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CELL SCIENTISTS TO WATCH

Cell scientist to watch – Vaishnavi Ananthanarayanan

Vaishnavi Ananthanarayanan graduated with a dual degree in Biological and Computer Science from the Birla Institute of Technology and Science in Pilani, India. She then joined the laboratory of Iva Tolic at the Max Planck Institute of Molecular Cell Biology and Genetics in Dresden, Germany, to work on the mechanisms underlying the activity of the cytoplasmic motor protein dynein. In 2014, Vaishnavi was granted the INSPIRE Faculty Fellowship by the Department of Science and Technology (DST), India and established her independent research group at the Indian Institute of Science in Bangalore, India. Three years later, she became an Assistant Professor at the Centre for BioSystems Science and Engineering and the Indian Institute of Science and an EMBO Young Investigator and Wellcome Trust/DBT – India Alliance Intermediate Fellow in 2019. Her research is focused on understanding dynein activation in living cells and the roles of microtubules in mitochondrial dynamics during neurodegeneration.

Vaishnavi Ananthanarayanan

What inspired you to become a scientist?

There are no scientists in our family, but I did a lot of reading as a child. One book that stood out for me was 'The big book of amazing facts'. I don't know if it's still in production, but it gives you all sorts of surprising facts on the world, the human body, and so on. This got me interested in popular science and then I got curious about how these discoveries are made and that's how my interest in science started. I was also an avid reader of Agatha Christie's books – Hercule Poirot and Miss Marple – thanks to my maternal grandfather, who gifted the entire set of them to me when I was a kid. As a result today, I like to see scientific questions as a 'whodunit'.

Where did you grow up?

In Puducherry (Pondicherry), which was a French colony once, unlike most of the rest of India. It is a small, very nice seaside town. I learned to speak French growing up there and I still like to practice the language when I meet a native French speaker.

However, for your PhD in Europe, you went to the Max Planck Institute in Dresden, Germany

I did want to go abroad at some point for my studies, and I had a couple of friends who were at the Max Planck and told me a lot about it and Dresden as a city. You have a big scientific community there and a lot of institutes are in close proximity. Plus, the Max Planck Institutes are renowned all over the world, so it was a no-brainer to apply. I remember the first day I landed in Dresden I was going to meet Iva (Tolic, now at the Ruđer Bošković Institute, Zagreb, Croatia) in the morning and she said "why don't you come in and we get you started on microscopy". It was amazing because it was the first time I had operated an advanced microscope and looked at fluorescent molecules in a cell. I was hooked on the job from day one!

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What questions are your lab trying to answer just now?

There are two major projects that we are working on in the lab right now. The first is to understand the functional regulation of cytoplasmic dynein within living cells. Fission yeast – a system I used already during my PhD – is a simpler model for this, but in mammalian cells you have several processes being controlled by a single class of minus-end-directed motor protein, cytoplasmic dynein. We are interested in finding out how you bring about spatial and temporal specificity as well as regulation of activity in this context. We use *in vivo* single-molecule microscopy techniques for this work. The second project is a continuation of what we stumbled upon recently in fission yeast, which is studying how the association of mitochondria with microtubules, or the lack of it, can affect dynamics of mitochondria. We are particularly interested in this question in the context of neurodegeneration. Our lab is centred on the common theme of processes that are enabled and mediated by the cytoskeleton.

How has the field of cellular roles of motor–microtubule interactions evolved and what work has inspired or influenced you recently?

There have been several excellent *in vitro* papers in the past few years on the overarching idea that the activity of cytoplasmic dynein is regulated by association with dynactin and cargo adaptors. It was shown conclusively that dynein doesn't simply start walking towards the minus end of a microtubule as soon as it binds it, but that you need specific changes in place for that to happen. It's therefore now an interesting question for the field how this regulation is controlled in a living cell, in a crowded environment. If you need several molecules to interact at the same time for dynein's activity, how do you enforce this within a cell? Then there are organelle–cytoskeleton interactions and the inter-connectedness of organelles. I think there has been a paradigm shift in the way people think of organelles – they are mobile and constantly interact with each other. In addition, how do external, physical cues change the compartmentalization within cells? How

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Vaishnavi Ananthanarayanan with one of her strongest supporters – her husband, Sumeet Yamdagni.

does a stiffer substrate, cellular differentiation or wound healing change organelle distribution and how is this information relayed through the cytoskeleton, and to the nucleus to perhaps effect changes in gene expression? These are all really interesting questions waiting to be answered.

What challenges did you face when starting your own lab that you didn't expect?

I didn't have a lot of research connections when coming back to India after my PhD – I didn't know many people. But there's a nice meeting conducted by IndiaBioscience called Young Investigators Meeting, which includes Heads of Institutes and young researchers looking to set up their lab. In these meetings, you really get to meet people and see what institutes could be a good match for you and vice versa. After having started the lab, I realized that things take much longer than you expect them to. Funnily enough, I never intended to go back to fission yeast after my PhD, and I wanted to work with mammalian cell culture. But our department was new at the time and we had to set up the cell culture facility from scratch and that took a lot longer than I expected. After a few months, I got impatient and I decided to focus on a couple of interesting, open questions in fission yeast. A good decision in hindsight. You have to be flexible about the research question that you are trying to answer if things don't run smoothly in the beginning.

How are the challenges that you're facing now different?

It is still a challenge to get applications from people interested in working with you when you are establishing a name for yourself. It is a learning curve to find the right colleagues to work with. I have been very lucky so far, but it's sometimes very hard to judge – within a limited amount of time – whether people are the right match: not only to become a part of the lab with all its research questions, but to also understand what students would like to get out of the experience of doing a PhD, what they want to do in the future.

"You have to be flexible about the research question that you are trying to answer if things don't run smoothly in the beginning."

Do you feel that an extensive postdoctoral experience would have helped you? Were you determined to start your own research group as soon as possible?

I'm going to be very honest – I had no clear idea what I was going to do after my PhD (laughs). I was considering several opportunities, including going to industry or a research fellowship such as INSPIRE. However, I had very supportive mentors with Iva and Nenad (Pavin, now at the University of Zagreb), and also Joe Howard (Yale) as a member of my PhD committee. They always thought I would do great in academia; I think they had a lot more faith in me than I had in myself. Overall, I would have been very happy to do science in any form, but I didn't just want to work on a project given to me. In the end, the fellowship allowed me to work on a couple of questions that I really was driven by and it was also good for me to be able to gauge if academia was something I want to do in the future – thankfully, it turned out alright!

A great example of the importance of mentors for your career!

Yes, Iva, Nenad and Joe told me I have everything it takes to run my own lab when I left for India. The support system I have here in the department also adds a lot to it. We are a very young department, established in 2015, and I have both department chairs as unofficial mentors, G. K. Ananthasuresh and Sandhya Visweswariah. They have been instrumental with their advice and it underlines the importance of support for your independent career. If you don't have it, seek it out! Even if your mentors work on very different things, having them makes a big difference. It gives you more confidence in the work you do as well.

"I think they [my mentors] had a lot more faith in me than I had in myself."

What is the most important advice you would give to someone about to start their own lab?

Having a mentor to navigate the process, as I had and have for myself. On a personal level, I think perseverance and flexibility are good qualities to have. At the end of the day, they will help you overcome whatever adversities you encounter.

How do you get the most out of the meetings you attend, particularly in the early stages of your career?

I always find conferences slightly overwhelming, even if it's a small one. You get all these ideas and input and that's amazing, but there is always this hesitancy that you have with approaching people that you want to build collaborations with or just someone who you look up to and this is something that I also struggle with. In the past few meetings, I have been trying to actively make contact and try and talk to as many people as I could – bringing them to my poster or make sure I talk to them in the mixer sessions. It might be a difficult task, but these are the places where you meet your future collaborators, where you get nice feedback on your work and you learn a lot.

Could you tell us an interesting fact about yourself that people wouldn't know by looking at your CV?

I play the piano and I like to call myself an accomplished bathroom singer! I recently learned to bake and play tennis. One interesting fact is that I speak six languages; I'm only fluent in two, though. I dabble in several things – I'm not an expert in any of these (laughs).

Vaishnavi Ananthanarayanan was interviewed by Manuel Breuer, Features & Reviews Editor at Journal of Cell Science. This piece has been edited and condensed with approval from the interviewee.