried This again contributed in no small measure to rendering the grounds more presentable.

The practice of spending a considerable sum every few months on the purchase of seeds from outside was limited to a few important items designed to introduce new material and steps were taken to meet the main requirements of seeds from the material raised at the Institute itself. A considerable quantity of the seeds raised at the Institute was called for and supplied to the Army Department.

Report by Rao Bahadur BS Nirody, honorary horticulturist, July 1950

Emerging green trails

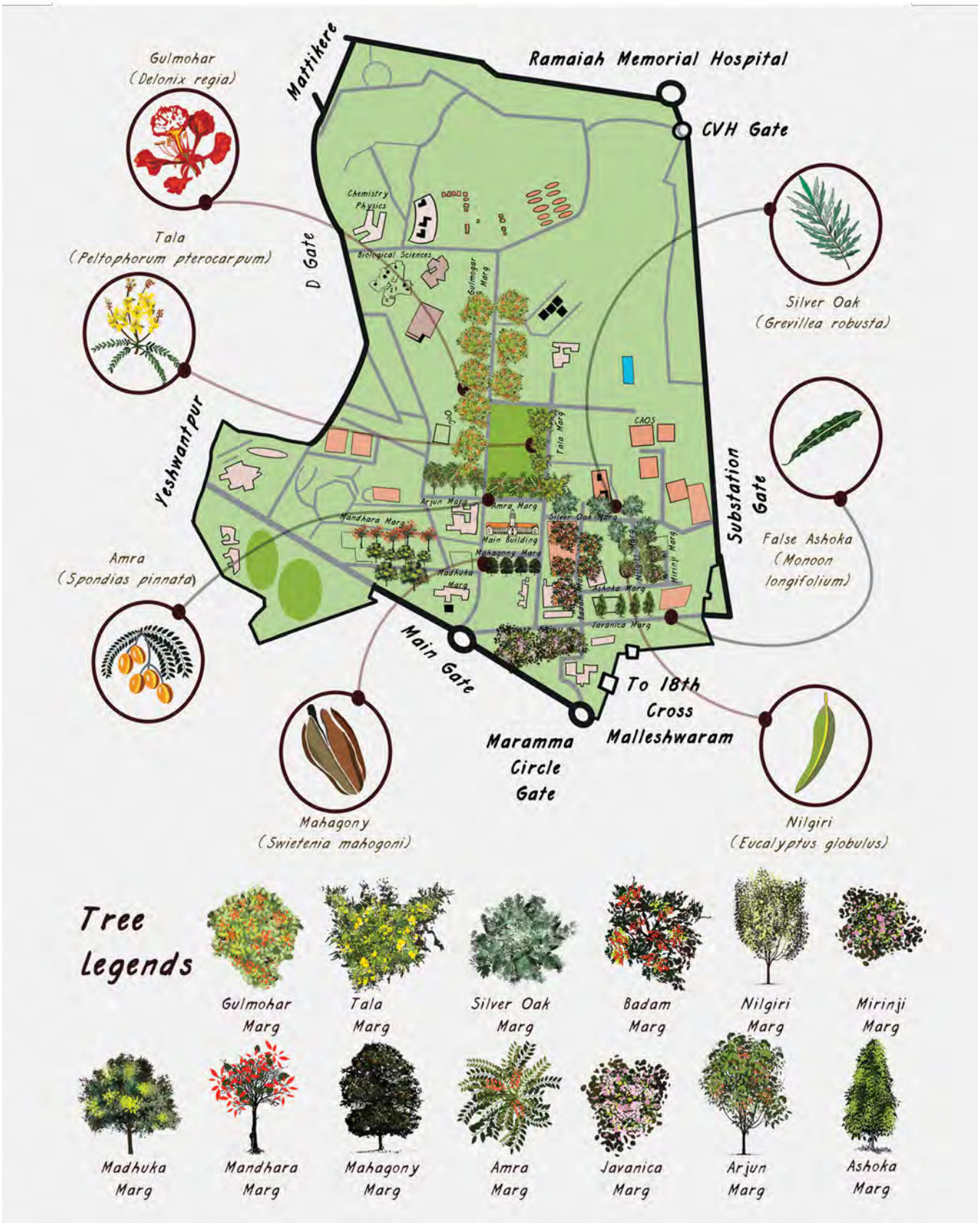
"The naming of the avenues most probably was done during Nirody's time," says Sridhar. The names, however, evolved organically and not out of deliberation. The avenue trees were planted for practical purposes; over time, their names caught on and eventually, the avenues began to be called by their tree names. Gulmohar Marg, Tala Marg, Silver Oak Marg, Mahogany Marg, Madhura Marg, Mandhara Marg, Badam Marg, Nilgiri Marg, Javanica Marg, Mirinji Marg, Arjuna Marg, Ashoka Marg, and Amra Marg are the beautiful strings of avenues that traverse the IISc campus.

The campus remains lively year-round, with trees bursting into spectacular blooms in different seasons. The dazzling red gulmohar flowers ignite the sky with their fiery hues along with carpeting the avenue in scarlet as they drift to the ground during April-May. The 'Yellow Flame' trees of Tala Marg bloom with clusters of sunshine-hued flowers draping the branches while a golden cascade gently carpets the ground during March and April and again in September-October. The Ashoka Marg is adorned with green, tall, conical crown-shaped Indian Mast trees on both sides. The Nilgiri Marg is named after the towering Eucalyptus tree on the lane. Likewise, all the avenues are called by the most striking trees on the lane.

The Institute had already begun to set a budget aside for the care of the gardens during the initial years of its inception

Sridhar himself spent 36 years at the Institute before retiring in 2022. When he joined in 1986, the avenues were already called by the names of the dominant trees lining them. According to him, planting particular trees in specific locations had functional purposes besides beautification. Various factors were considered while deciding the species to be grown, including the height of the trees, the depth of their roots, and the length and width of the lanes where they were planted. For example, big trees like Gulmohar and Jacaranda were planted in the avenues which required shade; tamarind trees were planted for

Illustration: Ravi Jambhekar



An illustrated map of the avenues of IISc

windbreak, the flowering Cassias were planted along the campus boundary, and near the guest house, which required privacy and breeze, imported Casuarina plants were grown. "The planners have done excellent work in preparing the ground itself," says Sridhar.

When he joined the Institute, he found a few vacant pits in the area where the Gymkhana stands today. Their dimensions were 4x4 feet – normally

the pits are made 2x2 feet for planting big trees. This was done to facilitate the development of a better root system. In his tenure, he oversaw the planting of about 60,000 trees, taking extra care to ensure that the avenue trees were planted from the same species that they were named after. Excellent root drainage systems and microbial treatment of the soil have helped the trees outlive their average age – most of them are 70-75 years old. What was a sparsely green campus in the 1980s when Sridhar first stepped in, transformed into an opulent green scape by the time he left it.

Enthralling greenscape

The avenue trees are managed by the "Garden and Nursery Unit" of the Centre for Campus Management and Development. Radhika Muthukumar, an engineer who presently heads this unit, explains that since it is a huge campus, every day, there is something that needs attention – identifying diseased trees and treating them, replacing dead trees with new ones, or pruning overgrown and dried branches. The unit maintains three teams, one each for the maintenance of the nursery, nurturing the department gardens, and taking care of the trees on campus. "Three supervisors go around the campus every day to check the trees and small plants. We prune the branches when a complaint is raised and a ticket number is issued," says Chethan K, a secretarial assistant at the Unit. The collection of heaps of dry leaves is another activity that the nursery unit does regularly. In a long and slow process, these leaves are used to make organic manure. The amount of fallen leaves is sufficient to produce manure for the entire campus; only some manure is obtained from the market for the potting process done during the Founder's Day flower show.

'Having abundant tree cover is a necessity for mental well-being. A walk around the campus can be deeply rejuvenating'

The campus trees are cherished by both the IISc community and visitors alike. They add to the rich heritage of the Institute. They attract numerous birds, butterflies, insects, and other fauna and provide a home for them. "Beyond their environmental benefits, these trees also have a calming effect on the mind. Numerous studies have shown that spending time in nature reduces anxiety and promotes overall well-being," says Subhasmita Patro, PhD student at the Centre for Ecological Sciences and current co-convener of the Institute's Nature Club. "A walk around the campus can be deeply rejuvenating, particularly for PhD students who face a high-stress lifestyle. In such an environment, having abundant tree cover is not just a luxury but a necessity for mental well-being." Among its other activities, the Nature Club also regularly organises "Tree Walks" for people in the Institute, to familiarise them with the campus trees, with the hopes of fostering an appreciation towards the flora on campus.

The avenue trees bear witness to decades of innovation, discovery, and learning and generations of students and researchers who have walked, cycled and sprinted along their lengths. Their sprawling canopies not only provide shade but also inspire contemplation, offering a serene escape from the relentless pace of competitive academic life. For generations, these majestic trees have been more than mere greenery; they have provided a testament to human's deep connection with nature.

Sridhar says: "As a horticulturalist, I can say that the selection of the trees for planting along every avenue is excellent. It was done with a certain purpose in mind and today they have become the identity of each lane."

(Edited by Rohini Subrahmanyam, Ranjini Raghunath)

Photo: Chirantan Pramanik

Gentle sunlight beaming through the leaves on Mandhara Marg

Expedition Aparajita

- Abinaya Kalyanasundaram

Photo courtesy: Arpita Patra

Faculty member Arpita Patra is on a lofty quest

Arpita Patra at the summit of Mount Kilimanjaro, Tanzania, Africa

When Arpita Patra woke, it was pitch dark. It took her a minute to gather her senses. As she slowly realised where she was, excitement rushed through her. She jumped up, put on her gear, and ran out of the tent.

Photo: Arpita Patra

Glaciers seen on Mount Kilimanjaro, Tanzania, Africa

It was D-day at Barafu camp, the highest camp on Mount Kilimanjaro. Nervous anticipation rippled through the group in preparation for the summit attempt. Arpita grabbed a quick bite of porridge and set off into the darkness at 2 am.

Excited and impatient, she walked ahead of the group with a guide. Their headlamps lit the rocky path ahead, as they climbed through the thinning air and loose scree rocks, pausing occasionally to catch their breath.

A few hours later, as the sun started to peek above the horizon, she started realising something was not quite right. There was a mild ache in her temples and nausea was creeping up – two tell-tale signs of altitude mountain sickness (AMS). She wasn't alarmed though. She kept sipping water and slowed her pace, letting her body gradually acclimatise to the higher altitude. After a particularly strenuous slope, she reached the rim of the summit crater, called Stella Point. The first, and longest, part of the climb was over.

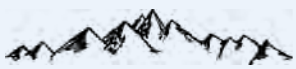
Waiting for the rest of her group, she looked into the bowl-like centre of Kilimanjaro. The terrain looked like a scene from the moon, with rugged rocks and monochrome slopes, and in the far distance, a glimpse of glacial mountains and the vast African plains below. Once the group caught up, they began the final push to the summit. By now, the sun was well above the horizon. Around mid-day, they finally reached the signboard she'd been waiting to see.

"Congratulations! You are now at Uhuru Peak Tanzania, 5,895 MAMSL (metres above mean sea level). Africa's highest point." She read the words again and again until it sunk in. She will remember the day forever – July 17, 2024, her first-ever summit.

But the adventure wasn't over yet.

After basking in the glory of a successful summit, the group trekked back towards Stella Point, their camp spot for the night. By 3 pm, the winds were picking up but they managed to pitch their tents. Head still throbbing, Arpita crawled into her sleeping bag and crashed. Half an hour later, she got up with a start for the second time that day. Her tent was whipping furiously in the wind. A group mate peeped in, shouting over the noise that they had to evacuate as fast as possible. One of the other tents had just flown away.

She jumped up, nausea be damned, grabbed her things, and rushed downhill with the others. Black dust hit them all around, making it hard to see more than three feet ahead. She tripped over loose stones every few steps, but survival instinct kept her inching downward under darkening skies. It was way past sunset when they finally reached the camp they had left earlier that morning. Arpita waited a few hours for dinner and tents to be set up, and then hit the hay. Again.



"Up until that summit camp [before the storm], everything was fine. I was going quite fast and I was confident. In retrospect, I was overconfident," Arpita admits. It's been months since her Kilimanjaro adventure in July 2024. Sitting in her office in the Department of Computer Science and Automation (CSA), IISc, Arpita is unfazed by the life-threatening experience of climbing down the mountain. Besides, she muses, this ordeal would probably be nothing compared to summitting Mount Everest. Which, if her plans go right, will be in another two years.

Arpita Patra is on a life quest to climb the Seven Summits – the highest peaks on each continent – and also the Seven Volcanic Summits. That's 12 peaks in total (Mount Kilimanjaro and Mount Elbrus appear on both lists).

Arpita grew up in remote West Bengal, walking to school with her two younger sisters, and doing her homework under the light of kerosene lamps. “We didn't have a TV. I used to run to someone's house in the neighbouring village to watch BR Chopra's *Mahabharat* series,” she recalls, laughing.

One thing she yearned for was the chance to explore different places. Travel was an unaffordable luxury given her father’s school teacher salary. But her parents ensured that she had plenty of books to read. In stories by Bengali writers such as Rabindranath Tagore, Satyajit Ray, and Bibhutibhushan Bandyopadhyay, she read of many characters who were explorers. “Through their eyes, I loved seeing the world.”

She found deep kinship with a character in Bandyopadhyay’s book *Chander Pahar* – a young village lad named Shankar, who voyages to Africa, seeing wildlife and hunting for diamonds in virgin forests. “Some day I want to retrace Shankar’s path. That kind of exploration, away from the crowds, intrigued me. I wanted to taste nature in its true sense.”

> ***That kind of exploration, away from the crowds, intrigued me. I wanted to taste nature in its true sense***

Arpita excelled in academics, finishing 10th grade early at 14 years old, and pursuing a BTech degree. “I liked theoretical computer science. It is comprehensive and unravels a lot of mysteries about computation,” she says.

She then did an MS Research degree at IIT Madras on pattern recognition and image processing, went on to study cryptography in her PhD, and completed three postdocs at different universities across the world.

"I did not have a single break!" she laughs. "You know how they say, ‘if you work hard in your childhood, later you can be laidback?’ That is just not true!"

When she joined IISc as an Assistant Professor in 2014, the grind continued. She got an early promotion, received funding for several research projects, and won a few awards.

The forced break during COVID-19 finally gave her pause to reflect on her life. “I suddenly felt ... am I doing enough in this one life? I'm just following the same track as whoever joins academia,” she says. In January 2024, she watched a biographical film titled True Spirit about an Australian teenager who circumnavigated the world alone on a boat. “I thought: ‘I am more than double her age; why don't I have that kind of clarity? I too had plenty of dreams. What happened to those?’”

Thus was born *Expedition Aparajita*, her ambitious goal to scale 12 summits. “Aparajita means invincible. It's a word that resonated with me when I was in high school ... I wanted to name my daughter that,” she notes. (And she did).

Photo courtesy: Arpita Patra

Arpita (left) with her two younger sisters, Swagata and Ankita, at their village Markandapur, West Bengal in 1995

Her husband was supportive of the whole endeavour. "He must have thought I was crazy," she says, laughing. But she didn’t tell her parents at first, not wanting to worry them.

Arpita sought advice from Satyarup Siddhanta, a Guinness World record holder for the youngest person in the world to climb both the Seven Summits and Seven Volcanic Summits. Luckily, he was planning to go to Kilimanjaro in July 2024 with a group, and Arpita signed up immediately.

To gauge her fitness, she first attempted a trek in the Sikkim Himalayas. “Not everybody's body is meant for mountains. You might be fit on the plains, but mountains pose a different challenge – there is less oxygen, more air pressure and AMS can kick in,” she explains.

The Goechala trek in Sikkim lasted 10 days, going up to 4,600 metres altitude and crossing 100 km including long climbs and steep descents. "That was my first ever trek. And it just opened the horizon to me. Sleeping in tents, gazing at stars … These were my dreams!" she reminisces, wistfully. "I knew … I am capable of doing this."

Though mountaineers are advised to start from easy and move on to intense treks, Arpita felt impulsively confident. “If I plan to do something, I just do it.”

That attitude became even more crucial during her second expedition to Mount Elbrus.

On a late August evening in 2024, Arpita boarded a flight from Bangalore to Mineralnye Vody Airport in Russia, eager to scale the snowy slopes of Elbrus.

Although slightly shorter than Kilimanjaro, Elbrus is more difficult to summit. Its icy winds are brutally cold, and reaching the summit involves climbing 1,500 metres in a single day.

After spending the night at a hotel in the town of Terskol, she woke up with a severe headache. She powered through the first day’s acclimatisation hike but by the time she reached her room again, her body was burning up. The next two days were a blur of high fever, severe muscle pain, and throbbing temples. She was not able to move from her bed. But she had no choice. A lot of time and money had already been spent. It was now or never.

On the third day, despite feeling ill, she joined the group on a cable car that took them to a higher base camp from where they would push to the summit. She attempted to break in her snow boots and crampons, to learn some basic snow and ice techniques. Her legs had never felt heavier. On the fourth day, still weak from fever and hunger, she attempted the summit climb.

> ***Not everybody's body is meant for mountains. You might be fit on the plains, but mountains pose a different challenge***

Starting at 1.30 am, in sub-zero temperatures, the group set off into the darkness. The next 12 hours were a blur. She vaguely remembers climbing long snowy slopes, surrounded by white peaks, lifting her heavy crampon-laden feet. One more step, one more step ... and finally reaching the gorgeously white, terribly cold summit by 8.42 am. She couldn’t believe she had made it.

Photo: Arpita Patra

Arpita photographs her group mates climbing the slopes of Elbrus in August 2024

“Mount Elbrus transformed me in every sense,” Arpita declares. “To be able to climb to a summit in sub-optimal health … it was crazy.”

Next in her sights were the Aconcagua (6,961 m) and the Ojos del Salado (6,893 m), both in the Andes mountain range in Argentina. "Aconcagua is the second highest in the seven summit series, after Everest," she says.

In preparation, she completed a month-long Basic Mountaineering Course (BMC) at the National Institute of Mountaineering and Adventure Sports (NIMAS) in Arunachal Pradesh.

“The night I reached there, I was thrown into a large hall with bunk beds and 15 other women,” she recalls. Over the next month, she pushed her body to its limits, going on long hikes and runs, climbing walls, rocks, and glaciers, rappelling through rivers, and finally camping at high altitudes. "It was very tough. There were days when we had to walk for 35 km with a 20 kg rucksack on our backs. Sometimes, the trails were extremely muddy, full of leeches," she remembers.

But it paid off with a major confidence boost. She finished first among the women in the 8 km mountain race. "We were supposed to finish in one hour. I took 55 minutes!"

Back in Bangalore, her fitness regimen continued. She would wake up at 6 am, eat channa or green moong salad and some fruit, and work out for at least two hours. She rotated between cycling, long-distance running, swimming, strength training, and sometimes badminton. She ended every workout with pranayama."I'm fortunate to live on campus; I can use all the facilities. I run about 10-21 km in the gymkhana grounds – the new track is very nice."

With this intense preparation, she hoped that the South American voyage would be a breeze. But the mountains had other plans.

The wind howled like a banshee outside Arpita's tent. Temperatures plummeted far below zero with fresh snow. Even relieving herself meant a terrifying dash outside, the frigid air stinging her face like needles. At Camp 3 on the Aconcagua mountain, 6,000 m above sea level, this was the highest Arpita had ever been in her life.

This time, she felt more anxious than usual. Her period, arriving five days early, had thrown a wrench in her carefully laid plans. The altitude sickness, the constant threat of frostbite, all felt amplified now.

At 2 am on January 22, 2025, bundled in thick down suits and three layers of footwear and crampons, the group began the 961 m climb to the summit. Hours crawled by as Arpita trudged alone in the dark, ahead of her group.

As the first rays of dawn pierced the gloom, she reached the dreaded West Face, a treacherous traverse across an exposed slope where the winds were strongest. Dizziness crept in. Chocolates and energy drinks offered little relief. She somehow crossed the traverse and reached La Cueva, the cave where climbers rested before tackling the final, steep section to reach the top. Sheltered from the relentless wind, she checked her watch. It was 11 am. There was still ample time.

She rested for 10 minutes and then took off again. In hindsight, she reckons she should have rested much longer to regain energy and acclimatise better. But she braved on, tackling the steepest part of the ascent now, the last few hundred metres to summit and glory.

> ***"There were days when we had to walk for 35 km with a 20 kg rucksack on our backs. Sometimes, the trails were extremely muddy, full of leeches"***

Her head felt hollower with every step. She saw the final stretch to the summit, barely 100 m from where she stood. Suddenly, her legs became heavy and unresponsive, refusing to take orders from her brain. A fellow climber was egging her on, but the voice seemed to be coming from another universe. The steep slope loomed above her. A single misstep could send her tumbling down the mountain.

Images of her daughter, Aparajita, flashed through her mind. She felt that

Photo: Arpita Patra

Arpita (fifth from left) completed her Basic Mountaineering Course in Arunachal Pradesh

Photo: Arpita Patra

Arpita's tent at Camp 2 on Mount Aconcagua, Argentina, in January 2025

if she took one more step, she might never see her again.

She decided to turn back.

The descent was agonising without the joy of a summit success to fuel her. One group mate walked ahead and one behind her, to catch her if she fell. She just wanted to curl up and sleep. Her body numb, she finally reached the camp at dusk. Her mind was reeling. "Why can't you be normal?" she whispered to herself, over and over. "A normal daughter, wife, mother, professor … What the hell are you doing here?" The next morning, she wanted to attempt the summit again. But as the rest of the group was descending, she decided to join them and attempt the summit later in the future.

"I was so, so close to the summit. But at that point, it was about life or death. I had to choose life," Arpita surmises. She still can't figure out what went wrong. Was it low blood pressure, AMS or extreme weakness due to periods? "I don't know what happened."

But there was not much time to deal with disappointment. A week after her return, she was already caught up with organising an international computation workshop to be held at IISc in March. "Where is the time to get depressed?" she says, wryly.

> ***We shouldn't take the body for granted. I'm just 40 years old. People are climbing even at 60! There's a lot of time for me. There's no reason to be disappointed***

The climb had taught her a valuable lesson. "We shouldn't take the body for granted. I'm just 40 years old. People are climbing even at 60! There's a lot of time for me. There's no reason to be disappointed," she says.

Her main motivation behind Expedition Aparajita has been to show how women can stand up for themselves and do things beyond what society tells them to. "I always encourage my students to do things outside academia too," she adds. "To accomplish great things, we must not only act, but also dream; not only plan, but also believe."

Arpita is already planning for her next expedition in the Oceania region. "In May, I'll steal some days to finish the volcanic summit Mount Giluwe, Papua New Guinea and the summit Mount Kosciuszko, Australia."

Garnering funds for these expensive expeditions has been a challenge. But she finds the strength to keep going. "I guess that's the teaching from mountains … the resilience that I have gained to handle grave situations."

(Edited by Pratibha Gopalakrishna, Ranjini Raghunath)

Behind the Badge

- Raisa Sanaa, Agam Ghotiya, Mishra Aman Ashok

Photo: Raisa Sanaa/Agam Ghotiya

A day in the life of hostel warden Chikka Gangamma

Chikka Gangamma going through her daily routine at the women's hostel at IISc

In the early morning hours, when most of the campus is still stirring from sleep, a familiar figure makes her way through the quiet streets of IISc. With a gentle smile that has become her trademark, Chikka Gangamma begins another day of guarding not just the premises, but also the wellbeing of countless young women who call these hostels home.

> ***Night shifts are particularly challenging … I must let go of all the tiredness and stay alert all the time***

She has the morning shift today, so she reaches the campus by 5.45 am, comfortably ahead of the daily briefing at the Security Office. “This is where we are assigned our duties to a particular hostel for the day,” Gangamma explains, as she marks her biometric attendance. “We will be briefed about our responsibilities by the head of security.” She makes her way to the assembly line of the security staff.

The briefing lasts about half an hour. Around 6.30 am, the security staff head towards their destinations, to start their day’s work.

“I have been working here since January of 2017,” Gangamma reveals, as she heads towards Tunga, the hostel where she has been assigned morning duty. Her eyes soften as she speaks about her late husband, who introduced her to this job. "My husband was a security guard here," she says, adjusting her uniform badge. “He knew this would be a secure job for me. Back then, I was working in a godown, doing packaging work."

She pauses, her voice gentle. "Though he's no longer with us, his decision changed our lives completely."

With an early call time part of the job, her day begins at the crack of dawn. "I wake up at 4 am whenever I have a morning shift," she explains. "I finish all the household work and prepare meals for my family, including my son and father. My brother drops my son at school and after my shift ends at 2 pm, I take him back home."

Upon reaching the hostel, she hurriedly takes over the responsibilities from the lady guards of the previous shift. It mainly involves taking charge of the registers – visitor entries, parcel deliveries, cleaning staff schedule, complaints, and so on. As she goes through the motions, she explains the process. “We have to take responsibility for everything that goes on in and around the hostel. It can range from technical issues with the lift or plumbing to personal issues concerning the health of a student, like taking care of them in the absence of a caretaker and ensuring food from the mess reaches them on time. We are also trained to handle emergencies such as a fire or medical situation.”

The pride in her voice is evident as she describes her responsibilities, to which the other lady guards accompanying her in the shift wholeheartedly agree.

Balancing family and duty

With a job that is dependent on different shifts and timings, it takes a lot of personal acrobatics to keep the family life moving smoothly. The morning shift goes from 6.30 am to 1.30 pm, the second shift extends till 8.30 pm after which the night shift starts and ends at 6.30 am the next day.

“Night shifts are particularly challenging. My 80-year-old father, who needs assistance, looks after my son when I’m away. Moreover, being a human and a mother, I must let go of all the tiredness and stay alert all the time, which is sometimes difficult throughout the night, but I try my best,” Gangamma admits. “Morning and afternoon shifts are easier as I’m home by evening.”

She works six days a week, with two days of morning, afternoon and night shifts. Fridays are her days off.

Over her seven years at IISc, she has formed deep and lasting friendships with her colleagues. Her warm, approachable nature has helped foster a strong sense of camaraderie within the team. They often share homemade breakfasts and lunches. Her

Photo: Raisa Sanaa/Agam Ghotiya

The hostel wardens and security personnel attend the routine briefing in the wee hours of the morning before their shift gets underway

thoughtful gestures have made her a beloved figure on campus. In one instance, when one of the hostel residents was suffering from severe period cramps, Gangamma went out of her way to assist the girl, taking her to the IISc health centre and stayed there all night, taking care of her like a mother. She frequently checked on the young woman, inquiring about her health and recovery, ensuring she never felt alone. Upon recovering, the young woman gifted her a large bag filled with chocolates, which Gangamma, true to her spirit, shared with her friends on campus and carried the remaining home to her family.

Photo: Raisa Sanaa/ Agam Ghotiya

Chikka Gangamma makes sure that every person entering the women's hostel writes their name and contact information in the register. Security and safety is of paramount importance

Her emotional intelligence sets her apart. "These girls need more than just security," she informs. "Sometimes, they need someone to understand them, and be patient with them."

"One day on duty, I received instructions from the security office to closely monitor a student who had been emotionally disturbed for a couple of days," she recounts. "She suddenly had an outburst."

Her voice takes a gentler tone as she continues. "I just observed her from a distance. Eventually, she broke down and hugged me. Sometimes, all they need is someone to show they care," Gangamma remarks. "My entire job is based on emotional connections."

Reflections and aspirations

On a personal level, her transformation has mirrored her years of service.

"Before joining IISc, we lived in a house in which the roof leaked every monsoon," she recalls, emotion evident in her voice. "Today, I have four rooms built with my own savings. But you know what matters more?"

She smiles before answering her rhetorical question.

"It's how this community came together when my father needed urgent blood transfusions. I received around 500 calls from students, faculty, and staff offering to help. That day, I realised this isn't just my workplace – it's my second home."

She goes on. "People always ask for more than what they have (when it comes to salary), but I am immensely satisfied and proud of whatever I earn as it has enabled me to pay for my kid's education and build a roof over our head in the absence of my husband. All the security officials are paid the same amount and moreover, they provide us with raincoats, umbrellas and other necessities for free. I ask for no more," she adds with a smile.

Working in shifts can be challenging, especially as a single parent. But whenever higher officials request her to

Photo: Raisa Sanaa/Agam Ghotiya

Chikka Gangamma along with her fellow mates. Gangamma and friends often share their meals together and have a close-knit relationship with each other

do an extra shift, she does not say no. “They have given me so much respect, " she explains.

> ***When my father needed urgent blood transfusions, I received around 500 calls offering to help. This isn't just my workplace – it's my second home***

Her face brightens as she talks about the most rewarding aspects of her job. “The connection with these students is priceless. When my son visits campus, they treat him like their younger brother. They even gifted him a chalkboard once,” she chuckles.

Throughout the conversation, she managed to seamlessly keep up with her chores without skipping a beat. Early in the morning, she attended to all the cleaning ladies who had come in for their work; she ensured that they were present and followed the rules. Then there were multiple parcel deliveries. She made sure that only allowed items were taken inside the hostel rooms. She put aside the others for further discussion with the respective students. She also registered a few complaints regarding the lift. During lunch time, she made sure the students who were unwell received their lunch from their messes on time.

In between, she swiftly addressed other minor issues from organising repairs with electricians and plumbers to overseeing balcony net installations. Moving in between the interview and her chores, she frequently indulged in heartful greetings with students she recognised.

As her shift winds down, Gangamma shares a heartfelt plea to students: “Please avoid smoking and drinking, especially in the hostels. If you’re stressed, there are better ways to cope. I’m always here to listen.”

Her unwavering smile, which has comforted countless students over the years, serves as a testament to this statement. In her role, she embodies more than just security – she's a mentor, a confidante, and a maternal figure who helps make IISc feel like home for students far from their families.

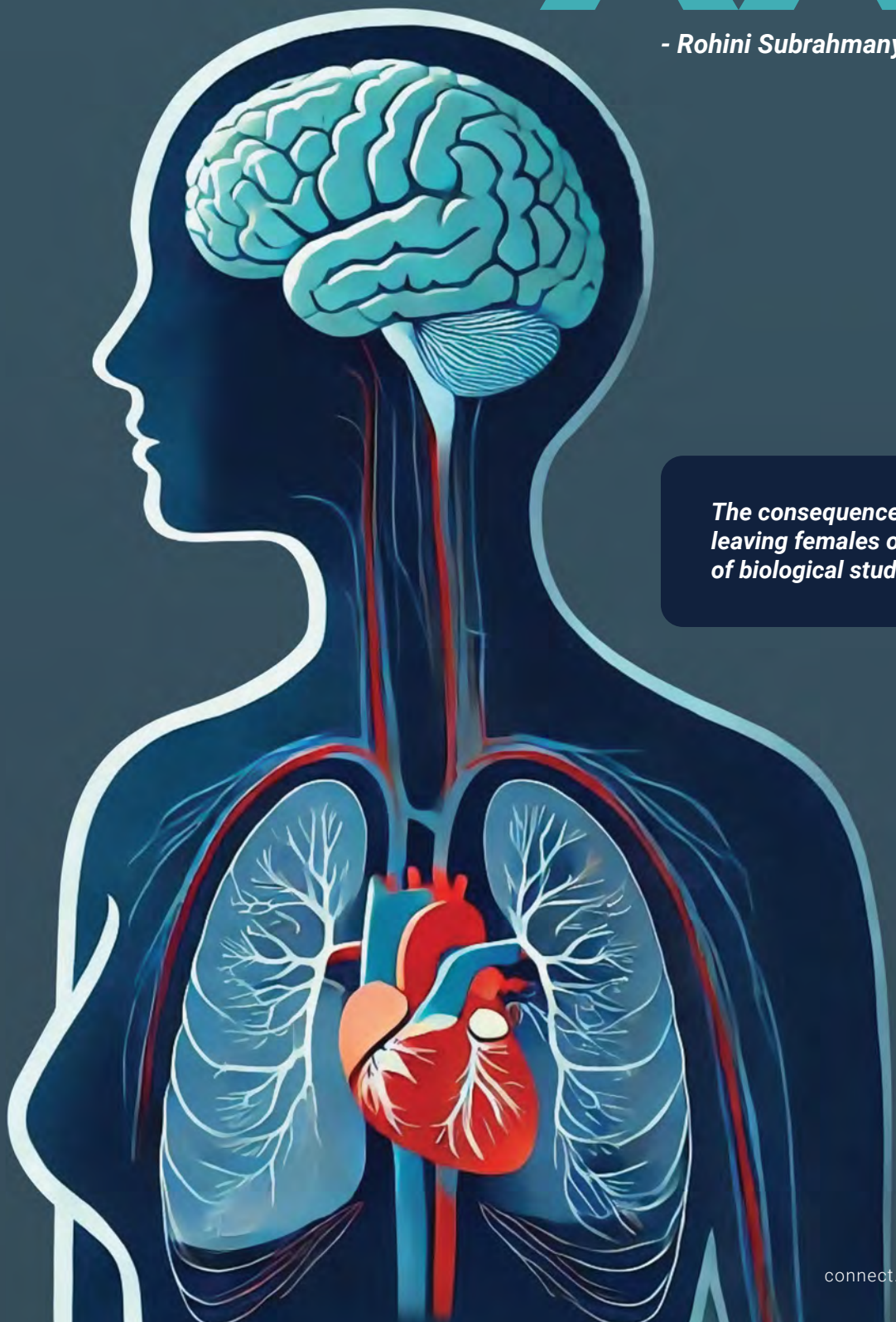
(Raisa Sanaa, Agam Ghotiya and Mishra Aman Ashok are undergraduate students at IISc. A shorter version of this article was first published as part of their Humanities class assignment)

(Edited by Sandeep Menon)

Excluding XX

- Rohini Subrahmanyam

The consequences of leaving females out of biological studies



Credit: This photo was generated using ChatGPT and is meant for representation purposes only.

Abha Khandelwal vividly remembers some of her unusual cardiac cases, a lot of them women. Like the 35-year-old woman who was watching her son play football when she suddenly felt nauseated. The mother brushed it off, wanting to stay and watch her son's game. But her son felt that something was off and encouraged her to go to the emergency room.

There, the doctors realised that she was having a less-known type of heart attack — one where the artery tears and restricts blood flow. This was unlike normal cases, where plaque buildup clogs the artery. When the doctors questioned her further, she eventually mentioned feeling a mild chest pressure. Chest pain or pressure is usually the first symptom that doctors hear about during a heart attack, but not in her case.

"I've dedicated my career to taking care of heart disease in women," says Abha, Associate Professor of cardiovascular medicine and Cardiac Director of the maternal heart program at Stanford University. "But it's very hard to take good care of [patients], when we don't have good science and data supporting our interventions."

Despite women comprising half the world's population, sometimes doctors do not fully understand how to treat them. Be it heart disease, diabetes, or dementia – it is becoming increasingly clear that women experience many diseases differently from men and also respond differently to treatments. But clinical data is still lacking due to complex biological and social reasons. Women are often not enrolled in clinical trials as much as men, and in many cases, scientists opt to use male mice models instead of females to do the preclinical experiments. As a result, the same drugs can have highly variable outcomes and side-effects in women compared to men.

Despite women comprising half the world's population, sometimes doctors do not fully understand how to treat them

"In the US, historically, we have been applying whatever the current [clinical trial] data is to both sexes. But if you look at where the data is originating, it's often from middle-aged Caucasian males," Abha explains.

Photo courtesy: Smitha Karunakaran

Students in Smitha Karunakaran's lab at the Centre for Brain Research, IISc

Scientists have known that fluctuating female hormones – like estrogen and progesterone – could affect female physiology, making it harder sometimes to interpret clinical trial data in women. "There may be, therefore, a preference to use male subjects in clinical trials," says Sandhya Visweswariah, Honorary Professor in the Department of Developmental Biology and Genetics (DBG), IISc. "It's just that when you're testing something, it is better to test it in a system in which the variables are less."

The Thalidomide tragedy in the early 1960s further complicated matters. Women in many countries used to take a drug called Thalidomide for morning sickness, but it led to birth defects in many babies. This prompted the USA-based Food and Drug Administration (FDA) to enforce rigorous testing of any new drugs before they are approved. In 1977, as the rules for clinical trials were being shaped, the FDA decided to bar women of child-bearing age from participating in Phase I and II clinical trials, because of potential risks to unborn babies.

But this exclusion eventually led to almost all women being left out of clinical trials.

Only in 1986 did the National Institutes of Health (NIH) in the USA start reconsidering this strict ban, realising that doctors needed to fully understand women's biology to treat their illnesses. And in 1993, the FDA issued a revised guideline stating that sex differences must be evaluated in clinical drug trials.

Despite the revised guidelines, even if some studies enroll more women, many of them still do not seem to provide a sex-specific analysis of the results. And in spite of multiple diseases being highly prevalent in women, they continue to be under-represented in many studies.

Symptoms and side-effects

Another reason for fewer women in clinical studies could be social challenges. "Women are generally the caretakers and will sacrifice their own health for the society around them," says Abha. "So, if you're creating a study

that requires multiple site visits and long hours, and they are responsible for ageing parents, children and spouses, they are not going to do it."

For example, when it comes to heart disease, women have a dizzying range of atypical symptoms, which complicates diagnosis. "Sometimes it's hard to really get the history from some of my female patients," says Abha. "Men will [simply] say: 'I'm having chest pain.' Whereas women might have a more exhaustive list of symptoms – of which one is chest pain. But it can get lost in all the other symptoms.'"

In India, a study across 17 hospitals between 2011 and 2015 found that even if women had higher comorbidities, they were not given the correct treatment for their cardiovascular issues.

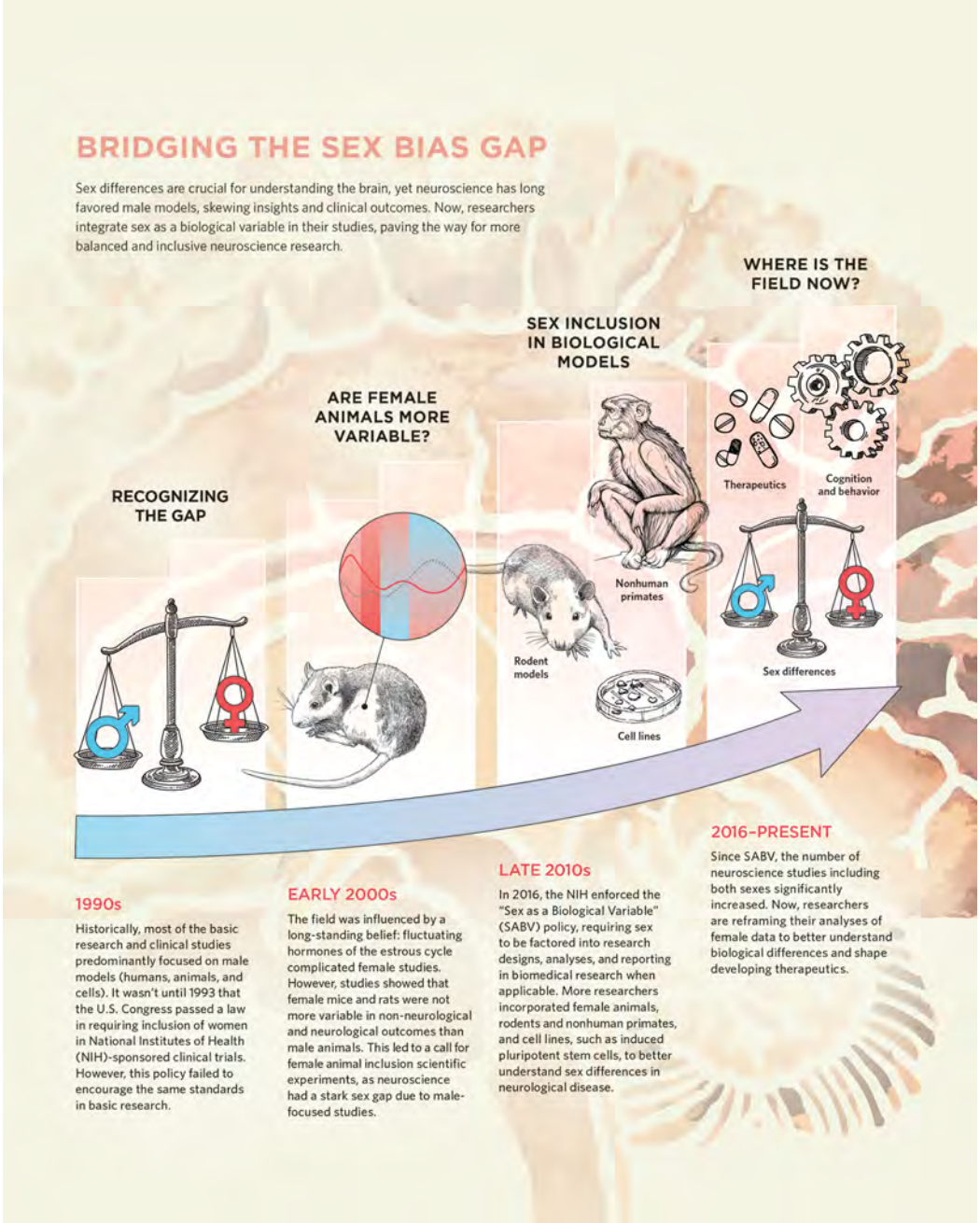


Image courtesy: The Scientist, September 2024

What causes heart attacks in women can also be different. Instead of the typical plaque build-up in the big arteries – called atherosclerosis – women can have spasms or tears in the arteries. Sometimes, instead of large arteries getting blocked, small blood vessels can be troublesome for women.

"When we were studying heart attacks back in the 1960s and 70s, it was men going to work and dying of a heart attack. So [clinicians] developed the angiogram, where they looked at the big arteries, because that's what was happening to the population they saw dying," explains Abha. "At the time, the field was not aware of the impact of the disease on women and how additional testing is sometimes required." She and her colleagues recently published a review on how increasing the number of women in cardiovascular clinical trials can help achieve better outcomes for women. "It is a call to action for all women; if we want better healthcare for our hearts, we need to participate in the science studying and treating it," she says.

Another consequence of limited clinical trial data on women is that how they react to drugs is not well known. A 2020 UC Berkeley study showed that since most drugs were designed based on men, women might be overmedicated, leading to increased adverse side effects. Indians largely rely on generic drugs because they are cheaper. But there are a lot of clinical symptoms and variations seen in women after taking these drugs, according to Nikhil Gandasi, Assistant Professor at DBG, IISc.

For Nikhil, the problem hit close to home. Both his parents-in-law take metformin, a common drug prescribed for diabetes. When they get their HbA1c levels – a measure of blood glucose – tested, the results vary. "With my father-in-law, it's more under control, below six," he says. "With my mother-in-law, even though she takes those [same] drugs, she doesn't get her HbA1c levels lower than seven."

This is one piece of anecdotal evidence, but in some cases, the problem might be widespread – a 2017 Uruguay-based study found that sex-based differences in gastrointestinal physiology can influence how generic drugs are absorbed by men versus women. And similar to the situation in cardiovascular diseases, women of child-bearing potential have been unnecessarily excluded from type 2 diabetes clinical trials as well, according to a 2016 review in *Diabetes Care*.

The disparity also extends to disorders of the brain. Alzheimer's disease (AD) is known to be almost twice as common in women than in men, with studies also linking menopause to increased risk for AD. Yet, women are understudied. According to a 2022 UK-based study, the number of women taking part in dementia clinical trials is better than in other diseases (58%), but it does not match the proportion of women in the global dementia population (64%). Plus, 113 out of the 118 trials analysed didn't report sex-based differences. "It appears that these trials are focused on treating one sex, as the mechanisms driving the brains of each sex are different," says Smitha Karunakaran, Assistant Professor at the Center for Brain Research, IISc.

Another consequence of limited clinical trial data on women is that how they react to drugs is not well known

Take the case of a newly approved AD drug called lecanemab. Phase III clinical trials produced stronger effects in men than in women, with men having a 43% slowing of cognitive decline versus women who had only 12%. "It's likely that males are benefiting more from this drug than females are," study author Madhav Thambisetty, senior investigator at the National Institute on Aging, USA, tells Axios.

Lecanemab is also known to have side effects called amyloid-related imaging abnormalities (ARIAs) – essentially brain swelling and bleeding. But how intense and frequent these are in men versus women is not fully clear. A key scientist involved in the lecanemab research recently gave a talk at IISc on how the drug leads to fewer ARIAs compared to others. Someone in the audience asked: "What are the male/female differences with ARIAs?" The scientist replied: "Oh, that's a wonderful question. We did not check it."

Model systems

Another reason why drugs might have varied effects in women is that even preclinical trials and lab research are skewed towards males. In many cases, scientists prefer to use male mice, as females go through a complex hormonal cycle called the estrous cycle. Many scientists believe that this cycle could make experimental results in females harder to interpret.

"We know that hormones affect behaviour. So, when you're doing behavioural sciences, you want things to stay the same," says Sandhya.

Annaliese K Beery, Associate Professor at the Integrative Biology and Neuroscience Department at UC Berkeley, however, claims differently. A tireless campaigner for the inclusion of female mice in biological research, Annaliese cites evidence that female mice are not inherently more variable than males at any stage of their estrous cycle. Be it gene expression, hormone levels, or even behaviours related to fear and anxiety, there were actually cases of males having higher variability.

Li Gan, Professor in neuroscience at Weill Cornell Medicine, New York, is also a strong advocate for using both sexes in AD research. She has written about how sex hormones and sex chromosomes lead to differences between male and female mouse brains – especially during ageing – recommending that sufficient sample sizes of both sexes should be used to design drugs more carefully.

In 2016, NIH announced a "sex as a biological variable" research policy, mandating that biological sex should be considered whilst designing experiments and reporting results. Journals have also become more strict and ask researchers to specify the sex of the animal models used, sometimes even encouraging them to repeat their experiments on female animals. This has gradually led to more labs looking at both sexes in studies.

Smitha's lab in CBR is one of them. Her team has seen that female mice show symptoms of impaired memory at a much older age compared to male ones, suggesting some sort of protective mechanism at work in female brains. Her lab is now trying to figure out these mechanisms. Another recent study from multiple labs at CBR has shown that although AD is more prevalent in women, they show some degree of cognitive resilience – their decline can sometimes be slower compared to men.

The gut is another point of difference. Sandhya's lab has found that mutations in a receptor called guanylyl cyclase C lead to severe gastrointestinal disease in humans. However, certain stressors to the gut caused male mice with the mutation to show more severe reactions than female mice.

"The gut has a very tight barrier to prevent the entry of harmful material into the body," says Sandhya. But in some genetically modified mice, the barrier was leakier in male mice. "So with that observation, we decided to look very closely at the differences between the male and the female gut."

Equal participation

Be it increasing the use of female mice in research or improving the numbers of women in clinical trials, strong voices amongst scientists and clinicians are now pushing for change. Abha points to a study that showed how having more women in selection committees for large-scale clinical trials resulted in more women enrolled.

Some scientists are also advocating for responsible and safe inclusion of pregnant women in clinical trials. The American College of Obstetrics and Gynaecology prefers to call pregnant women "scientifically complex" rather than "vulnerable", and in a significant advance in 2019, these women were no longer categorised as a vulnerable population by the FDA.

Abha's 35-year-old patient – whose nausea signaled a heart attack – eventually recovered fully. However, many women may not be as lucky until female biology is better understood. Raising awareness and outreach for women to take part in trials, and for scientists to report sex-specific analyses from clinical studies, is essential. "In all of the clinical trials I conduct, even if it costs more and takes longer, I will always enroll at least 50/50 [male and female]. I don't think it's fair to do it any other way," Abha says. "Further, as women continue to focus their efforts on the health and wellness of their family, they must realise that it is imperative to start with themselves."

(Edited by Ranjini Raghunath, Abinaya Kalyanasundaram)

Connecting Calls

Photo courtesy: Dhanalakshmi M

Beginning in the 1980s, Dhanalakshmi M was one of the many dedicated telephone operators at IISc for over three decades. She was born on 13 May 1957 in Bangalore and completed her BSc in Physics, Chemistry, Mathematics, and Biology from Maharani's College. After a diploma in 'Reception and Bookkeeping' from Sri Jayachamarajendra Polytechnic, Bangalore, she took up a career in hospitality. As fate would have it, she applied for a telephone operator role at IISc, a decision she says changed her life. From 1983 to 2017, she worked at IISc, first as part of the Telephone Exchange, transferring calls and connecting several vital communications, and then eventually moved on to other administrative roles.

Reflecting on her journey, Dhanalakshmi speaks to CONNECT and shares amusing moments from her telephone operator days and what she misses about life on campus.

Dhanalakshmi with colleagues Kala Gurjar, Daulathunnisa Begaum and Vyjayanthi R at the IISc telephone exchange in 1986

Tell me about your childhood, education, and family.

I was born and raised in Wilson Garden, Bangalore. My father, Murugan, was a successful contractor. One of his most notable projects was handling the entire water distribution system for Vidhana Soudha.

I have six siblings – an elder sister who now lives in Chennai, two younger twin sisters and two younger brothers, all of whom are in Bangalore. As kids, one of our favourite pastimes was going for walks in Lalbagh, picking plants and bringing them home to plant in our own garden. It was a simple and joyful childhood.

What was your first job?

My first job was as a Front Office Executive with the Karnataka State Tourism Development Corporation Limited (KSTDC), where I worked for two years. My role involved welcoming guests and guiding them to various destinations across Karnataka. I was responsible for organising tours and booking hotels throughout the country.

After transferring to Mysore, I took on similar responsibilities at the Lalitha Mahal Palace Hotel. I commuted daily from Bangalore. Those were simpler times, with far less traffic than today. We would typically arrive home by 8 pm, but sometimes it would get as late as 10 pm, or even midnight. I still remember this one time it got late and there was no train available, and the famous south Indian actor Kokila Mohan gave some of us a ride home!

Did you get to meet many celebrities during your time in the hospitality industry?

Yes! Those experiences are unforgettable. After leaving KSTDC, I joined Hotel Ashoka, now known as 'The Lalit Ashok,' and worked there for a year and a half. There were very few star hotels back then, and Hotel Ashoka was quite prominent.

I enjoyed my time working in the hotel industry. The appreciation we received, either as certificates from management or letters from guests, made the work rewarding.

What made you leave your job in this industry?

I had to leave and pursue a different type of work to "get married". At that time, working in the hotel industry, especially for unmarried women, wasn't viewed favourably. My parents were constantly urging me to leave the job. When the opportunity to join IISc came along, I gladly accepted it.

How did you come to know about IISc?

I applied for an advertisement published in the newspaper.

After a six-month 'Diploma in Telephone Operating' in 1983, I joined IISc as a temporary telephone operator. The position was later made permanent. I didn't get selected in the first round but one of the selected candidates joined another role at Vidhana Soudha, so I got the job in her place. I always say thanks to Bhavani for that opportunity!

What was the job of a telephone operator like?

The Telephone Exchange at IISc was located in the Main Building, in the left corner where the Dean's (Admin) office is now. In those days, there were several operators, including B Vyjayanthi Raghavendra, Daulathunnisa Begaum, James Kutty PC, and Sathisha AK. The institute had only a few direct phone lines, and our main job was to connect calls to the relevant departments, faculty members, and residents within the campus. When students received calls, we would inform them to come to the Telephone Exchange and wait to speak with the caller.

We operated in three shifts, covering the hours from 7 am until 10.30 pm. If there was any delay in opening the office, or if there were disrupted or misconnected calls, we would get complaints. It was a demanding role that needed constant attention to detail and punctuality.

There was also a P&T (Post and Telegraph, now known as BSNL) unit which handled other essential communication services like telex, fax, and postal services. It allowed people to make local, STD, and ISD calls on a payment basis as mobile phones did not exist at the time.

Were there any hard parts of the job?

Yes, sometimes, calls would go on longer than anticipated, and we had to politely intervene and ask the parties to wrap up their conversation so that others could get through.

If all the direct lines connected to IISc were busy, we would receive complaints from the Security Office. During office hours, we handled a high volume of calls from government offices and other organisations.

We also managed STD and ISD calls based on requests, which were

Photo courtesy: Dhanalakshmi M

Dhanalakshmi in front of the statue of JN Tata during Founder's Day in 1984

particularly expensive at the time. Even local calls could become costly if they lasted too long, so we had to manage call durations.

When did the Telephone Exchange stop?

I believe it was around 1993 or 1994 when all extension numbers at IISc were assigned the prefix 2293, allowing for direct calls. Each extension could make local and STD calls by simply dialling '0.' So, the role of the Telephone Exchange became redundant. Many telephone operators were transferred to different departments, while a few remained in what was called the 'Telephone Unit' to manage the exchange systems, handle repairs, and allocate new phones.

Initially, there was no STD facility for all numbers; later on, direct numbers were provided to select departments, beginning with the prefix '2360 XXXX' through the Malleswaram exchange. During this time, we encountered instances of misuse of STD calls, which led to the implementation of a locking system that required a secret code for making STD and ISD calls due to their high cost. Office staff maintained a register detailing who called whom, the purpose of the call, and its duration. At the end of each month, staff and officers would verify the final bill against this register, which often led to some lighthearted moments (*laughs*).

Communication has become much more accessible now, so different from those earlier days!

What was your job after the Telephone Operator role became redundant?

I moved to the Main Entrance Gate to work as a receptionist. I would guide visitors from the security room, opposite BHEL (now known as CNR Circle). I was here for six years, and there were times when I would personally drive visitors to their destinations.

I later moved to the Council Section, also known as Unit IA, where I handled administrative tasks for faculty members and officers.

Were you staying on the campus?

I loved living on campus, but getting accommodation in the quarters took some time.

Photo courtesy: Dhanalakshmi M

Dhanalakshmi and a colleague Nagarathna HR (HR Section) with Ratan Tata in 2016 at IISc

After marriage, we moved into the quarters next to the Kendriya Vidyalaya School at IISc. I was quite reluctant in the beginning; I missed the space and comfort of my childhood home, and it was difficult to adjust to such a compact house.

But I soon realised that this house brought me a lot of good fortune. After moving in, I had increased financial well-being, with many new opportunities, which I believe was partly due to the positive energy and luck associated with the quarters.

The house became a special place for me, symbolising not just a home but also a turning point in my life. It had a certain charm that I can't quite explain.

Did you meet any dignitaries during your service?

Yes, quite a few. I was so fortunate to have met the late Rajiv Gandhi when he served as Prime Minister in 1984, during a programme hosted by IISc in collaboration with ISRO. Various items used in space exploration were displayed in the Main Building reception hall.

I have also met JRD Tata and Ratan Tata, among others whose names now escape me. I still remember the day I first saw JRD Tata visiting the main building. The atmosphere was electric; all the staff stood in respectful anticipation. As he entered, he casually began combing his hair, a moment that broke the formality of the occasion (*laughs*).

What about your family?

My husband worked at Canara Bank, and we have a daughter and a son. Our son is an engineer and is yet to get married. Our daughter is married and is currently serving as an Assistant Manager at Canara Bank. I am happily retired and enjoying quality time with my granddaughter, who keeps me happily busy. I currently reside outside the campus in my own home.

What are some of your cherished memories from the job and the campus?

Many people still remember me for my role in connecting calls, and I have stayed in touch with some former students. They often fondly recall the days when we facilitated calls to their parents. Sometimes we would also get appreciated for our "sweet voices" (laughs). Some people would call just to hear our voices. I also remember many faculty members advocating for our permanent positions at the Institute.

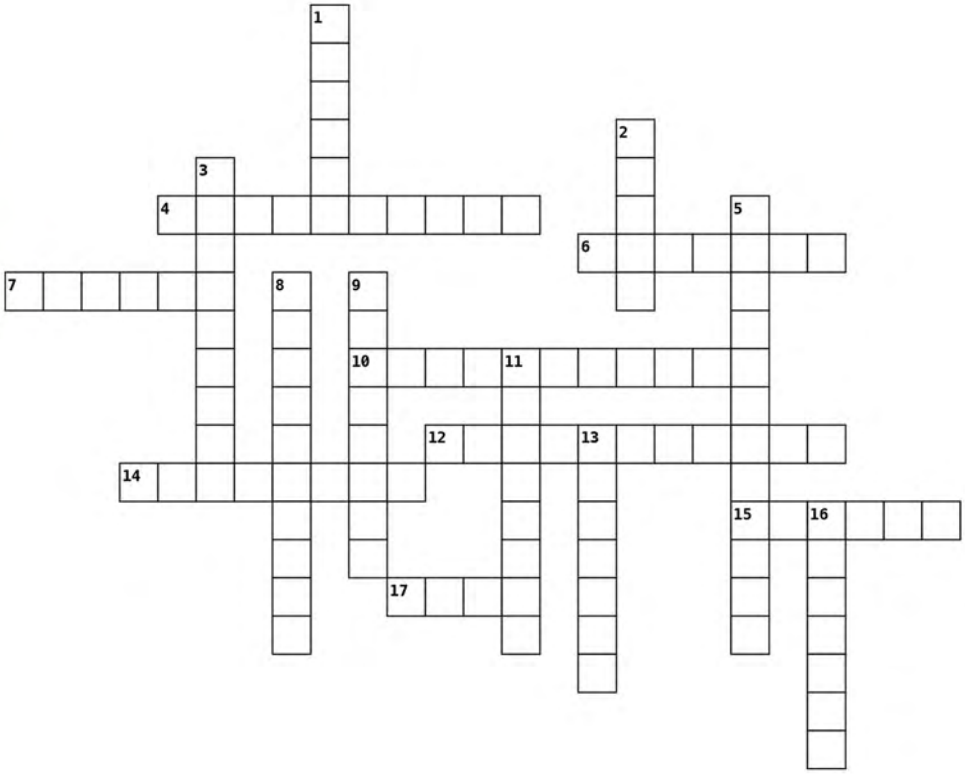
From 1983 to 2017, I spent a significant part of my life at IISc, and it truly feels like my second home. The Institute has cared for me and my family in countless ways, and for that, I am deeply grateful.

During those years, we enjoyed a subsidised canteen with delicious meals for employees. Since we worked in shifts, the warm welcome from the canteen staff always made our day a little brighter.

Every time I enter the campus, my mood instantly lifts … maybe it is the fresh air, the greenery, or the sense of community and respect we hold for this institution. Even now, my family and I frequently visit, to stroll around the grounds.

(Edited by Abinaya Kalyanasundaram)

Fun Corner



ACROSS

4. Most common brain disease in women
6. Measure of disorder
7. Alloy of copper and tin
10. Process of life arising from non-living matter
12. Highest peak in Africa
14. Group of bipedal carnivorous dinosaurs
15. River in Sikkim
17. Single-celled ancestor of all life

DOWN

1. Sugar in RNA
2. Recent asteroid found with essential building blocks of life
3. Animal with largest heart
5. Disproved 'spontaneous generation' theory of life
8. Study of earthquakes
9. Shoe accessory used in ice
11. Tree known as 'Flame of the forest'
13. Liquid metal at room temperature
16. Hormone cycle in non-primate female mammals

Want to do it online? Click here.

Send your completed puzzles to connect.ooc@iisc.ac.in
First 3 winners will be announced in the next issue!

Guess the spot on campus!

Send us your submissions (connect.ooc@iisc.ac.in) for a comic on the theme

"Life at IISc"

We'll publish the winner in the next issue!