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IndiaBioscience, a non-profit program, fills a unique niche in the ecosystem of life sciences in India. Our website features a variety of content—cutting edge life science research, academic and alternate career trajectories, scientist interviews, scientific events and more. This magazine is a compilation of a few select pieces and article excerpts that offer a sneak peak of the website.

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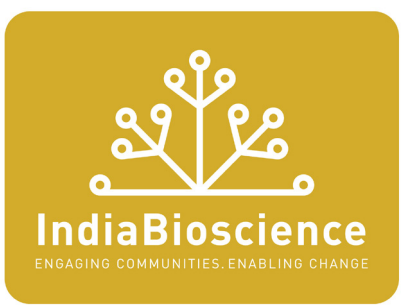


New bird genus endemic to the Western Ghats discovered

Asmita Sengupta

For the first time after 150 years a bird genus—a taxonomic category ranking above species—endemic to India has been discovered. A decade-long study has revealed that birds originally thought to be Western Ghats Shortwings are actually Flycatchers and those originally referred to as Laughing Thrushes are more closely related to Babblers.

Although India is one of the 17 megadiverse countries in the world, instances of evolution of bird species unique to the country are few. One exception is the Western Ghats, a global biodiversity hotspot, which is home to many endemic species. Now it seems we can add a few more to this list, thanks to the efforts of an international team of researchers, led by VV Robin from NCBS/IISER, Tirupati. Now designated as *Sholicola* (Flycatchers)and *Montecincla* (Babblers), these two groups of birds are the first known instances of avifauna, which have diversified from an ancestral form endemic to the Indian subcontinent.

"The key to making these important discoveries was genetics, which allowed us to place these birds on the evolutionary tree (genealogy or family tree of all species) more accurately. When we deciphered their genetic relationships, it was clear that these two lineages were very different from the birds with which they were previously categorised. Given their unique positions in their evolutionary trees, it made sense to give these two groups new genus names."

-- Sushma Reddy, NCBS & Loyola University, Chicago

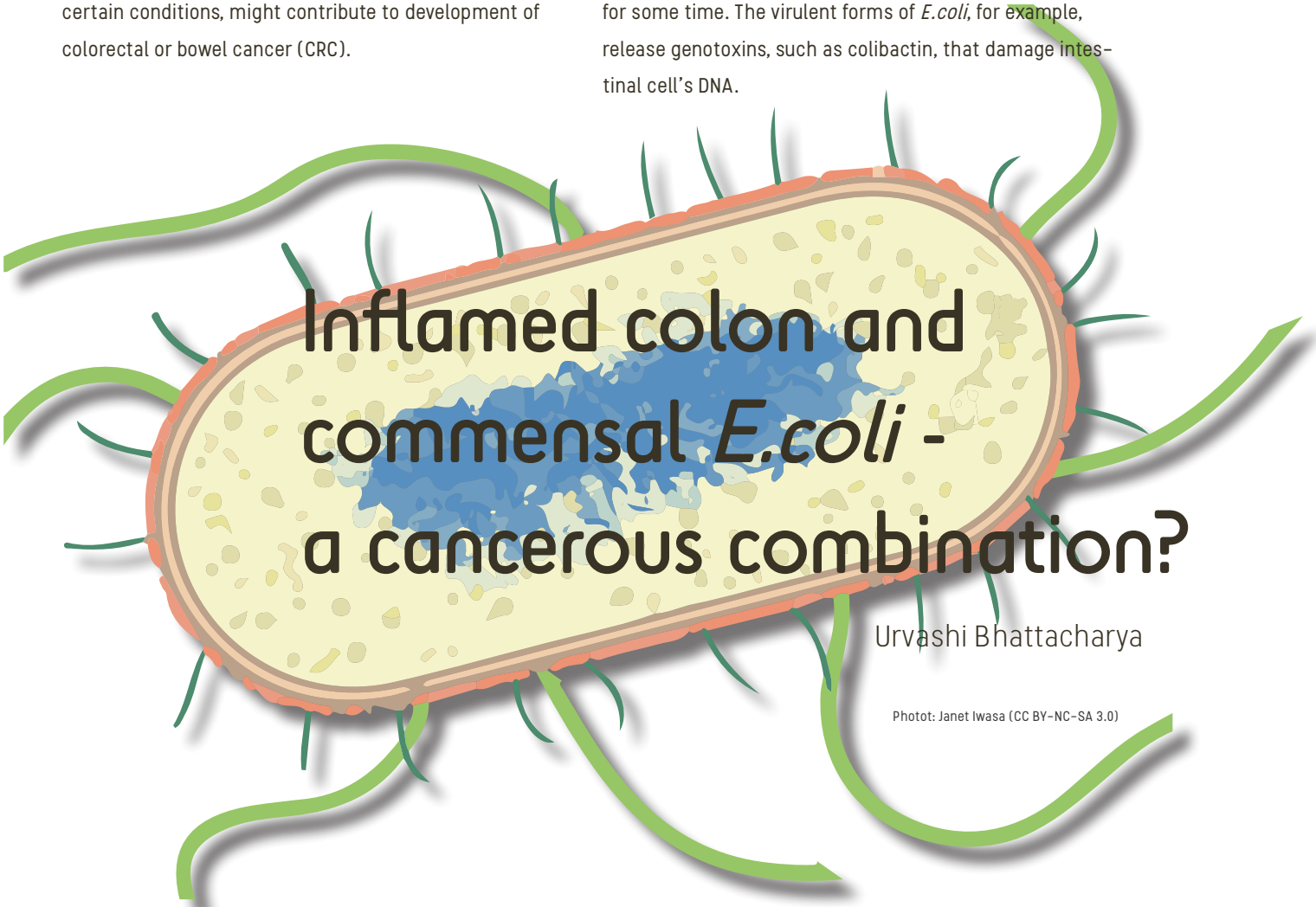
"One significant advantage we had to solve this mystery was this fantastic collaboration bringing together scientists from across the world with different strengths. We were also fortunate to be able to get permissions to handle the animals; we wouldn't have been able to do this work or make these discoveries without the trust of the Forest Departments of Kerala and Tamil Nadu."

--Uma Ramakrishnan, NCBS.

The study underlines the importance of long-term research involving both field research and museum specimens. It also highlights that there are many bird species with very narrow distribution ranges in the highly fragmented forests of the Western Ghats. The authors hope that the knowledge of their distinct evolution and ecology will draw the attention of conservationists to protect their habitats.

Inflamed colon and commensal *E.coli* - a cancerous combination?

Urvashi Bhattacharya



Photot: Janet Iwasa (CC BY-NC-SA 3.0)

Thought all those probiotics were good? Think again. Atleast that's what a new study published in Cell Death and Disease suggests. Scientists from New Delhi show that otherwise deemed 'friendly' bacteria, under certain conditions, might contribute to development of colorectal or bowel cancer (CRC).

As the name suggests, CRC is a cancer of colon and rectum that often develops as small abnormal growths on the inner lining of the large intestine. Evidence linking virulent strains of gut flora with colon cancer has been around for some time. The virulent forms of *E.coli*, for example, release genotoxins, such as colibactin, that damage intestinal cell's DNA.

Benign bacteria, on the other hand, act as commensals, i.e. while they grow and live in the gut, they also help with metabolism, synthesis of vitamins and a variety other functions. The 'friendly' tag assigned to these bacteria would then make sense, right? Not quite, according to the authors of this study. "With certain pre-existing conditions, friendly *E.coli* in the colon can turn rogue too", says, Sudeshna Kar of Jamia Hamdard, who is also the principal investigator of this study. The pre-existing conditions might be an inflamed tissue, a mechanical breach or certain mutations in the intestinal cells that lead to lowering of cellular defence. The 'friendly' *E.coli* can then repeatedly invade cells that were otherwise protected.

"Modelling conditions of lowered cell defence that would allow benign *E.coli* to repeatedly invade and cause harm isn't easy," admits Kar. To overcome this, the team developed a system where intestinal cell lines were exposed to an *E.coli* strain that was mutated to be highly invasive. Over long term, the population of cancerous stem cells in the intestinal cell line and the number of tumours grew. Similar tumours were also observed when these infected cells were injected into immuno-compromised mice.

So, what transpires inside invaded cells to turn them cancerous?

We have the means, today, to transplant entire hands: rather than using prosthetics, individuals who lose their limbs can gain new living ones. Such surgery remains very rare, however, and for a good reason: the risks far outweigh the benefits. The immune system is likely to rebel against the foreign object, and long-term global suppression of the immune response is far more damaging to the body than an artificial replacement limb.

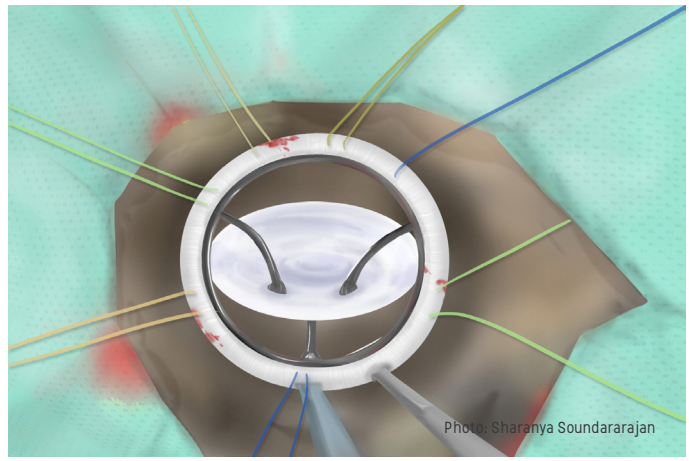


Photo: Sharanya Soundararajan

M. S. Valiathan and his colleagues spent twelve years working through multiple iterations with different materials to develop a heart valve that would serve as a low-cost alternative to foreign imports. By 1990, the team developed what is now called the TTK Chitra Heart Valve, still used today.

But what if immunosuppressants could target only affected tissue—as and when an immune response flares up? That degree of precision in medical treatment, drugs riding the bloodstream to hone in on a specific destination, has been the subject of science fiction in the past. But drug delivery systems have improved since pioneering work in the field of biomaterials in the 1980s and 1990s.

From tissue regeneration to drug targeting technology

Anjali Vaidya


Photo: Vemula Lab

Biomaterials research covers a wide swathe of disciplines and topics, from nanotechnology to immunology to mechanical engineering. The common thread that binds these together is the study of materials that go inside the body, typically for medical reasons.

Immunosuppressant-laden hydrogel packets have improved the success of limb transplants; they selectively degrade upon contact with the inflammation that signals an immune response.

"The desired effect is to have something like a tiny pharmacist within the body, doling out medicine as and when required." - Praveen Vemula, inStem, Bangalore

Originality in scientific writing

Chaitanya Athale

According to Karl Darrow, "more than half (of) all scientists who have ever lived are living and active today". Add to it the rapid growth in the scientific base in the fast developing nations India and China, and this rough estimate from 1962 is likely to need an upward revision. This means that we are in a unique position to push the boundaries of science and innovation globally, in a manner not possible before. However, that also means that, as practising scientists (described once by my Norwegian colleague as somebody who continues to practise research more than six years after their Ph.D.), the burden of novelty that rests on our shoulders is heavier than before.

Does this burden supplemented by the tremendous access to information via the internet drive an increase in plagarism?

Spreading the wealth

Ron Vale

India has now developed a few internationally recognized research institutes in the life sciences. These centers have developed a critical mass of outstanding scientists, are well equipped for modern research, attract international scientists, and have become competitive for junior faculty recruitment with institutions in the US/Europe. However, the success of these relatively few centers also poses challenges. First, when Indians doing their postdocs abroad consider applying for a junior faculty position in India, they often only imagine themselves working in these few elite institutes. While these elite institutes have been expanding considerably in the past five years, their rate of faculty growth is slowing down. A second and related challenge is how to expand the overall number of "centers of excellence" for research in India.

The long-term scientific goals of India cannot be met by just a few outstanding scientific centers, and a "phase two" expansion is needed for diversification, driving economic growth, and accommodating/employing India's best scientific trainees.

Through the lens

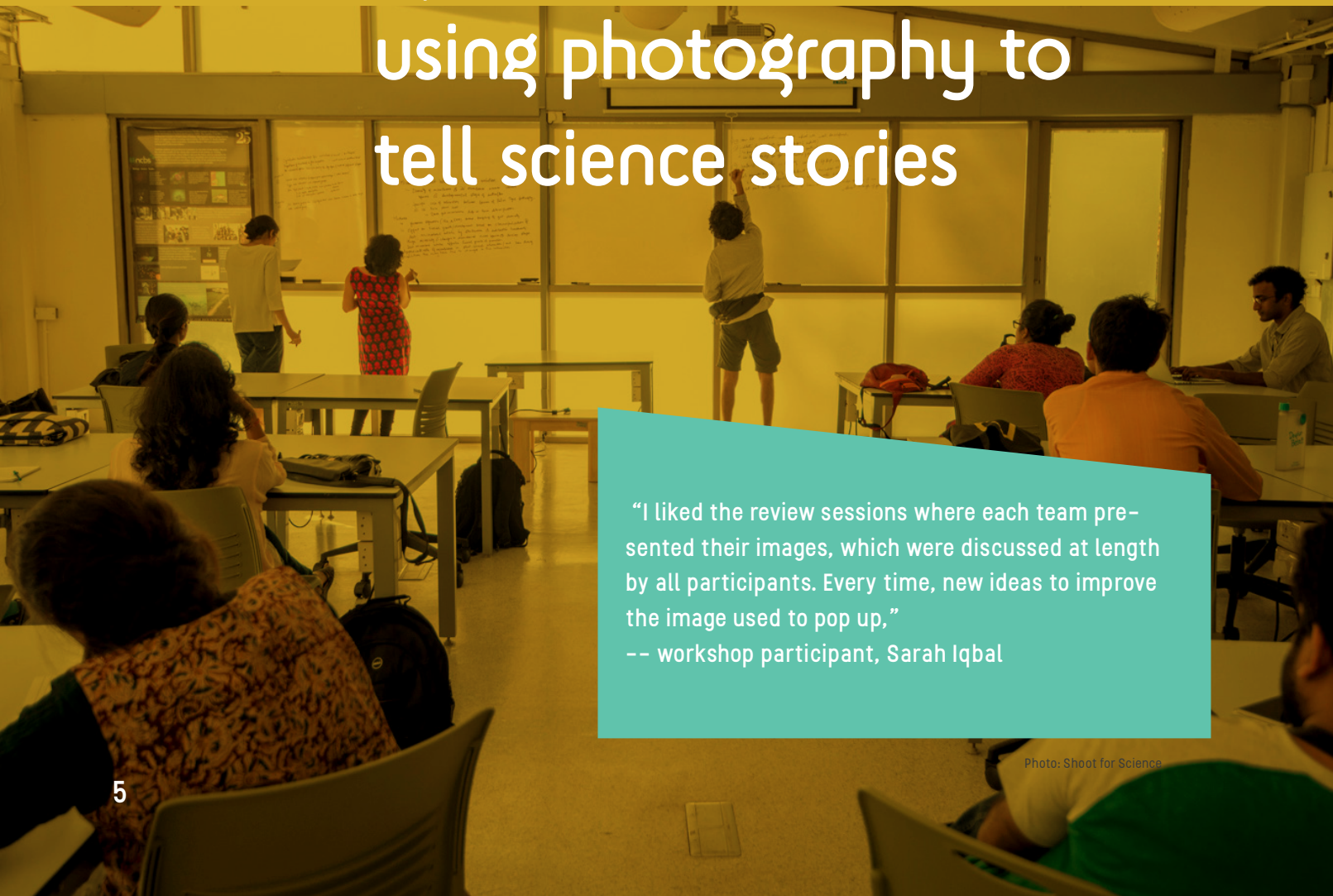
using photography to tell science stories

Harini Barath

Sixteen researchers, eight days, four stories, two instructors; the Shoot for Science workshop that recently concluded, was the brainchild of molecular ecologist turned science tphotographer, Prasenjeet Yadav. Co-organised by Anand Varma, a National Geographic photographer based in the US, the core focus of the workshop was on science communication.

While scientists pursue questions with a passion, few others have an insight into the scientific process. The language scientists use is often technical and the excitement of science gets lost in jargon. Efforts to bridge this gap are of vital importance—they inform a wide audience about the successes and impacts of science, increase scientific literacy and inspire young students. Effective communication requires time and creativity. The first step is to capture the attention of the audience. Few media achieve that first step more successfully than photography.

The aim of this unique workshop, held at NCBS, Bangalore was to enable scientists to tell the story of their science to a wide audience using photography. Training scientists for the job was a natural choice—it would be easier to equip a scientist with the tools and know-how of photography; they already have a deep and personal insight into the process of science.



"I liked the review sessions where each team presented their images, which were discussed at length by all participants. Every time, new ideas to improve the image used to pop up,"
-- workshop participant, Sarah Iqbal

Photo: Shoot for Science

A lot of science communication focusses on results and findings. It is as important to talk about the process itself—the tools, methods, experimental design, measurements and analysis that go into building and verifying a hypothesis. Seen here are some of the stunning pictures produced by these newly-minted science photographers that capture ongoing research efforts at NCBS.

Using the scientific method in Biology classrooms

Swati Patankar

When I first started teaching biology at IIT Bombay, I quickly realised that if I taught facts, my students and I would have an awful time in class—my students had learned these facts very recently, were much better at memorizing information than me; and in terms of being a repository of facts, my real competition was the internet, which I did not have a hope of beating. Interestingly, and very intuitively, my strategy to handle this was to use the scientific method to teach biology.

What is the scientific method? How might one use the scientific method as a structure for teaching biology and its benefits?

Jigsaw classroom: using student differences to bolster student learning

Reeteka Sud

Consider a typical undergraduate classroom—students from different economic sections, who have had different types of schooling, who differ widely in their grasp of the English language as well as of the subject matter—are thrown in the mix together, in the same class in college. In the face of this immense diversity, not to mention the large class sizes and tight teaching schedule, the teacher is forced to assume a "middle path" — a level they think is "middle of the curve" for their students. As a teacher, how do you use this diverse spectrum of student abilities to benefit them? Is there a way to add up the differences? With jigsaw classroom, there is.

Education

Could weekly exams help students learn better ?

Anusha Krishnan

Come March and April, and exam season begins. All over India, students in schools and colleges begin sweating as exam fever hits—it's the final exams. These are the ones that really count, especially for undergraduate courses, since students' grades depend on how well they perform in these exams. In many cases, first year students score poorly in the finals despite their efforts to do well—a fact that can dishearten students who genuinely want to learn.

One way to help such students is to change the way courses are designed and taught. A case in point is a recent study from Brigham Young University, USA. The study shows that a series of short weekly mid-terms with formative assessment before a final exam coupled with creative grading can help students learn better. Furthermore, the researchers' novel model for assessing and grading avoided the discouragement typically felt by students when faced with poor grades. Instead, the course structure allows students to benefit from their mistakes without being penalised for early failures.

10 women questions

Harini Barath &
Manupriya

1

Who or what inspired you to become a scientist?

I got interested in science very early on. My father was in railways and I grew up in small towns, where your group is limited and you don't have much to do on the weekends. So our idea of a fun time was establishing a lab and doing experiments. And, it was fun! I knew I was going to do something with science but it just made more sense to me to go into medicine. By the time I finished medicine and my post-graduate training, I knew taking one patient at a time wasn't really enough for me. I wanted to go into research where you could think about doing things that are based more upon the principle than the practice of individual medicine.

2

Is there one thing you're currently working on that keeps you awake at night?

Currently with oral vaccines with most enteric infections, we make products without understanding them. Other than polio we don't have a correlate of protection for anything. We're on a long road now to finding a correlate of protection for rotaviruses and novoviruses—20 years done and still plenty to do.

3

Who are your women role models and not necessarily in science?

I have two. One is a scientist, Mary Estes, with whom I did my postdoc. She is a molecular virologist at Baylor College of Medicine, USA who has done phenomenally well. Everybody in the field knows her and respects her. She is still active at the age of seventy and expects to continue. I think the year I spent with her really transformed me.

The other person is my mother, who kept working through many, many moves that my father had to make. She's always had that incredible attitude that nothing is impossible.

4

Does your organisation have a cell or policy to address sexual harassment? Do you talk to your students and post docs about these issues?

I am new to the institute but yes, we do have such a cell. In fact, tomorrow we have gender training for all of the staff of the institute. And, that is something that I have asked to be a regular feature for new inductees as well.

5

Would you say that through your career, things have become better for women in India?

I think things have definitely become better for women in India. I am starting to see more young women in science who are enthusiastic, who are not worried about needing to give it up in the near future. Not ideal, but improving.

Gagandeep Kang

6

Do women benefit from being mentored by older women and do they need to be mentored differently?

No question about their benefiting from older women mentors. For women I have mentored, I notice that time spent talking to successful women is what allows them to have the confidence that they can also do it. I think it really matters. Often, the busier you get, the less time you have to mentor individuals and you have to consciously try to overcome that.

7

Do you think there are particular structural road blocks that impede the progress of women in science?

There are plenty of cultural road blocks. Structural road blocks—like things around leave, having a lack of access to support facilities and a lack of structure flexibility in how people work; If you were to say you want to change your working time and the institution doesn't allow it, that's one instance.

8

One change that will hugely benefit the young women scientists who are just making their way in?

I think completely flexible timings would really help. And, institutionalise that, don't make it a favour.

9

How easy or hard has it been for you to achieve a work-life balance? And, how do you think institutions can help in this regard?

If you ask my family, they are likely to say that I don't have a work-life balance; I have a work life. I think institutions that allow women to take care of their children by being flexible and providing on-site support services are very, very important. Some people will manage anyhow but you need for the median and above to manage as well.

10

One piece of advice that you wish some one had given you when you were starting out?

That's a tough one! Don't be afraid to say no. It took me a long time to learn that.

Photo: Munmun Dhalaria

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