Perspectives from K. VijayRaghavan

Former Principal Scientific Adviser to the Government of India and Secretary of the Department of Biotechnology, Ministry of Science and Technology | Professor and former Director of the National Centre for Biological Sciences, Bengaluru | EMBO Associate Member

Can you share with us your professional journey?

I accidentally took up my undergraduate studies in chemical engineering and went to the Indian Institute of Technology Kanpur. It was an exhilarating experience. Our class was much larger than it should have been and many of us were therefore dumped into a postgraduate hostel from our first year. This allowed me to interact with PhD students and postdocs and get interested in research. At Kanpur, and later in Delhi, I read about biology, and heard about the research of Obaid Siddiqi at the Tata Institute of Fundamental Research. I joined the Tata Institute for my PhD. From there I went onto a postdoc with Elliot Meyerowitz at Caltech and came back to work with Obaid Siddiqi to start the National Centre for Biological Sciences, which is in Bengaluru.

How did you make the transition from research to science administration and policy?

It was like the proverbial frog in a pot of water which is slowly being heated. Several of us were involved in starting the National Centre for Biological Sciences in Bengaluru. This effort included a lot of administrative work, and we were doing our research too, not realizing the intensity required for both. In hindsight it was far more intense than we felt when we were in the midst of it. When I was asked much later to take the position as Secretary of the Department of Biotechnology at the Indian Ministry of Science & Technology, I didn't think much of that in terms of compromising research or as an administrative burden. I thought that the country had funded me very generously to do fruit fly research and do as I please, and therefore it would be inappropriate not to take on such public responsibilities, with enthusiasm and commitment, when asked.

How did the partnership between India and EMBO come about?

We must give credit to the EMBO leadership and the Department of Biotechnology (DBT) who did a lot of the groundwork together, which led to India becoming an Associate Member State of EMBC, the EMBO funding body, in 2016. The partnership with the Human Frontier Science Program was started a few years earlier too, and the partnership of the DBT with the Wellcome Trust to create India Alliance. All these were transformative in bringing international connections between Indian and European biosciences. Maria Leptin, Gerlind Wallon and others at EMBO worked with Raj Bhan, Shailja Gupta and later me at the DBT. Their cheerful persistence and commitment catalyzed the reduction of all energy barriers.

How has this partnership benefited scientists in India and Europe?

A very important aspect of science is peer criticism, and the ambitions you set yourself by interacting with peers. It is relatively easy to start an academic career or one in industry or anywhere with great enthusiasm - especially in India - and then get into an ostrich-like pose. Eventually you can declare yourself the best in your street. However, if you keep meeting the best colleagues right through your career, and you criticize their work and they criticize yours and you set benchmarks according to the best in the world, wonderful things happen, and you can be amongst the best anywhere. And that is what partnerships like the one with EMBO did and are doing. We get the best scientists from Europe coming here, our best scientists are going there, our students are getting EMBO Postdoctoral Fellowships which really brings out the best in them. Science is about exploration with human interactions, that makes it of the highest quality and impactful.

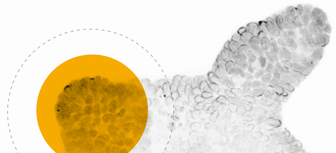
What are the current trends in the life sciences landscape of India?

There is a dramatic change in the way we approach biology today. Sydney Brenner said that we are seeing an onslaught of data that, but that that alone will not solve the big questions in biological sciences. We must embrace big data, but also see the importance of theory in biology. We need the ability not to get overwhelmed, but to think deeply and experimentally understand specific areas. These requirements bring to the fore a strong intellectual tradition in India, that of mathematics and computing. So, in many ways, this onslaught of data is an opportunity for breaking departmental silos in India and integrating to include physics, mathematics, and computer-science research in the core biology curriculum. There are positive trends in this direction, and they need to grow greatly.

Are there other opportunities and challenges for the life sciences in India?

Several. Agriculture and healthcare are examples. Because of the consequences of global warming and climate change we are going to see dramatic changes in infectious diseases. In agriculture, patterns of cultivation are going to change. Seasonality of crops is going to be affected. We need to see these and related problems, and address both adaptation and mitigation as being urgent and important. Whether you are in engineering or in medicine or in basic science or in science communication or industry, this is where our resources and our ideas need to go. And one can tackle these and other very difficult problems if we come together. The future of our planet is precarious. No matter what our own interests and drives are, we must also work together on addressing this big problem.

Read the full interview at embo.org



Meet scientists from the EMBO communities

Siddhesh Kamat
Collaboration beyond the own research field

Associate Professor, Indian Institute of Science Education and Research, Pune | EMBO Young Investigator

Siddhesh Kamat explores lipid signalling pathways for potential approaches to disease cures. Based at the Indian Institute of Science Education and Research (IISER) Pune, Siddhesh's lab is trying to figure out not only the ways in which lipids are made or broken up in cells and the pathways they regulate in healthy cells in humans, but also what is going wrong with them in different diseases. "Signalling lipids are associated with a range of diseases from the nervous system to the immune system," explains Kamat who grew up in a family of medical doctors and is fascinated by biomedical sciences.

His lab is one of the few in India working with mass spectrometry-based platforms in lipidomics, metabolomics and chemical proteomics. "The really cool thing about our lab is that people come with very different backgrounds and look at problems very differently," he says with pride about his students who grew the lab's work in different directions.

The EMBO Young Investigator Programme has helped Kamat sustain the salaries of students and support crucial experiments over the last two years. Constructive criticism from his interactions with scientists from the EMBO communities across Europe has been beneficial for embracing the new work his lab has started. "EMBO Young Investigators don't need to be limited to their fields, because they will always find collaborators within the network," he suggests to potential applicants to the EMBO Young Investigator Programme.

Monika Fajfer
Starting cross-disciplinary international co-operation

Assistant Professor, Department of Molecular Biology and Genetics at Cardinal Stefan Wyszyński University, Warsaw | EMBO Scientific Exchange Grantee

Monika Fajfer developed a keen interest in herpetology as a child. "At that time, I did not realize that the red spots I had seen on lizards from time to time were parasitic mites. I understood it years later during my Bachelor's studies," the Polish scientist says recalling lectures with acarologist Czesław Błaszak. Inspired by the lectures, she decided to combine these two fields of research, acarology and herpetology, and learn more about host-parasite relationships between mites and reptiles.

At Cardinal Stefan Wyszyński University in Warsaw, Poland, her current focus is the Geckobia genus of parasitic mites, associated with geckos and distributed worldwide. "The mites are an interesting subject for research because they show great phenotypical plasticity and different host adaptations, and may also play a role in the transmission of reptile diseases," Monika says.

As an EMBO Scientific Exchange Grantee, Fajfer was able to carry out fieldwork in India where she collected mites from geckos. The sample allowed her to start using molecular data in her research and kickstart a collaboration with Praveen Karanth from the Indian Institute of Science, Bengaluru, who has herpetological experience. The EMBO grant allowed her to overcome limited research funding opportunities for young scientists in her country. "It helped me gain experience, learn new techniques and start cross-disciplinary international co-operation," she says.

Jyothilakshmi Vadassery
Decoding plant-insect interactions at the molecular level

Staff Scientist V, National Institute of Plant Genome Research, New Delhi | EMBO Global Investigator

Jyothilakshmi Vadassery, the first plant biologist from India in the EMBO Global Investigator Network so far, is intrigued by plant-insect interactions. At the National Institute of Plant Genome Research, New Delhi, Vadassery is trying to decode the molecular mechanisms deployed by plants to defend themselves against a variety of insect herbivores. This is important to India, which in recent years has been challenged by significant crop losses from attacks of insect pests and the inadvertent use of pesticides to control them.

Vadassery's lab specifically works on early activated plant calcium channels involved in immunity. "We address the question of how plants defend against herbivory by insects. My lab applies a combination of reverse genetics, metabolomics, cellular imaging and transgenic approaches," she says.

Her postdoctoral work at the Max Planck Institute of Chemical Ecology, Jena, Germany, opened up the path to her research in chemical and molecular ecology. "Becoming an EMBO Global Investigator boosted my confidence to do even better work," Vadassery says. The EMBO funding made travelling and networking easier for her and her students, so that they could better highlight their work internationally. "During the COVID-19 pandemic, childcare support funding and a bridging grant were also highly welcome," she adds.

India and EMBO in numbers

4 EMBO Young Investigators[a]

12 EMBO Global Investigators[a]

94 EMBO Scientific Exchange Grants[c]

2 Coming to India

Going to 16 countries

44 EMBO Postdoctoral Fellows[b]

Going to 11 countries

6 EMBO Associate Members

3 Bengaluru
1 Hyderabad
1 Kolkata
1 Mumbai

28 EMBO Courses & Workshops and India | EMBO Lecture Courses[d]

1,682 participants in India altogether
2,555 Indian nationals attended EMBO Courses & Workshops throughout Europe and beyond

Mumbai
Hyderabad
Bengaluru

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a as of 2022
b from 2017 to spring 2022
c from 2017 to 2022. EMBO Scientific Exchange Grants were called EMBO Short-Term Fellowships until March 2021
d from 2017 to 2022

Opportunities in India

EMBO Postdoctoral Fellowships

fund scientists to carry out research for a period of up to two years. International mobility is a key requirement. Applications accepted throughput the year.

EMBO Scientific Exchange Grants

support new, international collaborations, enabling the transfer of expertise unavailable in the applicant's laboratory. They fund research visits of up to three months. Applications accepted throughput the year.

EMBO Core Facility Fellowships

support training for staff of core facilities that provide services to research institutions or universities. They fund international exchanges of up to one month. Applications accepted throughput the year.

The EMBO Young Investigator Programme

supports group leaders in the early stages of setting up their independent laboratories for a period of four years. Networking is a key aspect of the programme. Application deadline: 1 April.

The EMBO Global Investigator Network

supports group leaders, who set up their laboratories in India, with financial support, training and networking activities. The Global Investigators have access to an international network of more than 600 current and former EMBO Young Investigators and Global Investigators. Application deadline: 1 June.

EMBO Practical Courses

provide training in new techniques for researchers and core facility staff. Application deadlines for organizers: 1 March and 1 August.

EMBO Workshops

bring together scientists to present and discuss their latest discoveries. Application deadlines for organizers: 1 March and 1 August.

India | EMBO Lecture Courses

Funding for lecture courses for PhD students and postdoctoral researchers in India. Application deadlines for organizers: 1 March and 1 August

EMBO Press

The five journals of EMBO Press publish important advances in the life sciences from around the globe: The EMBO Journal, EMBO Reports, EMBO Molecular Medicine, Molecular Systems Biology, and Life Science Alliance, which is published in partnership with Rockefeller University Press and Cold Spring Harbor Laboratory Press.

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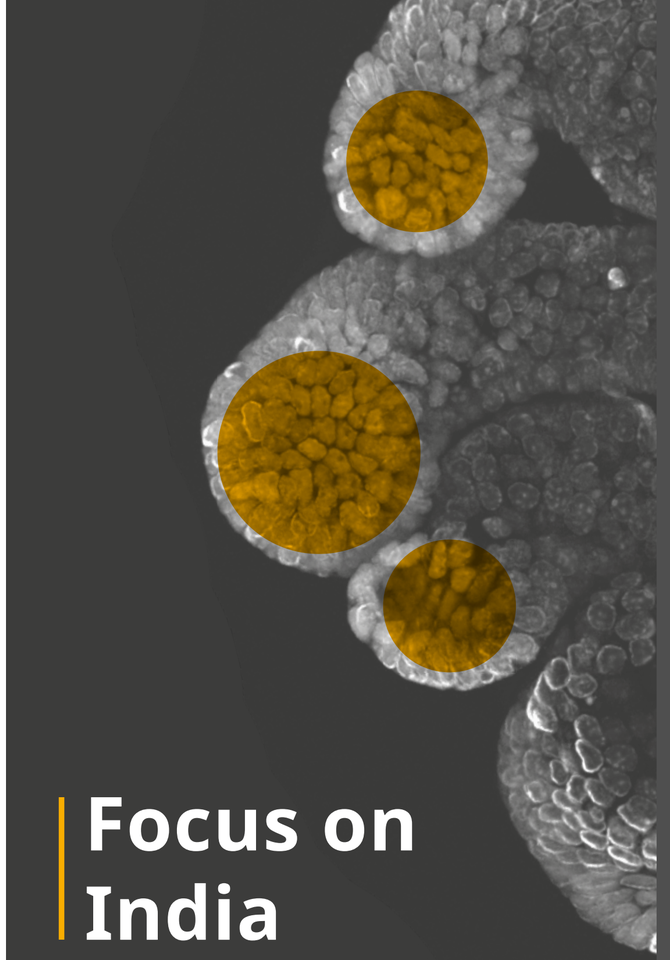

Focus on India

EMBO

Facts and figures

India's gross domestic expenditure on R&D (GERD) is 0.7%[1] which is around 43 US dollars per capita.[2] The government is the major contributor to R&D funding (nearly 60%); private participation is low[2]. India's number of researchers per million people increased from 218 in 2015 to 255 in 2017, with the total number of researchers in the country at 342,000.[3]

In 2018, India employed nearly 552,000 personnel in its R&D institutions. Of this, 61.1% were performing R&D activities, 17.9% were engaged in auxiliary activities, and 20.3% provided administrative and non-technical support.[4] The R&D sector employs 56,747 women.[4]

Five major scientific agencies under the central government, the Defence Research and Development Organisation (DRDO), Department of Space (DOS), Indian Council of Agricultural Research (ICAR), Department of Atomic Energy (DAE) and Council for Scientific and Industrial Research (CSIR), account for 82.2% of the total R&D expenditure, with DRDO alone accounting for 31.6%.[4] During 2017-18, the share of basic research was 23.9%, applied research contributed 36.9%, experimental development 32.4% and related supporting activities 6.8%.[4]

India has 1,043 universities. Student enrolment reached 38,536,359 in 2019-2020. The percentage of female students enrolled is 49%.[5]

Filing of patents has increased from 42,763 in 2014-15 to 66,440 in 2021-2022, an increase of more than 50% in seven years, with a nearly five-fold increase in granted patents from 5,978 in 2014-15 to 30,074 in 2021-2022.[6]

India's bioeconomy grew from 70.2 billion US dollars in 2020 to over 80.1 billion US dollars in 2021. The country aims to reach the 150 billion US dollars threshold in bioeconomy by 2025.[7] The number of biotech start-ups has increased from 50 to over 5,300 in the last ten years, with a push from India's Department of Biotechnology (DBT) and the Biotechnology Industry Research Assistance Council (BIRAC), an interface agency set up by the DBT.[8]

Key figures

Population: 1.423 billion[9]

R&D spending: 0.7% of GDP[1]

Patents: 66,440 filed in 2021-2022[6]

Researchers per million population: 255[3]

Universities: 1,043[5]

Foreign students: 49,348[5]

References

1. Expenditure on scientific R&D https://pib.gov.in/newsite/PrintRelease.aspx?relid=231302
2. India Innovation Index 2021 https://www.niti.gov.in/sites/default/files/2022-07/India-Innovation-Index-2021-Web-Version_21_7_22.pdf
3. Ministry of Science & Technology press release ID 1743182 https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1743182
4. Government of India, Research and Development Statistics 2019-2020 https://dst.gov.in/sites/default/files/Research%20and%20Deveopment%20Statistics%202019-20_0.pdf
5. Government of India, Higher Education Profile 2019-2020 https://www.education.gov.in/sites/upload_files/mhrd/files/statistics-new/he_profile_1920.pdf
6. Ministry of Commerce & Industry press release ID 1815852 https://pib.gov.in/PressReleasePage.aspx?PRID=1815852
7. India Bioeconomy Report 2022 https://birac.nic.in/webcontent/1658318307_India_Bioeconomy_Report_2022.pdf
8. Ministry of Science & Technology press release ID 1842730 https://www.pib.gov.in/PressReleasePage.aspx?PRID=1842730
9. World Population Review https://worldpopulationreview.com/countries/india-population