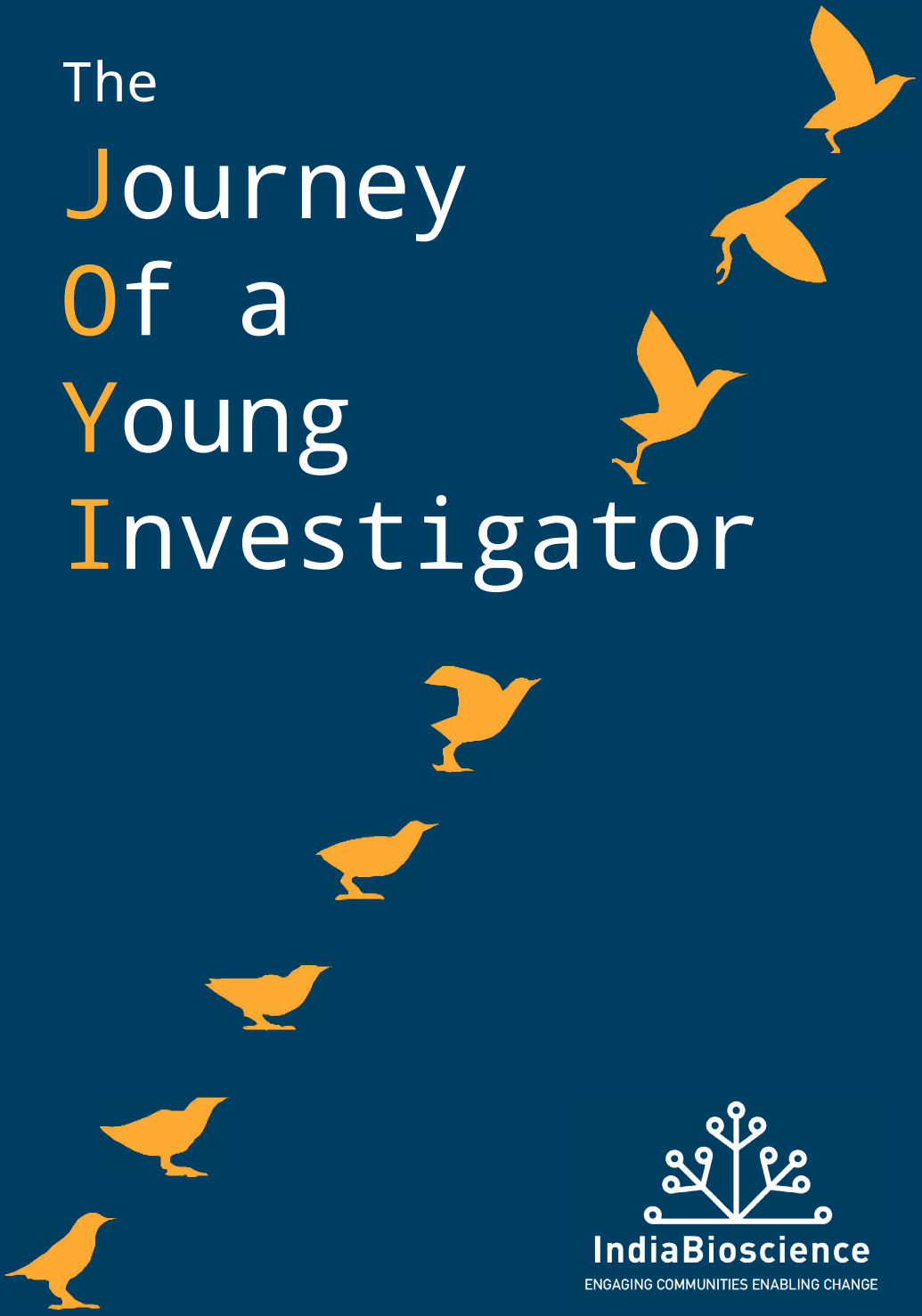
The Journey Of a Young Investigator



IndiaBioscience

ENGAGING COMMUNITIES ENABLING CHANGE

We asked the young investigators attending YIM 2019 to describe their experience in setting up an independent lab in India, along with any take-aways or lessons from their journeys. This collection celebrates these stories.

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DREAMS TO REALITY

A young scientist's 'Return to India'

Karishma Kaushik

Needless to say, I raised a lot of eyebrows (and questions) from colleagues and friends when I shared my decision to move back to India to start my independent research career. A physician-scientist, I had completed my MBBS and MD in Clinical Microbiology in India, and moved to the US to pursue a PhD in Molecular Genetics and Microbiology at the University of Texas at Austin. After almost 15 years of formal education, I had the requisite degrees, skill sets and training to steer my own research group.

My research vision focused on using interdisciplinary approaches to study microbial infections, thereby bridging the gap between the laboratory bench and clinical bedside. For this, India, with its vast array of infectious agents, reservoir of clinical material, and my accreditation as a medical doctor, presented exciting prospects. Further, I received the prestigious Ramalingaswami Re-entry fellowship from the Department of Biotechnology, Government of India, which would fund my research interests in India for five years.

I moved back to India early this year and activated my Ramalingaswami fellowship at a DSIR-recognized R&D laboratory, GenePath Dx, in Pune, engaged in cutting-edge molecular diagnostics for a range of conditions, including infectious diseases. Through the grant, I have established my independent research group, The Wound Infection Lab, that employs laboratory and clinical approaches towards the study of wound infections. This ranges from developing a human-relevant wound infection model system to the long-term characterisation of microbial

populations from patients with chronic wound infections.

In addition to this, after several years in academic research and teaching, I have the opportunity to work at the interface of clinical diagnostics and patient care. I am also leading the development of innovative diagnostic solutions for infectious conditions relevant to India.

Through a combination of events, both planned and fortuitous, my return to India has enabled my professional profile to include a rare combination of academic research, clinical diagnostics, and biotechnology invention. This is a very unique opportunity to contribute to different aspects of Indian science, which includes advancing the frontiers of original research, impacting the lives of individual patients', and innovating mass scale solutions for infectious diseases in India.

I am certain that there are several other young Indian scientists looking to return to India and establish themselves as independent investigators. Having transitioned the early stages of this path, I am encouraged to share some initial thoughts that could possibly facilitate others on a similar journey.

NETWORK, BY ALL 'MEANS'

Incredible as it may sound, my return to India was consolidated by a connection on Facebook. I came across a public outreach group, The LOFT Forum, which hosted events on a range of topics for community awareness. On my next visit to India, I spoke at the forum on the implications of antibiotic resistance. It was not only a great way to re-establish connections back home, but the forum introduced me to scientists at GenePath Dx, Pune. Till this time, the possibility of activating my fellowship at an organization other than a large-scale university or institute was not known to me. For returning researchers, this underlines the significance of leveraging virtual, albeit unconventional, avenues of networking, especially since they are likely not to be physically present in India. Further, it is important to assess the option of working at small R&D facilities, and beyond conventional research set-ups. A niche R&D

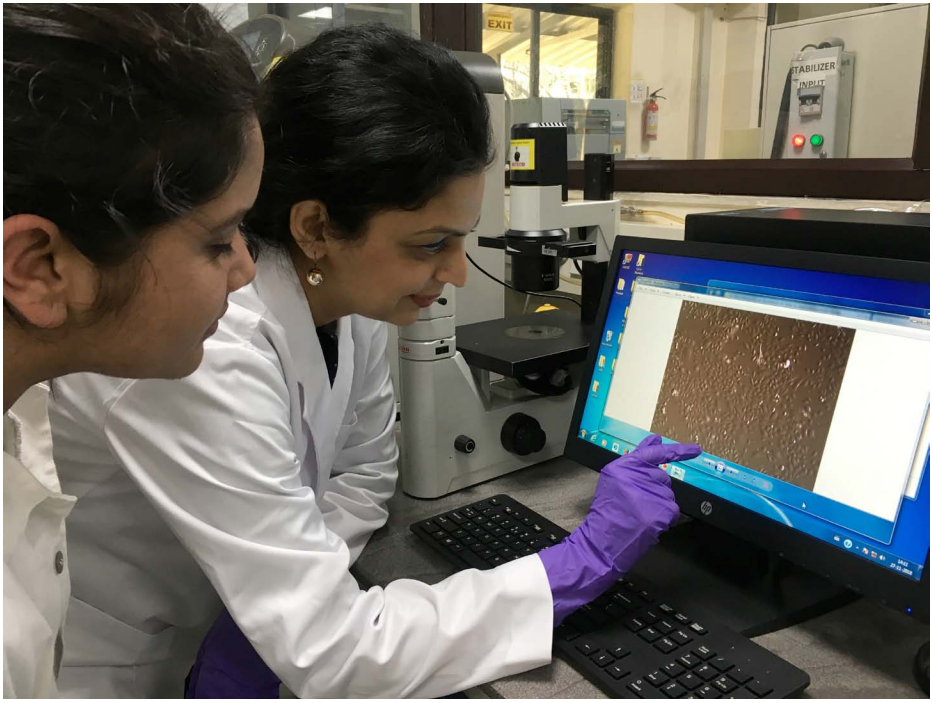
organization might prove to be a closer fit to one's area of expertise, and large academic institutions are often inundated and back-logged with numerous applications from potential returning scientists.

GO 'LOCAL'

A few weeks into my return, a colleague invited me to speak at a Students' Microbiology Association inaugural event at an undergraduate college. Starting with this, I continue to volunteer to share my research interests at college events, meet potential collaborators, as well as attend local workshops, conferences and seminars. Through these opportunities, I was fortunate to meet some highly motivated and young researchers, and can lightheartedly say that I impressed them enough for them to join my research group. Though not necessarily intended to be so, reaching out to different scientific communities enabled the expansion of my research group with high-quality local talent.

THINK 'OUT OF THE LAB BOX'

As returning scientists, we have often worked in very well-equipped international laboratories. For example, I worked in a laboratory in the US which had in-house capabilities for confocal microscopy, microengineering, microfluidics, nanofabrication, in addition to cell culture, microbial culture, and even advanced bioinformatics. Moving back on a start-up grant, it is financially inconceivable to establish this gamut of instrumentation all at once. Instead, one can look for solutions that do not involve building massive infrastructure for each project component. For example, India has some excellent engineering institutes and biotech companies with capabilities to develop microfluidic devices. I found it a viable option to leverage the expertise and resources of an engineering firm dedicated to building such platforms. This way, even though I may have the requisite microengineering skill sets, I can focus on the real science in my research, which is to study certain biological phenomena on these platforms.



YOUNG ADVISOR, SEEK ADVICE-GIVERS

A huge facilitator on this return path has been the guidance and recommendations from senior scientists, professors, and heads of institutions. I have been fortunate to have advice from these experienced individuals an email click away, and their suggestions have been invaluable in setting up my research, looking for funding options, and seeking out forums and conventions that cater to young investigators. The big takeaway from this is that a young scientist does not have to walk this early, uncharted path alone. Most established faculty in Indian institutes would be happy to share their experiences with young faculty, and this is a great way to build a mentorship network.

RE-DISCOVERING THE SCIENTIST WITHIN

I was pleasantly surprised that moving back to my home country would uncover a range of scientific opportunities beyond traditional research.

Through affiliations with GenePath Dx and NCL-Venture Center, I was exposed to a new wave of biotech start-ups and innovation in the Indian science scene, while I discovered a personal interest in public and science policy. In fact, there are several universities with courses and programs catering to train the new breed of science policymakers. While these paths obviously exist in the US and elsewhere, often immigration and bureaucratic issues restrict us from fully exploring them. Interestingly, my interaction with policymakers has enabled a behind the scenes look at healthcare strategies and science funding, while exploring entrepreneurship has made me understand the needs and challenges of taking academic research forwards to the bedside and clinic.

"I am certain that there are several other young Indian scientists looking to return to India and establish themselves as independent investigators."

A few months into this journey, it has been a very exciting and dynamic transition albeit with a steep learning curve. To others pondering a similar situation, I can say that while it may be daunting, it is a privilege to be a part of India's story to transform the country's 'brain drain' into 'brain circulation'. The process will be a professionally and personally rewarding experience, and will greatly expand your competencies, experiences, and scientific vision. As I responded to colleagues and friends sceptical of my plans to return, 'I have lived the proverbial American dream, it's now time to shape the emerging Indian dream'.

Karishma Kaushik is a recipient of the Ramalingaswami Re-entry Fellowship, Department of Biotechnology (DBT), Government of India. .

HOMERUN

Trinath Jamma

Well into my post-doc at the University of Massachusetts Medical School (UMASS, Worcester, USA), I decided to head back home and explore career options that would allow both research and teaching. Yet, a hiatus from research in India was sufficient to raise several questions in my mind, the foremost of which were: will I be able to continue with my vision of metabolic inflammation research in India? What must I do to match the research standards set by those in the west?

While I am still looking for answers to my latter question, I am happy to reaffirm that, indeed, there are numerous prospects for excellent research in India. But I soon realised that one needs the immense support of systems that share your dream to grasp such opportunities. Two pillars were pivotal in helping me build foundations in my early days of an independent career: **mentors** and the **host institute**.

Good supervisors can be lifelong mentors and perhaps even collaborators, granting you the autonomy to coalesce new research directions in familiar environments. It is natural to forge a meaningful relationship with your PhD supervisor who has been there for you at formative stages of your science career.

My thesis supervisor, K N Balaji at the Indian Institute of Science, Bangalore, continues to be a phenomenal support in shaping my scientific outlook. Our informal discussions propelled some of my most successful studies. Additionally, he trained me to have a good foothold in academic administrative processes which stood me in good stead in starting my own

lab. During the same time, I was fortunate to work with Srini Kaveri and Jagadeesh Bayry at INSERM, Paris. Their generosity is such that even today, their doors remain open to me for all forms of scientific networking.

My post-doc mentor at UMASS, Worcester was himself a young investigator. Jun R Huh was a true multi-tasker with colossal persistence. Efforts from both of us led us to secure funding support to the laboratory. Our time together gave me lessons on time management, leadership skills and effective productivity. Upon my return to India, I had a short stint as a UGC-Kothari Post-Doctoral Fellow in the laboratory of Sharmistha Banerjee at the University of Hyderabad. Sharmistha is an enthusiastic, dynamic and candid mentor. There remains much to be learnt from her.

"I hope every young investigator receives the support that I have."

These mentors with their varied academic experiences and leadership styles have provided unconditional support when I was exploring unchartered territories. The initial excitement of being offered a faculty position at Birla Institute of Technology and Science (BITS Pilani), Hyderabad, was quickly followed by the realisation of its multiple challenges. It is well accepted that starting an independent research group today is perhaps more difficult than ever and in this respect, paucity of funding is just the tip of the ice-berg.

BITS Hyderabad has several schemes to encourage the effective integration of junior researchers into their first leadership roles. They have a "how to" manual with valuable information and recommendations for newcomer faculties. Additionally, they conduct orientation and communication drives with key personnel in administration, information technology, human resources and finance departments to deal with region- and institute-specific regulatory nuances related to laboratory work, biosafety and ethics.

With regards to the funding perspective, BITS is now propelling more resources into research than ever. They have established a timeline for allocating research initiation grant to incoming faculties in addition to intramural competitive seed grant support. I was the recipient of its OPERA (Outstanding Potential for Excellence in Research and Academics) Award which is in the form of a "joining bonus" paid over three years. Such incentives are aimed at bringing research in BITS at par with the best institutions in India and elevating its QS World University Ranking.

While applying for external funding, I received critical and constructive feedback from experienced senior faculties. A joint drive for the recruitment of JRF and laboratory technicians allowed us to generate wider interest among candidates and gave me important tips on good recruitment. Further, a well-organised and clear account of expected teaching load, commitment to research and intellectual leadership made sure that we were all on the same page. Senior faculties also proved resourceful when preparing lectures and in classroom technology. In this way the institution strives to stand out not only for its scientific enquiry and its ability to attract funding, but also for nurturing talent, measured on an enduring time scale.

I hope every young investigator receives the support that I have. If not, I urge them to actively seek out good mentors and institutions that grant them the freedom to flourish. After all, chasing science is not for the faint-hearted.

Trinath Jamma is an Assistant Professor at BITS Pilani-Hyderabad Campus.

BACK TO THE ROOTS

Kaushik Biswas

I still remember the excitement that gradually grew from the time I first learnt about my new job back in Kolkata, India, till about a month before my departure from the US. I was returning to my home country after almost 8 years of postdoc. During those eight years, my only aim was to publish quality science and that too fast (which is easier said than done) and return to India.

Surprisingly, my "exponential" curve of excitement gradually died down with an almost parallel growth of anxiety and emotions in anticipation of facing the reality of being an independent PI in India. Amongst these, self-doubt was the most predominant. It is in human nature to desire success in whatever we venture towards, and uncertainty in whether or not we may succeed creates that element of doubt within ourselves. I was no exception.

The other aspect was that having completed my PhD in India, I knew that the "research terrain" in India is more "rugged" in terms of infrastructure, resource as well as funds, all three of which are somehow directly or indirectly related to each other. This knowledge only helped compound my self-doubt.

It was only after the next 8 years in India that I fully realized that my worries were not baseless. Here, I will try to share some of the experiences I had as an independent researcher from the time of setting up my lab till establishing (in the form of a peer-reviewed publication) a research

problem of my own. Running a research lab in India made me realize the true worth of the age-old phrase "No Cross, No Crown", and in spite of all the hardships and struggles we undergo as a young PI, the joy and satisfaction that accompanies the success of solving a scientific question is reason enough to return to India and head our own labs. There is no "magic recipe" for success, more so for a fresh YI who has just returned, but the following points may help make the transition smoother.

OVERCOMING THE ELEMENT OF SELF-DOUBT

I would not worry much about this, and let it remain within myself. To me, self-doubt is necessary as it formulates a mechanism of "chronic" self-assessment. Without self-assessment we would be blind. So let the self-doubt remain within its own limits as long as it helps you perform better.

SETTING UP THE LAB

This is one of the most difficult phases in the career of a YI, and it needs minimal scientific ability and more management skills. Management includes handling the very limited resources of most Government Institutions, dealing with the lack of adequate infrastructure (in most places in India, a lab space is often not pre-designated and allotted, and the lengthy process of lab space handover happens only post-joining), getting the most out of the very limited funds you have been supplied with, and last but not the least, utlizing the restricted manpower (in the form of a few newly recruited JRFs) in setting up the lab and at the same time generating the very critical preliminary data for a possible grant, which may be one's lifeline for the next 3 years. My take for this whole scenario is to take one day at a time, and avoid looking too far down the road.

GETTING THE FIRST GRANT

Quality science and research grants are the two "Lifelines" of a lab, and the two are interdependent. It is always advisable to find a basic

scientific question (however challenging it might be), answering which might lead to significant insights into the vital processes of life, and which might be applied for societal benefit as well. This will expedite the chances of getting the first grant, without which a very good problem might fall short of being resolved. Another factor that might affect the funding of a proposal in the early stages is the researcher's age. Starting early, preferably below 35 years of age, has its own advantages. Several extramural funding agencies have tailor-made opportunities for funding, specifically for YIs below the age of 35. So if you are an aspiring YI eager to return, return early.

CHOOSING THE SCIENTIFIC PROBLEM

Choosing the correct scientific problem is key to one's success. More often than not, we are tempted to continue our independent career with the same problem where we left off at postdoc, either because of closer acquaintance with the subject, or because it is the easiest route. This might work for a few, but for many, this approach lacks originality and one may also end up competing with their own postdoc lab. Try to think of something new, perhaps related to what you might have pursued before, but not a continuation. Explore some new aspects which have not been studied before or may have been neglected.

Try finding a question which has a direct bearing on human health, as that scores hugely in terms of direct benefit to mankind. We must never forget that we use Government money to explore our independent ideas, and we owe it to the nation to return back with something that might directly/indirectly contribute towards societal improvement.

"I believe that whatever we choose to do, we should study in-depth and not superficially"

I believe that whatever we choose to do, we should study in-depth and not superficially, and complete a story. A story is something which

everyone likes, remembers and hence presents an opportunity for us scientists to reach others easily, eventually providing a gateway to improve understanding of the subject.

TOO MUCH DIVERSIFICATION MAY LEAD TO DE-FOCUSING

As a YI, it is extremely important to identify one's research area and draw a clear line in as far as diversification is concerned. Diversification in research is often necessary and important, but within a certain limit. Too much diversification may lead to unnecessary dilution of one's original research problem. Keeping focus on the primary research area and carrying out in-depth studies ultimately also helps in getting noticed and recognized for contributions to a particular subject area, both nationally as well as internationally.

OPENING THE DOORS AND WINDOWS OF ONE'S MIND TO NEW IDEAS

As a YI, I have been open to new ideas from all avenues, be it my senior colleagues, younger colleagues and particularly students and post-docs. It often helped me open my eyes towards directions I may have never fathomed, and that have opened up a totally novel area of research in my lab. More often than not, fresh ideas emerge from students who are completely invested in their research, and this investment in terms of time, effort and passion provides returns in terms of new emerging ideas.

The other aspect of being open is to accept criticism in the most positive way – even if you feel that a critic is particularly harsh on your newly presented data, taking the positives from these interactions will ultimately benefit the YI. The quality of accepting criticism in a positive way should be embraced by every YI, as this would not only help in improving the quality of the work, but will also provide the necessary trigger to invoke challenge within the YI to further his/her research.

All this said, the success of a YI will ultimately depend on his/her motivation, determination, perseverance and willingness to dive deep into whatever he/she is pursuing. Quality science stems from in-depth and detailed studies, and quality science will be the ultimate basis for a scientist's success – whether they be young or old.

Kaushik Biswas is an Associate Professor at the Division of Molecular Medicine, Bose Institute, Kolkata.

A LESSON LEARNED

three pillars to an excelling scientific society

Priyanka Singh

I believe that my inclination towards research work started with the one year long research project which I pursued as a part of the Master in Biotechnology program at Jawaharlal Nehru University (JNU), India. Developing new methods and strategies in the field of healthcare gave me enthusiasm and ignited a passion to dive deep into this beautiful world of enigmas that defines life science research.

Around the same time, I started developing a habit of reading interesting research work from all over the word. While going through all the great discoveries in life science, I was troubled to note how India with such a rich history of advanced scientific knowledge and huge scientific population still lags behind in the number of research articles in high impact journals or representation in prestigious awards like the Nobel Prize. It dawned on me that in order to get my answers I should embark on the quest myself and gather diverse research experience by working in different parts of the world.

So, I applied for PhD positions in various foreign universities and got a competitive North Rhine-Westphalia graduate fellowship which provided me the opportunity to do my PhD in Molecular Biology from the University of Muenster, Germany. Moving to a different country, one which didn't have English as the first language, was a scary proposition at first. However, once I got accustomed to the culture and language, a sense of normalcy was restored.

Apart from the research work, I found it quite exhilarating to be able

to interact with people from different parts of Europe. For me, the most noticeable feature of life in Europe is not the luxury of advanced technologies, but rather the attitude of the masses which understood the importance of maintaining the right balance between core human values including self-enhancement, openness to change, self-transcendence and conservation which makes them efficiently function as a developed society. I also noticed that the majority of Indians studying abroad were excelling in their respective fields, which suggests that Indians are just as skilful as their counterparts from developed nations.

After completing my PhD, I was awarded some excellent competitive European fellowships like European Molecular Biology Organization (EMBO-Long Term Fellowship) and Alexander von Humboldt (AvH) fellowship which allowed me to spend a few more years in Europe in different labs working on diverse research topics. As a student, I worked in some very well-funded research laboratories in India and abroad. The administration in these places was well organized, efficient and supportive. As a result, the entire focus for me was always on research and scientific activities. After gathering almost a decade-long experience of working with some of the best researchers in the world and learning cutting edge technology in the field, I decided that it is now time to make use of this knowledge by going back to my country and getting a firsthand experience of working in Indian academia as a faculty.

"Moving to a different country, one which didn't have English as the first language, was a scary proposition at first."

With great zeal and motivation towards contributing to the advancement of scientific community in India, I started applying for faculty positions in India. Simultaneously, my husband was also applying for faculty positions in the field of Chemistry. We had to face the two-body issue and went through the struggle of sending numerous applications and appearing for multiple interviews for almost two years. Finally, we both got Assistant Professor positions at IIT Jodhpur and we joined together in May 2017. It

was overwhelming for me and my family as having a couple working in a same academic institute is highly unusual and very hard to come by.

"A nurturing and supportive academic environment acts as an incubator which also affects the speed and direction of science."

I was very hopeful as a new chapter of my career was beginning which held the prospective of working towards becoming a torch-bearer of Indian Science and grooming the younger generation through teaching and research. Although I was prepared that the beginning might be tough, there were some situations which I hadn't anticipated. I had to go through bureaucratic processes which seemed ancient. It started with the movement of the institute to the permanent campus, which led to postponement of research lab allotment. The allotted lab had no water connection or furniture. Despite no previous infrastructure-related training, I was surprised by my abilities to expand in different aspects of lab designing. I laid out the design for the furniture, water and electric connection for the lab. It took almost one and half years for the Institute to implement these designs and furnish my laboratory. However, this gave me the confidence of building a laboratory from scratch and it was overwhelming for me to see getting these ideas implemented after the long haul.

Funding was another hurdle as the first external funding agency where I submitted my application took more than a year to review the proposal and finally sanctioned it with some budgetary cuts. This made me realize that my mentors must also have gone through several of these hurdles themselves and they still kept working towards their scientific goals. My situation had just made me appreciate them more and I took these hurdles in stride. Getting a lab functional was slower than I expected but I am glad that we are finally there and I will always be thankful to the first batch of my students for walking this path with me.

My experience has taught me a valuable lesson that while being a good

scientist is still an important part of the deal, a nurturing and supportive academic environment acts as an incubator which also affects the speed and direction of science. The quest to get the answers to my naive questions, and my journey so far has presented me with three pillars for an excelling scientific society 1) Scientist 2) Administration 3) Funding. If any one of them is weak then the science will suffer. So, it is very important for these three pillars to work together with the right intention, courage, professional ethics and moral towards science and society.

My journey has made me strongly believe in the quotation by the German philosopher, Friedrich Nietzsche "Was mich nicht umbringt macht mich stärker" which translates in English as "What does not kill me makes me stronger". I am glad that IndiaBioscience is providing this platform to give voice to young investigators of India which will definitely not go unheard.

Priyanka Singh is an Assistant Professor at the Indian Institute of Technology (IIT), Jodhpur.

FINDING A FOOTHOLD
in a medical Institute: The journey of a basic scientist

Priyanka Upadhyai

Contrary to what is perhaps the experience of many biologists, I was never awestruck with the life sciences as a child or a student in school. Conforming to the conventional scheme of education in our country, I was confused and struggling to embrace what I really loved as opposed to what I was seemingly good at as per my grades. I ended up going to the erstwhile Presidency College (now Presidency University), Kolkata and pursuing an undergraduate degree in Zoology.

And it was here that I discovered my passion for developmental biology; I found beauty in the orchestrated development of life from a single cell and was struck by how molecular entities could communicate and make sense in achieving form and symmetry. It was lyrical almost, and I knew I had found my calling.

After a postgraduate degree in Biotechnology from the University of Calcutta, I went to the University of Pittsburgh, USA, for my PhD and thereafter went on to pursue postdoctoral research at the University of Manchester, UK. My studies focused, so far, on early organismal development and patterning, in alignment with my core interests in developmental biology and genetics.

My academic training abroad was marked by a sense of idealism, perfection and a thrust on quality, which overpowered the idea of churning publications out in large numbers. Trained in the labs of basic scientists, I was honed not only in routine molecular biology but also in

specialized strategies of working with fruit-flies, our model of choice. It was an arduous world of trial and error where things took time to refine and perfect. At the same time, people were committed to the same.

Married to an evolutionary biologist, I had always been open to the idea of returning to India. Initially, the reason was to be closer to family, but this was accentuated with the downturn in basic science funding as well as the increasing uncertainties in obtaining secure academic positions abroad. However, it was 2.5 years into my postdoctoral work that my husband was offered a position at Manipal Academy of Higher Education (MAHE), Manipal.

As a young couple who were training in science, we had lived, studied and worked apart for various bits of time that had collectively added up to several years already; it had weighed us down. So when I was also offered a position as Assistant Professor at the Department of Medical Genetics, Kasturba Medical College, MAHE, Manipal, it was hard to turn it down, even though it meant leaving my postdoctoral project, which was finally shaping up to yield meaningful results, mid-way.

"I found beauty in the orchestrated development of life from a single cell... It was lyrical almost, and I knew I had found my calling"

I was also filled with trepidation because I was walking out of the comfort of state-of-the-art laboratories and a well-oiled research support machinery of my training days into a world that was completely unknown. After almost a decade abroad, I had been largely removed from Indian academia and its workings. So, suddenly, returning no longer felt like coming home. However, for all practical purposes, it made sense. I was also buoyed by having steered projects single-handedly during my postdoc. So venturing to go independent, and putting my skills and training to action with a faculty position next seemed feasible.

It was a position at a relatively new department that was focused on rare diseases and included only clinical faculty at the time. The University was keen to have me establish laboratory facilities in a primarily clinical setting and to complement their ongoing research. The prospect of doing so from scratch in an unfamiliar setting was a mix of both daunting and exciting.

"As a young couple who were training in science, we had lived, studied and worked apart for various bits of time that had collectively added up to several years"

I had started out in shared labs with serious constraints on budgetary spending for equipment, space limitations and long wait-times for any allocated funds. The department with its thrust on clinical genetics was beginning to identify new disease associated genes and was intent on me to have functional assays 'quickly' in place so as to validate and characterize them. Importantly, I was required to ensure that all of my research was directly and intrinsically related to rare disease biology.

Despite no prior experience in the nitty-gritty of lab set-up, I found myself navigating through the same reasonably well and about two years later we had most of the basic facilities in place. I also managed to submit a grant to study two novel disease-associated genes that had been identified in the department and was happy (and relieved) to find it sanctioned within a few months. These funds also allowed me to procure a couple of new equipments, which would help the research planned. On a personal level, this was also a time when my daughter was born and I was torn between doing justice to both fronts.

In the initial year and a half at my new position, aside from getting my lab off the mark, I was closely working with clinicians and staff on diagnostic testing for rare diseases. As part of the group, I witnessed clinical research at close quarters. It was an extended training and my first foray into the

area of human disease genetics.

Like many basic scientists, my academic training so far had been enwrapped in blue sky research, which often tended to be fairly distant from having direct implications on healthcare. At my current position, it came as no surprise to me that clinicians were acutely pressed for time, given the sheer volumes of patients they saw daily.

Further many clinical scientists had limited formal laboratory training, not having undergone the rigours of obtaining a PhD, unlike some of their peers abroad. It was therefore, not easy to have them understand my concerns or have a sense of the challenges I was facing. It was even more difficult to convey how long experiments in a lab could sometimes take to design, frame and fine-tune in order to yield meaningful results.

"At heart, I remain a basic scientist and hope to never stop learning."

However, to bridge the chasm I decided to approach things positively. Given the effort and dedication from their end to enrol patients in a research study, and provide samples sometimes by painful and invasive procedures, it was important to convey that as researchers we were respectful. It helped to be open, interested and attempt to grasp their concerns. Refraining from jargon in communication and simplifying ideas was also beneficial.

In addition to broader goals to be achieved over a longer term, I focused on facilitating the routine and seemingly simpler assays with the resources available, so as to enhance confidence-building while working with a clinical team. Importantly, I always tried to be realistic and transparent when collaborating together.

At heart, I remain a basic scientist and hope to never stop learning, regardless of my setting. So while I strive to define research goals that are congruent with what has always enthralled me, I also seek to extend and

apply myself to meaningfully address other research problems that might resonate more with being within a largely clinical setup.

Almost three years into this journey, I look back feeling exhilarated. My journey so far may not have been perfect but has changed me in important ways. It has taught me to embrace the unknown with perseverance, fortitude, and grace. And to never cease being inspired.

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IN-SERVICE TRAINING
for young investigators in Indian universities

Mohammad Imtiyaj Khan

A young faculty member in a traditional university, however much he/she has excelled research-wise, is a greenhorn in teaching. To establish himself/herself as a personality to be looked up to, creating new knowledge and simultaneous effective dissemination of knowledge are a must. However, is there any effective training mechanism in place to help tackle the challenges that crop up in doing so?

The present human resource development centres (HRDC) under the UGC evolved from the past academic staff colleges, which, as per XI Plan guidelines, *"emphasizes teachers as agents of socio-economic change and national development and underlines the need to make them skill–oriented teachers"*. Since the only teaching job in our country that does not require a professional degree/diploma or training in education/pedagogy is assistant professorship, the national policy on education (NPE, 1986) paved the way for in-service training for assistant professors.

It is mandatory for an assistant professor to undergo an orientation programme (OP) in the first two years and two refresher courses (RCs) in the subsequent four years. Many a time, the programme and course syllabi do not serve the purpose because of the following reasons.

- Insufficient funds to engage resource persons from across the country
- Lack of experts in and around the host institution
- Absence of lectures by industrialists/entrepreneurs/environmental warriors/politicians of repute and high academic quality and integrity,

- Heterogeneity of the candidates' backgrounds (e.g. on one hand, orientation programmes are open to one and all in their first two years of joining the job. On the other hand, refresher courses on life sciences, more often than not, turn out to have more of one particular subject, such as classical taxonomy/botany or zoology-oriented lectures/activities, while the participants are from botany, zoology, biochemistry, microbiology, molecular biology, and other backgrounds),
- Mixing of degree college and university teachers in the training, though the latter deal with only post-graduate and doctoral students,
- Questionable academic quality of the experts, some of whom are retired and not tech-savvy enough to deal with the Google-era participants, and some of whom themselves did not undergo such training.

Because of these circumstances, orientation programmes end up disorienting the participants and refresher courses serve to normalise the levels of motivation and knowledge, instead of improving the same. Still, we are obligated to attend these 'trainings' out of learned helplessness.

"Because of these circumstances, orientation programmes end up disorienting the participants"

Many serious participants expect to get some quick tips for balancing research, teaching and administrative work, in that order. However, that does not happen because for many of the resource persons, during their initial stage of teaching at a university some decades ago, eligibility criteria for the job were different, and, therefore, there was not much push for research. For example, they could become university teachers with just a Master's degree, and, hence, there was no expectation of research from them. Therefore, there was also no need for a proper funding mechanism for research.

Till date, there are a few instructors, for whom the research programmes are considered an academic formality for the respective degrees, while the postgraduate teaching programmes in universities top the priority list. This is so deeply ingrained in their mind that they have separated research into industrial and academic. Further, they believe that only the research institutes/laboratories under the DBT, the ICMR, the DST and others should do hard-core research, not the universities.

As a consequence of this mindset, research infrastructure is weak with erratic power and water supply, insufficient supporting staff, insensitively allocated budget for repairing equipment, non-existent auctioning mechanism for the junk materials, and so on. To compound the matter further, there are issues like the lack of environmental management systems and proper disposal of waste (chemicals, plasticware, glassware, metal scraps, solvents and biologicals). These issues could be addressed by installing an incinerator on the campus and by constructing a well-planned drainage system without involving much labour and hence, financial cost and time.

The absence of a dedicated section for research/project-related accounting leads to a step-motherly treatment and inappreciable status of research, even though these universities (including many central and state universities) award degrees like MPhil and PhD regularly. This situation is a consequence of irregularly-updated policies framed by people who were themselves never exposed to research labs of international repute, and some of whom are from non-experimental science backgrounds. In a traditional liberal arts university where the core strength is the social science or languages, it is impossible to exclude people from non-experimental science backgrounds while framing certain policies for the university as a whole, which may not take into account the needs of experimental scientists.

"The sorry state of research in universities is because of the missing emphasis on it."

In the beginning, orientation programmes and refresher courses did not have any mention of helping in research-related matters as an integral part of the training. Subject-specific refresher courses were introduced much later. This means that batches of trained teachers have not attended subject-specific refresher courses, wherein research and development come into the picture.

"Administrative checks alone cannot ensure the efficient and effective utilisation of funds"

The sorry state of research in universities is because of the missing emphasis on it. The problem with doing research in a traditional university largely arises out of misplaced priority of the administrators or the founding fathers. A separate research cell should be set up and adequate attention should be paid to the researchers in terms of supporting their needs. There is enough funding nowadays, even though its effective utilisation is an unrealised dream. Administrative checks alone cannot ensure the efficient and effective utilisation of funds if the policies governing the utilisation are not redesigned to be research-oriented from its current administration-friendly design. For example, under the overhead budget, there is limited flexibility to utilise the funds[1]. The solution to this could be brought about through both top-down and institutional interventions.

A young faculty member who has not managed to get his/her professional balancing act right even after attending the mandatory in-service training has to face non-technical problems as well, including financial and administrative hurdles. Among them, the problem of cramped space hits him/her hard in the very beginning as he/she fails to get himself/herself even a room to call 'office'. Ironically, the apparent reason for this is that

[1]Overhead charges/budget is a part of the overall budget of a research project allocated for meeting the costs incurred by the project implementing institute on account of administrative and infrastructural supports. The infrastructural support is narrowly defined under this budget head as physical infrastructures, such as computers, ACs, furnitures, etc. Minor equipment and gas cylinders, for example, are excluded undermining the project's requirements.

these traditional universities were not built to create space, but to occupy space, as they are spread over a large area with less built-up floor area because of which there is limited space to utilise for research or to work in.

The next hurdle is the merry-go-round in the administrative offices that could be perfectly exemplified by the saying 'if the mountain will not come to Muhammad, then Muhammad must go to the mountain'. Left with no option, young faculty members learn financial and administrative matters on-the-job, though the orientation programme could be made more comprehensive by incorporating them in the syllabus.

Pedagogical/educational training (orientation programmes and refresher courses) for in-service faculty members could also be done more effectively. I have heard of the old practice of learning the art of teaching from senior teachers still being practised in a few universities wherein the new faculty members are allowed to attend the lectures of the senior professors in the first six months of their career without being assigned any class themselves. This practice can be quite effective in orienting new recruits towards teaching, but in conjunction with orientation programmes and refresher courses. Of course, it should be optional for those with prior teaching experience.

"A separate research cell should be set up and adequate attention should be paid to the researchers in terms of supporting their needs."

Considering that new recruits are usually motivated and prepared to take up the professional responsibilities, one can presume that they will not slide into the Scully effect[2], rather they will develop their own effective style of teaching. A robust real-time cross-feedback mechanism involving teaching, administration and finance should be introduced to assess the performance of young faculty members so that they get opportunities to improve on their weak points. The institutional quality

assurance cell (IQAC) should be vibrant enough to provide the right guidance and recommendations to those who are in need of these.

A holistic approach to train assistant professors on pedagogy, administration and finance can minimise the time taken by them to fit into the role.

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[2]Scully effect is the phenomenon of viewers getting unmindfully inspired by the fictional characters in TV shows or movies resulting in copying the choices and ideology of the characters.

MENTOR-MENTEE RELATIONSHIPS

creating a positive work atmosphere

Geetanjali Sundaram

As one transitions from being a graduate student to a post doc to an independent investigator, one does get opportunities to pick up some of the skills that are very essential to set up and establish a productive lab doing good work. The day you start the journey as an independent researcher, however, you realize that juggling all of these aspects simultaneously on a daily basis is an entirely different ball game and nothing could have prepared you for it.

There are also added administrative responsibilities that one may not apprehend. I soon realized that being the "Boss" basically meant that "from peon to PI", every job was my job. Clearly the first couple of years were quite overwhelming and it took some time to find a stable footing. The constant deadlines associated with every aspect of the "peon to PI" role also never fell short of keeping me on my toes.

While meeting all the demands of being a PI, it is essential to not lose sight of an extremely important aspect of this job - mentor-mentee relationships. It is also the one aspect of your job that you are probably least prepared for. No amount of experience in training undergrads and juniors can make you apprehend the expectations that a graduate student has from their PI.

Becoming the custom-made and context-dependent support system that your graduate students need you to be and learning how to communicate

effectively with them is not easy. It is a very demanding aspect of a PI's job and when you are struggling with multiple important deadlines, finding the time and patience to provide the support and motivation to the mentee isn't as easy as it sounds. In fact it won't be an exaggeration to say that for every student who is awarded a PhD, the mentor should be awarded a degree in psychology as well.

I started my journey with a vision of building a "happy lab" with a group of people who were passionate about the science being done in the lab and for whom research was more "fun" rather than "work". Building up this "people" part of the lab was much more challenging than I had expected and each day as a mentor has truly been an evolving experience. Over the years I have worked out a three-step approach to sustain my "happy lab" and here is what I learnt while developing this approach.

MAKING THE RIGHT DECISIONS ABOUT FELLOW RECRUITMENT

I believe that it's crucial for every young PI to know exactly what they are looking for in a prospective graduate student. It's equally important that every PI has the administrative freedom to make the recruitment choice simply based on intuition, if they so desire. When I joined as an Assistant Professor at the Department of Biochemistry, University of Calcutta, there wasn't any structured procedure for recruiting research fellows at the department. This was a big advantage as it allowed me to create my own recruitment process.

The general norm of assessing a CV in isolation and judging the suitability of a prospective graduate student in a couple of meetings did not appeal to me. Instead, I asked the prospective student to volunteer for a month or two so that both of us really got to know each

"I soon realized that being the "Boss" basically meant that 'from peon to PI', every job was my job"

"Most PIs are well aware of the fact that the journey towards a PhD degree can sometimes be equivalent to facing a wrecking ball on a regular basis."

other before making things official. The main assessment was academic in nature, but it was important to judge the applicant's temperament and tenacity. At the end of this period I asked them to make a presentation about a topic related to our research problem and end it with a section on the direction in which they think the work can go.

This part may seem too much to ask from a beginner and it really is tough for some of them. At the same time, I found that their ignorance about the difficulties of experimental research made them fearless about the ideas that they proposed. It gave me a very good understanding of the academic and analytical abilities of the student and helped me decide which of the projects in the lab would be better handled by this new student. Over time this system has worked quite well for me and 80% of the time both the fellow and myself have been right about our abilities to work with each other.

"IT'S GOING TO BE ALL RIGHT"- SUPPORTING AND MOTIVATING THE MENTEES

Most PIs are well aware of the fact that the journey towards a PhD degree can sometimes be equivalent to facing a wrecking ball on a regular basis. To either dodge these regular blows or to recover from them, every graduate student needs the support of the PI.

Some would need it almost everyday and some would need it on an annual basis. Some would demand this support and some would be hesitant about sounding needy and vulnerable. I realized that regular communication with the students was the key to identify their need for more attention at certain times. At the beginning of every month I put

up a calendar on the lab notice board which specifies the schedule of meetings with them. These one-to-one meetings help them discuss their data in a less formal setting compared to the "data-club" and they feel free to discuss the issues they might be facing- failed experiments, access to infrastructure, personal issues, and sometimes the inability to deal with the demands of the job.

Some students would require a patient hearing and a pep talk while some would require a "not so polite" joke or remark to get them motivated and back on track. It's crucial to identify who responds to what and use a "whatever works" approach to help them regain the required positivity. A good mentor would really care about providing this support.

"It won't be an exaggeration to say that for every student who is awarded a PhD, the mentor should be awarded a degree in psychology as well."

It is equally important to know when to extend a helping hand and when to allow the student to be independent. To be their honest friend, you might also have to sometimes point out the bitter truth that they are in denial of. They are going to not like you for that and that's a reality I learnt to accept. A student who held the PI's hand all through the journey may not be ready to cope with the demands of a post-doctoral position.

The balance a PI strikes between the support and independence given to the graduate student is therefore very crucial for "raising" an independent and self –sufficient researcher. Striking this balance is often the most difficult part and the position of fulcrum on the weighing scale might require student specific adjustments.

CREATING A PRODUCTIVE WORK ATMOSPHERE

All work and no play make Jack and Jill very, very dull. Creativity and

intelligence require a stress-free mind to thrive. I make sure that my graduate students get to have some fun in the lab as well. We often organize theme-based events in the lab. The themes are of course academic in nature and we just add a fun twist that not only helps us have a good time but also sometimes gives birth to very creative ideas about solving a particular academic problem.

Once, our theme included performing thought experiments where the experimental model would be a particular lab member and students were asked to present the expected outcomes of those experiments in the form of a research paper. One of the presentations described my presence in the lab as a "stress-signal" for changing the work pattern of a fellow lab mate who was described as a transcription factor in the paper. This paper went on to talk about experiments designed to test the effect of a combination of multiple stress signals (the other stress signals were related to infrastructural limitations of a state university lab) on this lab member.

I really liked the logic of one of the experiments that was suggested in this paper. Later, we actually did a similar experiment in the lab (of course, both the stress signals and the experimental model were changed!) On another occasion a student who always shied away from "writing" about her science, wrote wonderfully when the science part was masked in these themes and this made her realize that she was actually good at it.

"It is important to know when to extend a helping hand and when to allow the student to be independent."

We also have weekly tea parties where we customarily do not discuss science. Not all of these activities need to be pure fun though. Some can be purely academic. For example, I started a reading club in the lab where we choose papers for each other to read and there are monthly themes for the reading list. We then sit and discuss what we read. To rejuvenate the young minds (and "old" ones too) we make sure that these themes are a bit distant from what we work on.

I have found that flexible lab timings are also important for graduate students to strike a work-life balance and so I have never really judged them on the amount of time that they spend in the lab. I have found that for most dedicated researchers the flexibility to choose their work timings is rewarding.Of course there are work related deadlines that they must adhere to.

I also implemented an annual appraisal system for the students in my lab. At the end of every year I hand them a questionnaire that allows them to analyse and list their achievements, failures and targets and requires them to rate their development as a researcher on some specific aspects. They also get to mention which of their expectations I may have failed to fulfil. Some students are more candid in written communication and I have often discovered things about them through these questionnaires that I had otherwise failed to notice. I found that they really appreciate this opportunity for self-assessment.

These approaches worked for me and of course they are not part of a "formula" that will work for everyone. I feel that every young investigator should take this part of their job seriously and work out a method that works best for them.

Geetanjali Sundaram in an Assistant Professor at the Department of Biochemistry, University of Calcutta.

ORGANISMAL BIOLOGY
in the classroom

Anand Krishnan

When I was a postdoctoral fellow at Johns Hopkins, a particular highlight of my experience was being given the opportunity to TA an undergraduate Animal Behaviour course. The idea of communicating a research concept in a field that interested me was very exciting, and the experience got me thinking long-term about doing something similar within the Indian education system. Soon after, when preparing to move back to India, I made up my mind. Whatever my professional life held in store for me, it would involve teaching, and I was going to figure out if there was a way for my research philosophy to inform how I approached the organismal biological disciplines in the classroom.

As the son of a school teacher, I had grown up aware of the importance of engaging students to think independently. Could I, then, distil complicated concepts in my field of research down to their first-principles (the fundamental concepts on which a field is based), and then use this as a framework to construct research ideas with my students? If this was true, could I then approach any subject with the idea that all of the biological sciences could be similarly distilled using the perspective of "curious naturalists", to borrow a phrase from Niko Tinbergen?

This, while not a novel approach, is quite a lofty ideal, but I have set it as a personal benchmark to strive towards in my teaching, and in tandem, also my research. I will, over the course of this article, attempt to illustrate how this approach has informed both aspects of my life as a scientist and my thought process on the role of a scientist as a teacher.

Soon after starting in my current position at Indian Institute of Science

Education and Research (IISER) Pune, I was given the opportunity to team-teach our own undergraduate Animal Behaviour Course. Naturally, I was very excited at the prospect, as I was keen to implement the concept-oriented and comparative approach to the subject that I had learnt in the US.

"Whatever my professional life held in store for me, it would involve teaching."

As an undergraduate in India, I had been privileged in having some exposure to organismal biology from some of the best teachers, but had found myself hungry for more. I had also been made acutely aware through graduate school how few of my compatriots had actually studied organismal biology. Many biology undergraduate programmes overemphasize cell and molecular biology, genetics and biochemistry to the detriment of the diverse, and often first-principles driven organismal disciplines.

Without taking away from the crucial importance of these other biological disciplines, I felt that the vibrant, diverse community of scientists and students at IISER Pune offered a laboratory of sorts for me to develop my abilities in communicating these disciplines. Here, I cannot be grateful enough for the opportunity and freedom accorded to me by my department and course co-instructors, who were very supportive of, and receptive to my teaching plan and lecture content.

At the outset, I tried to turn my still rather free-form thought process into a set of rules that I would use to govern my approach henceforth. I now go by this "rule-of-four" in all my teaching: (1) always distil lesson material into its first principles so students can see a narrative in the subject, (2) always use chalkboard lectures (in the way that I myself was taught), (3) never hand out reading material (I do send out papers I find interesting, but I leave it up to the students to decide how much depth they want to incorporate), and (4) always test students on concepts and problem-solving as a researcher might encounter them.

Adopting this approach certainly had potential downsides: for example, I am not the best at drawing anything, and so had to figure out how to communicate effectively within this limitation. Leaving the reading material open-ended is not likely to endear one to students, particularly around exam-time. I tried to get around that by making my lectures as dynamic as I could, so that students paid attention and took down notes. Ideally, that should make their extra reading much easier to approach as well. Finally, preparing a chalkboard lecture is a lot of work. I spent a week before semester reading up my entire syllabus, would do a second reading the night before, and would wake up extra early the morning of a class to write out lecture notes and "rehearse" so I could deliver a lecture from memory.

The pros, however, outweighed the cons considerably. Personally, I have always felt I teach best when keeping things a little loose and freestyle, and this approach hopefully makes it easier for me to keep changing things up and updating myself in future iterations. Preparing lectures in this way brought back fond memories of my own college professors, who relied on nothing but chalk and sometimes hand-drawn transparencies to capture our imagination.

So how did I approach each class, and how were the lectures informed by my research? To any scientist, the primary research motivator is curiosity. If I could, using the power of narrative, spark curiosity about a phenomenon/behaviour among students, and test them with questions (and the occasional intentional 'mistake'), I might, I hoped, take them along a researcher's thought process.

"Personally, I have always felt I teach best when keeping things a little loose and freestyle"

At first, this was met with dead silence and expressionless faces, but as the semester progressed, students became progressively more responsive, even coming up with thoughts that had never occurred to me. My classes

began with a discussion of how behaviours might have evolved, and went further into discussions on function and adaptive value. My exams focused similarly on problem-solving related to these broad questions, with an emphasis on the fact that there are multiple possible interpretations of any behavioural observation if you think carefully.

"If I could, using the power of narrative, spark curiosity about a phenomenon/behaviour among students, and test them with questions (and the occasional intentional 'mistake'), I might, I hoped, take them along a researcher's thought process."

The course includes a mandatory research project, carried out in groups (a tradition which preceded my teaching it, and which exists in other courses on animal behaviour as well), and one of the highlights of the course was seeing students apply concepts learned in class to understand the adaptive value of camouflage, interspecific competition, the determinants of various insect behaviours, and many other phenomena.

The experience had a positive impact on my research as well. Interacting with students who are in many ways "blank slates" allowed me to reflect more on communicating my own research, and made me more aware of alternative hypotheses and explanations. As a researcher, the main qualities I try to impart in the classroom are to be curious, not to fear the unknown, to work from first principles in a collaborative way, and to place value on process rather than outcome. In turn, my students, with even seemingly mundane questions, teach me not to take anything for granted, to break down all tasks into simple building blocks, and above all to not over-complicate my thinking. Finally, observing and working with this heterogeneous assortment of students gives me great perspective in listening to diverse views of science and the world, and teaches me to be

ever more accommodating of views that do not match my own.

With modern technological advances such as CT scanning and open-source 3D reconstruction software broadening the horizons of organismal biology, the hope (and challenge) now is to integrate these advances with a more old-school approach to instruction (one that has stood the test of time for decades) in the classroom. A host of excellent researchers and teachers across the IISERs have been promulgating an interdisciplinary view of biology using diverse pedagogical approaches, and it is my humble hope that my contribution will in some way add to this and expand its scope.

The details are very much a work-in-progress, and there is always room for improvement. For instance, one complaint from students is that I often run too fast, which I am working on fixing. Another is that some students find this sort of syllabus confusing when it comes to preparing for exams. We have a long way to go to break the idea that all coursework should be geared toward exams, but I treat this as something to bear in mind nonetheless. All in all, though, I have found that incorporating the perspective of the curious naturalist into my teaching has been a rewarding experience for me both personally and professionally, and the students seem to enjoy it as well.

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RESEARCH WITH UNDERGRADUATE STUDENTS

Sravanti Uppaluri & Divya Uma

After many years of research training, we all start to think of how we can contribute to the scientific community. How can we best utilize our training? Which environment will allow us to thrive?

The path to finding a suitable niche wasn't immediately clear for either of us. Research and teaching are deeply intertwined, and have been artificially separated in some institutions – this is especially the case in undergraduate institutions. Yet the skills that are required to do research are precisely what students should be developing at all stages of their education – observation, critical engagement with data, suggesting alternative interpretations – to name a few. These are skill sets that are useful not just to scientists but all citizens.

Joining as faculty members at Azim Premji University (APU) within the undergraduate programme has given us the opportunity to continue pursuing a research career, albeit one in which progress has to be measured in unique and perhaps unorthodox ways. It is also a career that is deeply rewarding.

Using research as a pedagogical tool, students have the opportunity to learn by questioning, rather than passively receiving knowledge, and are better prepared for any kind of career. Undergraduate research projects can be run through more formal avenues such as honour projects with a fixed duration and expectations, or informal ones in which outcomes do not have to be clearly planned and may serve as exploratory pilot studies.

Working with undergraduates in the discovery process is uncharted territory for most young investigators. At best we may have been teaching assistants, or mentored undergraduate thesis projects during our postdocs. But these teaching experiences are rarely seen as paths to actually doing research in the sense of knowledge production, and rarely contribute to our own research careers. Yet, undergraduates don't come with as many preconceived notions and serve as a truly creative pool for scientific inquiry. Combined with the intellectual freedom we have at our institution, these two factors allow us to ask some rather unconventional questions.

At APU, we have leveraged the diverse student body as well as the eclectic set of interests of the faculty (we are integrated in a liberal studies programme with colleagues from all disciplines – from psychology to physics to economics to humanities) to develop an equally eclectic set of research questions. Recently one of our students wanted to understand how "identical" progeny arising from asexual reproduction in multicellular organisms are. We worked together to hone the question and choose one specific characteristic that could be tested within our infrastructural constraints and ended up asking whether associative conditioning

and memory is passed on to progeny. Since Planaria have incredible regenerative potential, we used amputations to produce progeny rather asexual reproduction.

The challenge, of course, is that a lot of foundational work has to be done when working with undergraduates when compared to graduate students. They require a lot more mentoring in reading and interpreting literature, they do not come with any experimental expertise (lab or field), and they often have difficulty evaluating the feasibility of a project. An additional challenge is of time scales—a conventional three year undergraduate degree where students are predominantly taking coursework leaves little time for a rigorous research project. Research has to be done primarily in the summer and winter breaks when both students and faculty are free. Moreover, by the time a student has developed some research skill, and the ability to work independently, it's time for them to graduate!

Students entering our undergraduate program only have a faint idea about how science is done, and don't think they themselves can be scientists! But after they have spent a year working on a research project, they begin to understand various processes that go into research such as, identifying a problem, developing different ways to tackle the problem, and collaborating with people with different expertise. Students also realize that science need not always be complicated and expensive, and often the elegance of an experiment lies in its simplicity. The liberal studies setting enables students to interact and learn from their peers, as well as faculty from other disciplines. For example, two students working on the biology of social spiders talked to an economist on campus, and are now learning to use agent-based modelling to visualize the rules that the spiders use to

"Using research as a pedagogical tool, students have the opportunity to learn by questioning, rather than passively receiving knowledge."

build a web.

Recently, the first batch of BSc Biology students graduated from Azim Premji University. Some have gone on to the top research institutes within the country and abroad, while others have chosen paths in the teaching profession - the range is wide. Whatever their choice for the future, their research experiences have provided them the right tools to look at real world problems more critically, and engage with them at a different level.

As young faculty, such a research environment has challenged us in unique, exciting ways, and importantly shown us a new way of thinking about how to do research and how to choose new problems to tackle.

Sravanti Uppaluri and Divya Uma are faculty members at Azim Premji University, Bengaluru.

MANY FACES OF TEACHING

Research as an important component in University teaching

Rama Krishna Kancha

The transition from Postdoc in Heidelberg to Assistant professor in Hyderabad was joyful but had a lot of surprises in store. Interestingly, my cancer biology lab is located at the Centre for Plant Molecular Biology (CPMB). I teach MSc and Pre-PhD courses in the Department of Genetics and Biotechnology. We actively collaborate with the Department of Chemistry and frequently visit them. Even though I work in Osmania University, my salary is paid by the University Grants Commission (UGC). Thus, I am both an insider and an outsider at multiple locations, which demands a lot of flexibility.

This is not possible without active support from senior professors in the University, directors who facilitated smooth access to resources, heads of departments who are welcoming, supportive administrators and friendly colleagues. Sharing lab space with the then-director of CPMB was very helpful in starting the work immediately and a couple of grants from UGC and DST were crucial to conduct research work at a decent pace. In the early stages of your career, associating with the right people is the key.

IMPORTANCE OF RESEARCH IN UNIVERSITIES

Universities provide the majority of the manpower that caters to the needs of national research institutes and private companies. The quality of education received at the universities determines the overall performance of scientific enterprise in the country. An up-to-date training in theoretical knowledge and practical expertise makes students employable in the

"The quality of education received at the universities determines the overall performance of scientific enterprise in the country."

industry and also lessens the burden on research institutes to conduct graduate programs.

Conscious of the importance of training skilled scientific workforce, I take a special interest in training MSc students for their dissertation, in addition to supervising PhD students. A decade-long experience at the Technical University of Munich in training medical and biotechnology students equipped me to guide masters' students towards dissertations with tangible outcomes within the short duration of their stay. Conducting quality research in a university setting is thus very important for training postgraduate students with adequate technical and scientific skills.

CLASSROOM VS PRACTICALS VS DISSERTATION

Our teaching basically is of three forms: theory, practical and project work. I employ a story-telling approach to teach theory in which an initial overview and context are presented followed by explaining the topic with the help of relevant experiments that helped at arriving at those concepts. In addition, I share relevant information with students via email and social media.

For teaching practicals, I present an elaborate theoretical background before training students to perform experiments. In addition to conducting practicals in the Department laboratory, I also conduct some practicals in my own lab so that the students experience a research laboratory setting first-hand and also gain awareness about a PhD students' life by interacting with them.

The MSc dissertation students in my lab are trained in multiple aspects of scientific exercise on par with PhD students, including designing a

project, defining objectives, theoretical and practical methodology, data analysis and presentation. I assign students to present a topic each semester to improve their language and presentation skills. It is, however, a very difficult task to achieve all this due to a huge diversity in student community with respect to the socio-economic background, subjects studied at undergraduate level, language skills and personality traits. Attending the Wellcome Trust-DBT sponsored EMBO scientific leadership workshop was very helpful in dealing with many of the issues we encounter on a daily basis.

NETWORKING - AN ESSENTIAL COMPONENT OF TEACHING/LEARNING

I make sure that any friend from India or abroad visiting Hyderabad also gives a lecture at our institute, facilitating our students gaining deeper insights into various disciplines. We also arrange informal meetings with visiting scientists so that our students have first-hand knowledge regarding the work culture and expectations of potential future employers. Given the multi-disciplinary nature of our work, the students often have an opportunity to interact with chemists and physicians both on campus as well as at hospitals.

Attending orientation and refresher courses helped me network with many faculty friends in the region. The Regional YIM organized at the University of Hyderabad and the Wellcome Trust-DBT annual fellows meeting were very helpful in networking with researchers of the region and country, respectively. I also frequently share my experiences with faculty friends and constantly learn from their

"I believe that a teacher with a lot of dedication and sound research background combined with excellent communication skills can impart knowledge to university students in a meaningful way."

perspective regarding teaching and research in India.

I believe that a teacher with a lot of dedication and sound research background combined with excellent communication skills can impart knowledge to university students in a meaningful way to meet the current demands of the country. Upon graduating, some students may take up various non-scientific roles such as teaching or management for decades to come; a brief but decent research experience that cultivates scientific temper is essential for them to easily update their knowledge in the future and stay relevant in their respective jobs. It is thus important to conduct high-quality research in universities to give students a valuable learning experience combined with a taste of laboratory research.

Rama Krishna Kancha is an Assistant Professor at the Centre for Plant Molecular Biology (CPMB), Osmania University, Hyderabad.

WORKING FOR THE NEGLECTED INDIAN MAJORITY

Rakesh Joshi

Like many of us, I grew up watching science fiction cartoons. I used to find it very fascinating to think that a scientist can solve any problem by doing crazy but exciting experiments. I got a stronger introduction to science and its wonders during my school life when I realised that agriculture is the largest source of livelihood in India.

In terms of farm output, India ranks second worldwide and agriculture contributes around 17-18% to the country's GDP. More than 50% of the Indian population depends on agriculture for employment. But the current economic health and the overall status of Indian farmers are highly degraded. Frequent news stories about farmers committing suicide due to various socio-economic reasons disturb me a lot. I always asked myself what are the reasons for this situation? What I can do to change this?

While searching for answers to these burning questions, I focused my graduation and post-graduation training in biotechnology in a way that will be applicable for agriculture. Very soon, I had my first encounter with the research environment while doing an undergraduate dissertation on micropropagation of medicinally important plants. This gave me an insight that biotechnological advancement can be applied for better solutions in agriculture and other related issues.

Training in biotechnology and willingness to work in the agriculture-

related area drove me to pursue research in the area of crop protection. Initially, by looking at the proportion of the population depending on agriculture and its socio-economic impact, I expected that research and development in agriculture would be top-notch. However, slowly I realised that this is not the case.

Although serious efforts are being undertaken, it is often difficult to attract the best researchers to agriculture as most students and young researchers are inclined towards other 'glittering' research areas. There are enormous problems that farmers face today, including unavailability and the high cost of good seeds, biocides, fertiliser and manures. Global warming has led to changes in rainfall amount and its pattern; this has imposed new abiotic and biotic challenges for the crops. Due to illiteracy, many farmers are not aware of these changes and the reason behind them.

These problems are further aggravated by the lack of knowledge and inclination among young researchers to take up agricultural issues and research. I honestly think that we need to motivate and sensitise bright students, engineers and scientists to pursue and conduct quality research and affordable innovations to tackle burning agricultural issues. Use of sophisticated tools and advanced methodologies to understand these issues will surely provide hints toward a solution.

"More than 50% of the Indian population depends on agriculture for employment."

Working as a Research Scholar at CSIR National Chemical Laboratory, my motivation was to understand pest biochemistry and its bio-control for crop protection. After completing my PhD., I got the opportunity to join the Institute of Bioinformatics and Biotechnology, Pune University as an Assistant Professor. My friends, colleagues and my advisors were surprised when I opted for this offer and declined lucrative post-doctoral offers abroad, but I never regretted my decision to stay back in India.

While establishing my independent research group as a young investigator, I began to realise that even if one performs quality research in fields allied to agriculture, it's very difficult to make an impact and to bring the attention of the community to this significant area. Furthermore, I found that many universities and institutes failed to conduct quality agricultural research and to inculcate its importance in the younger generations.

"Although serious efforts are being undertaken, it is often difficult to attract the best researchers to agriculture."

Initially, I thought that it would be difficult to flourish as an agriculture scientist in a conventional university, whose basic aim is providing quality education and developing skilled human resources at the grassroots level. Many times it has been observed that the research component often gets neglected in most of the Indian central or state universities. Fortunately, a few premier universities like Pune University give a lot of importance and encouragement to doing cutting-edge research.

After joining, I got enormous motivation from my seniors and peers to do high-quality research in my area of interest and expertise. A cherry on the cake is being among young students with their infectious positive energy, which helped me find and develop a teacher in myself.

Being a young faculty member in a place like Pune, where there is a cluster of institutes which provide leverage to initiate new collaborations and a platform to get expert opinions on various experimental and technical issues, is a valuable opportunity. The collaborative environment in and around Pune University is quite conducive and encouraging to tackle challenging problems as important research questions.

I also got an opportunity to visit the Technical University of Munich (TUM) as an EMBO fellow on sabbatical leave. The main focus of

this visit was to acquire information about technological advances in agriculture-allied areas, which can be applicable to the Indian scenario. I must admit that some of the Indian institutes have research infrastructure at par with European labs, but their approach and attitude of doing science are different. My stay in Germany taught me about discipline, time management and how to appreciate good science.

After returning from TUM, I was awarded the SERB Early Career Research Award which provided me with an ample amount of funding for the progress of research activities and the establishment of an independent group. Currently, my group at IBB has students ranging from undergraduate to PhD levels working on various aspects of carbohydrate metabolism and chemosensation of agricultural insect pests. It is hoped that our efforts in understanding insect biology, devising new bio-control methods and insect enzymes engineering will be of great importance for basic studies of insects and also applicable for sustainable agriculture.

Thus as a young investigator, who is in the position to influence impressionable minds, I aspire to motivate young research students to choose to enter agricultural research and contribute to the betterment of the country's agricultural scenario. I am quite encouraged and thrilled to take up the challenge to contribute fullest to make this country 'Sujalamsuphalam' through my research efforts along with nurturing younger generation through teaching. The first Green Revolution of India was nearly 60 years ago; it is now time to work towards a second.

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MAKING THE MOST OF THE POST-DOC EXPERIENCE

Shilpak Chatterjee

It is said that a house becomes a home not by the bricks, the doors, or the windows it is made up of, but by the people living in it and the bonds they share. Similarly, a laboratory with all its instruments and chemicals never comes to life without the PI, the scholars and the efforts they put in. Thus, it becomes their abode of creation - the creation of new information.

Last year I was offered the position of Senior Scientist and assigned a lab at CSIR-Indian Institute of Chemical Biology (IICB), Kolkata. This gave me the pleasure of setting up my own lab and a chance to lead four young minds – four future fore-runners of basic sciences – to embark upon their voyage through the ocean of science, by virtue of my experience and guidance.

The post-doctoral tenure that I spent in the Medical University of South Carolina (MUSC), USA has unequivocally helped a lot in shaping my career as a scientist. An enormous amount of inspiration, motivation and advice was provided by my PI while I was starting this journey from scratch.

I still remember my first day at MUSC when my post-doc mentor and I had an hour-long discussion regarding my work, projects and goals. As I was leaving his office, he called me back and said "Your goal should be to reach this end of the table and sit in this chair I am on today. This might be the toughest journey you ever had, but plan your journey judiciously and you surely will succeed."

Now that I am on such a chair, his wise words still appear as a ray of motivation in every step. Since postdoctoral tenure is an important transition phase from being a research scholar to a PI, a postdoc should consider a few things to put himself/herself ahead of others.

First, "write, write and write". There should be a continuous effort of writing small research proposals which immensely helps in selling scientific ideas to funding agencies. I attended many grant-writing workshops and seminars during my post-doc that have given me an advantage for obtaining grants today. Another crucial point that I learnt from these workshops is that an idea must be nurtured well before being shaped into a proposal. If one is clearly convinced about his/her own idea, then only can he/she put it forward in the form of a proposal that is convincing enough for others as well.

Secondly, interactions with eminent scientists and sharing ideas with them was an experience from my post-doctoral life that has helped in shaping my scientific ideas as well as in acting as a source of inspiration for a budding scientist.

I remember a particular incident in this regard. During my postdoc, I was driving a particular project. Everything was going well initially, but suddenly, at some point, I got stuck. The experiments failed repeatedly. I was so frustrated by this repeated failure that I was about to quit the whole project. At that point, in a research meeting, I approached a professor, one of the big shots in our field, and discussed my problem. He simply suggested that I add one extra group along with my other experimental groups. That idea clicked and finally I got that work published in a reputed journal. This professor advised me to always start by answering small questions keeping the big-

"I have never been an adventurous person but I must say that setting up my lab has been nothing less than an adventure. ."

ger picture in mind. When such experiments yield results, it can boost one's confidence towards solving the bigger problem.

Thirdly, at my MUSC lab, I was assigned internship candidates whom I was to mentor and help prepare for a life in science. This experience has been fruitful in mentoring my own PhD scholars. Graduate students also used to approach me frequently with their problems. Listening to their discussions helped a lot in untangling the knots and advancing steadily towards the solutions. I try to practise this open discussion policy with my scholars too, and this helps us to clarify our problems to a great extent.

Last but not the least of the lessons that I learnt during my post-doctoral tenure was that building and maintaining good, cordial relationships with my fellow post-doctoral students from different disciplines, many of whom will also become PIs one day, can be very beneficial in long term by promoting a collaborative culture.

ADVENTURES IN SETTING UP A SCIENTIFIC LABORATORY

Setting up the lab has not been an easy task. It came with tons of challenges which are still ongoing: the funding crunches, the administrative hassles, the standardisation of protocols and the huge responsibility of leading my scholars on the right track. The best part of being the PI has been the chance to infuse a scientific framework into the minds of my scholars, to motivate them to practise science more & more, to impart my knowledge to train them and set up their lab pro-actively, to encourage them to question, to wonder, to think logically, to do research, to fail, to learn from it, to try again and never give up.

I have never been an adventurous person but I must say that setting up my lab has been nothing less than an adventure. The day we ran our very first experiment successfully was a memorable day for our immunometabolism lab family.

This roller-coaster ride through science will bring its many ups and

downs. But as a PI, I will definitely try to make the journey worth the effort and lead the lab and its members towards achieving our ultimate goal – to contribute in our own way for the welfare of mankind through our scientific explorations. Also, the bond that I share with my students, our joint ventures and struggles in this initial phase, is something that I will cherish and treasure in my heart for a lifetime.

Fernando T. Maestre writes in an article in Nature titled, 'Seven steps towards health and happiness in the lab' – "The key to running a healthy and productive lab can be summarized in a single word: happiness." I believe the same and aspire to make our journey a happy, exciting and a successful one.

Shilpak Chatterjee is a Senior Scientist at the CSIR-Indian Institute for Chemical Biology.

ON CHOOSING A RESEARCH PROBLEM

Smarajit Polley

If I have to tell you how did I hit upon my topic of research, I have to go back to my childhood.

I grew up in a small village called Bhawanipur in the district of Howrah, West Bengal. In my childhood, there was very little unhealthy competition amongst peers in the village. My family never imposed that sense of competition on me, nor did they ever compel me to choose a specific career path.

As a result, I enjoyed freedom – freedom to decide what I wanted to be. Freedom of speech was an added advantage. Irrelevant, you may think, but it definitely wasn't so. My present strong sense of independence and freedom are the gifts of my childhood and liberal upbringing, which brought me closer to the scientific philosophy that I try to adhere to in my lab today and sowed the seeds of appreciating the importance of multi-disciplinary approaches in solving a problem.

A FEW BLIND MEN AND AN ELEPHANT

Among the many things that I owe to my childhood, I remember one story that I heard from my grandparents as well as from our science teacher. How do a few blind men perceive an elephant? There are many different versions of the story. Almost all versions, however, begin with a group of blind men who had never encountered an elephant before. Since they were blind, they had to figure out the shape of the elephant by using 'touch' alone. So, each of them touched a different part of

the animal and declared their interpretation to the rest. The man who touched the trunk thought that the elephant was like a thick snake. Likewise, those who touched the ear, legs, body and the tail thought that the elephant resembled a fan, a pillar, a wall and a rope, respectively.

In some versions of the story, the men then started fighting each other and accusing each other of dishonest practices. In others, they listened to each other, respected different views, and after a collaborative effort arrived at a more accurate picture of the elephant.

I liked the story at that time without much thought; however, it kept coming back to me as I grew older, especially when I decided to be a researcher. I realized at almost every turn in the journey afterwards how significant the story was. As a researcher one has to deal with and tame the entire elephant, and examining just the tail or the leg would not bring any more insight than did the observations of the blind men at the beginning of the story.

I consider myself extremely lucky to have had extraordinary teachers at all stages of my development. Excellent teachers had taught us both at the BS and MS levels. It was while doing my MS in the Department of Biochemistry, University of Calcutta, that I first got attracted towards post-translational modifications (PTMs). Conformational changes caused by PTMs that lead to novel functionalities of a protein fascinated me. This term 'conformational changes' would keep reverberating in the classroom lectures, during conversations among friends, and even in my mind. At one point I felt I was entangled with the phrase.

"My present strong sense of independence and freedom are the gifts of my childhood and liberal upbringing"

I would receive a battery of responses when I asked around about what exactly did 'conformational changes' mean in chemical or physical terms, and how did such physicochemical changes translate to the biological effects

downstream. Sadly, most of the responses I got made me feel that something was lacking in these descriptions. Since I couldn't be satisfied with these explanations, I knew that I had to find about the subject in further detail, from some other source. But how?

The Calcutta University Biochemistry department had a tradition of inviting its ex-students (who were established and renowned researchers by then) to share their experience and insights with the current students. Such encounters were priceless. This was a time before YouTube, before the internet had become a part of our daily lives. It was not possible to witness the excitement of modern, cutting edge research just by the click of a mouse. Personal encounters were thus invaluable.

On one such occasion, we witnessed the beaming passion of Gourisankar Ghosh (University of California, San Diego (UCSD)) who had just published a seminal paper describing the structural basis of NF-kB inhibition by I-kBalpha in the journal Cell. This lecture was a gamechanger in my life. As I left the lecture hall, I knew that I wanted to be a structural biologist.

UNDERSTANDING THE INTERACTIONS OF P300

The course to reach there, however, was not as linear as I would have liked it to be. I joined Siddhartha Roy's lab at Bose Institute, Kolkata, as a PhD student. I was given a couple of problems to tackle in order to come up with a thesis. One of the problems that I was dealing with aimed to understand the structural basis of stress-induced phospho-p53 recognition by its co-activator p300/CBP. NMR spectroscopy was the preferred method of choice, but we soon realized if we remained adamant about using NMR to understand this system we would either end up with the 'rope' or the 'pillar' but not the elephant.

p300 is a multidomain protein and many of these domains interact with the N-terminal Trans Activating Domain (TAD) of p53. These interactions were intricately connected to site-specific phosphorylation of p53-TAD. It would be an unfathomable task if we had to study each and

every such complex by NMR. We would know a great deal about one or two such complexes, not all, and a comprehensive picture wouldn't emerge.

This offered me the opportunity to embrace the possibility of employing a number of other experimental techniques and realize the importance of an open mind to appreciate the value of something that wasn't my forte. We took help of chemical biology tools and fluorescence spectroscopy and studied almost all of those combinatorial complexes. We found that different domains of p300 differentially recognize differentially phosphorylated p53-TADs. It helped embolden the thought that different post-translationally modified p53 fragments may form transcription-initiating complexes of different configurations, leading to the activation of different promoters and hence different gene-expression programs.

CHASING THE STRUCTURE OF IKK

After completing my PhD, I joined the field of NF-kB research in the Gouri Ghosh lab in UCSD. I was assigned a project aimed at unravelling the structural basis of IKK-activation, primarily by using X-ray crystallography. IKK-structure had remained an enigma since its discovery in 1998, despite its importance in metazoan biology. Even though it was recognized as one of the most attractive drug targets of that time, several big pharma companies and academic labs alike had failed to determine its structure. Ghosh lab was no exception.

"I consider myself extremely lucky to have had extraordinary teachers at all stages of my development."

Everything was new to me - the molecule, related biology, experimental techniques, the expression system, new society, new culture - everything! Gradually I realized what a beast the molecule was, and I readily sympathized with everyone else who had failed in this project in the past since its discovery in 1998. And, slowly but steadily I made a

connection with the molecule and the project grew on me. I had taken on the challenge to conquer it.

It was a strange relationship with a strange molecule. Finally, in 2013, we managed to determine the first X-ray crystal structure of the human IKK2/beta. In the process, I discovered a number of seemingly disparate yet intriguing characteristics that made me look at the molecule differently. I was awestruck by kinase signalling and regulation, especially the pathways that behave differently depending upon the upstream signal, and often lead to devastating outcomes as they go awry.

During this period, I had the opportunity to work/collaborate with a number of renowned scientists: Inder Verma (Salk Institute, Cancer biologist), Alexander Hoffmann (UCSD and now at University of California, Los Angeles, Systems Biologist), and Dmitry Lyumkis (Salk Institute, Cryo-EM). Close encounters with a group of people with different expertise yet overlapping interests helped broaden my thought process tremendously. And it served my cause well - to describe the whole elephant!

AND THE STORY CONTINUES…

I remained focused on understanding the IKK-system, and that's what we primarily do right now in the lab. I must tell you that IKK is no longer considered a lucrative drug target given that it is too important physiologically to be inhibited indiscriminately. In fact, the related biology is overwhelmingly complex. Context-independent, indiscriminate tweaking of IKK-activity often causes havoc. Still, IKK remains an interesting target as it is involved in so many pathological scenarios along with its protective and homeostatic roles. Any clue to the possibility of tweaking IKK-activity in a context-dependent manner (i.e., only in a pathological scenario when it has gone awry) will be invaluable, which makes it a highly intriguing problem.

So, a complex mixture of passion, personal entanglement, and the depth and complexity of IKK made me stay with the system. We use a number

of techniques that come handy in finding a clue to solving the mystery. In addition, we are also dealing with a MAPK module that plays vital yet contradictory roles in neuronal degeneration as well as regeneration in worms.

We also deal with two other programs in the lab that are not related to kinase-biology. These non-kinase projects bring a different aura to the lab, give us opportunities to practice a different kind of science. It helps assess our abilities to move away from our comfort zone. I had not practised this kind of science ever before in my life, yet I believed that my present skill-set and thought process can be useful in dealing with those problems. More than anything else, these projects will allow us to learn something different.

SO, HOW SHOULD A YOUNG INVESTIGATOR CHOOSE THEIR RESEARCH PROBLEM?

To be very honest, I don't want to preach. Only thing I can tell you is that, don't let others decide what's going to be the focus of your lab. You are the master of your own research. Be resilient. Ask yourself: what is it that you are looking forward to the most when you start your own lab? What is 'success' according to you? Don't look around for an answer; the answer should come from within. Be true to yourself. This answer will tell you what problem should you deal with in your lab. I wish I could be more elaborate, but this is a very individual decision. Choose to do something that would excite you every morning and help you carry on no matter what happens. Personally, I enjoy the journey more than the destination. Do you? Cheers!

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If you are a young investigator and would like to contribute to this series, please write to us at hello@indiabioscience.org

About us

IndiaBioscience is an organization that fills a unique niche in the ecosystem of the life sciences in India, by being a catalyst to promote changes that affect the culture and practice of the field, through engagement with academia, government and industry at various levels. IndiaBioscience aims to increase the visibility of science in society, by being a hub for policy discussions, science communication, and as an aggregator of information.

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