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INTERVIEW

Transitions in development – an interview with Aissam Ikmi

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Aissam Ikmi is a group leader at the European Molecular Biology Laboratory in Heidelberg, Germany. Aissam uses the sea anemone *Nematostella vectensi* to interrogate how genetic and environmental factors combine to influence development. Aissam shared with us his thoughts on the ups and downs of scientific careers, and the importance of surrounding yourself with the 'right' people.

Let's start at the beginning, when did you first become interested in science?

My interest in science stemmed from an early interest in nature. I grew up in Morocco, in the coastal city of Agadir. Living between the ocean and the Atlas Mountains opened my eyes to the diversity that exists in nature. During high school, we took field trips to the mountains and these excursions really primed my interest in understanding the natural world. Over time, my interests shifted from nature in general, to both biology and geology, which I studied at university. But what really solidified my interest in pursuing science, and furthered my obsession with science, was the first time I opened a developmental biology textbook and saw a four-winged fly mutant. I was fascinated by how scientists were able to generate these mutants and that curiosity overtook all other interests in my life! That it is possible to make a four-winged fly, to me, was amazing. It blew my mind! And that was the beginning of my life in science.

You moved to Paris, France for your undergraduate and graduate studies, what prompted this move and how did you choose the lab for your PhD?

I wanted to advance my academic training in life sciences, but at the time there weren't many opportunities to pursue this kind of career in Morocco. I already spoke French, so studying in France seemed like a natural next step. The move, however, was not as easy as I'd imagined. I tried to visit the country to assess whether I could see myself living there, but as a Moroccan citizen, I needed to apply for a visa. The first time I applied, my visa was rejected, which completely traumatised me. Despite this disappointment, I continued my university applications, and after securing several acceptance letters, I was eventually granted a visa. The whole process really marked my life and I still remember that first rejection from the embassy.

In terms of choosing the lab, I was drawn to the science of my mentor, genetics professor Dario Coen. I was really impressed by his ability to translate complex knowledge into very simple concepts. For example, I remember asking him one day, 'how many books do I have to read to become a geneticist?' His answer was completely unexpected. He told me that to be a geneticist, you only need to know two facts and two tests. That's it. So, what are the facts and the tests? He said, 'Okay, the facts you need to know are how mitosis and meiosis work, and you need to know how to do a complementation test and a recombination test. Then, congratulations, you are a geneticist!' The way he simplified science really shaped the way I approach my work. Later, when I did my PhD work with Dario, I saw that he was very motivated by how fun science can be. I really liked that mentality. He taught me several genetic tricks to manipulate the biology of flies and I loved that, and he made me enjoy the process.

You also made a big move for your postdoc to the Stowers Institute in the USA; did you notice any differences in the approach to research between the two countries?

I moved from a small university lab in France to a competitive research institute in the USA. Stowers is a unique environment to do research because the institute has generous funding, which gives the researchers the opportunity to take risks. When I joined the lab of Matt Gibson, he encouraged me and gave me the confidence to engage in this high-risk, high-gain science, which I was not exposed to during my PhD. Another difference that I noticed between the two countries is that scientists in the USA tend to emphasise the medical relevance of their science. I was not exposed to this during my PhD. We studied the basic processes of life, whether they were relevant for medical research or not!

What was your research focus in the Gibson lab?

When I joined the Gibson lab, I had really broad research interests and wanted to explore a fundamental problem in developmental biology, but from an evolutionary perspective. My first project was

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working on the evolutionary origin of growth factors. I wanted to look at how growth and size are controlled across the phylogeny of animals or even in our closest unicellular relatives. I used flies as my experimental system for my research. I cloned genes from our closest unicellular relatives, choanoflagellates, as well as sponges and *Nematostella,* to test their activity and see whether they have any growth-promoting activity in flies. While doing this, I realised the limitation of these heterologous assays because they tell you about the molecules, but not about the biology. At that time, I had a parallel project working on developing genetic tools in the sea anemone *Nematostella vectensis*. I soon realised that I could use this system to get at the biology, not just the structure and function of the molecules, by directly studying growth in this early branch of animals. This became my main project in the Gibson lab.

What were your most important considerations when you were looking for group leader positions?

When I was exploring group leader positions, I prioritised three components. I wanted to work in a place that promotes curiosity-driven science. I was also looking for an environment with great opportunity to engage in collaborations. And, finally, I wanted to work with colleagues who were willing to help each other to grow, to challenge and improve each other's science. When I visited the European Molecular Biology Laboratory (EMBL), I felt that the developmental biology unit, headed at that time by Anne Ephrussi, checked these three boxes: curiosity, collaboration and a collegial environment.

I am proud of this sense of community that my team has built

What were your best moments and the most challenging ones in your transition to becoming a group leader?

My best moments were when I was recruiting lab members. It was exciting to build a new team and to discuss ideas for projects. Another great moment was seeing the first solid data come from lab members that I mentored. That was a life changing moment. I thought 'okay, now people are properly trained, and the projects are moving forward'. I was so happy to share and discuss the data with my neighbours here at EMBL. On the other side, it was challenging to move from a postdoc environment, where you are at the height of your productivity, to training young scientists in a new lab, where productivity takes a big hit. And, of course, in the beginning, nothing works for unknown reasons, even simple experiments. With these factors combined, you often think that your lab is collapsing. However, I was grateful for supportive colleagues who often reminded me how normal these challenges are when starting your own lab.

Is this when having a collegial environment is so important?

Yes, and another aspect is that in your first months as a new group leader, you often feel alone. You are used to being on the other side, in an open lab with your colleagues, other postdocs and students, discussing science on a daily basis. But now you're in an office without this constant feedback. So, there can be this loneliness at the beginning, which can be challenging. As you build relationships with colleagues and collaborators, I can say that the feeling fades away, and, most importantly, the connections you build as a mentor in your own lab become more fulfilling. My lab members are very proactive in sharing their diverse perspectives and supporting each other. I am proud of this sense of community that my team has built.

Can you summarise the research themes of your group at the moment?

My research is driven by the principle that change is the only constant in life. That's the principle of our research. We are trying to understand how the interplay between genetic and environmental factors shapes animal development and evolution. That's the big picture that we are trying to capture. We are using Cnidaria, or taking advantage of the biology of cnidarians, especially the sea anemone *Nematostella vectensis*, which offers a platform to study the interactions between organisms and the environment, because they have high developmental plasticity. Many aspects of their development integrate environmental inputs; for instance, we recently described that the number of the tentacles is dependent on the amount of food they consume (Ikmi et al., 2020). The link between food, growth and tentacle pattern was an ideal context to integrate environment into development processes. We are also branching into new areas, like recently in our bioRxiv paper (Stokkermans et al., 2021 preprint), we show a link between organism behaviour and morphogenesis. This is a parameter that developmental biology does not often study; how behaviour can shape the developmental trajectories of an organism. Our *Nematostella* model gives us the opportunity to challenge the link between these two processes. We also study regeneration, but I would say that, more generally, we allow the biology of the system to guide us through the niche of research that we're exploring. Of course, spending hours at the microscope, studying the biology is the best textbook that you can ever have to explore these questions.

Are you still working on developing new tools in *Nematostella*?

We are working on new tools, for example, we now have an inducible system where we can control gene expression in time and space. This means that we can explore the biology of the polyp. Previously, we could use knockouts or knockdowns, or microinjection, to explore early development, but the biology of the polyp was inaccessible in terms of precise genetic manipulation. We are writing the paper right now! But it is not only genetic tools that we are developing. With my collaborator here at EMBL, Robert Prevedel, a physicist who builds microscopes, we are working on a system that will allow us to capture the biology of cnidarians that was inaccessible with conventional microscopes. We built a new generation of microscopes that allow us to track the deformation of tissue at the single cell resolution in a freely moving organism.

What has been your approach for hiring new team members?

I'm just starting this process again because, after 4 years, my first pre-doctoral students are graduating and I'm recruiting the secondary generation of pre-docs. I'm looking for candidates who are genuinely interested in science and excited about science. I have to feel that they really care about developmental biology, that it's not just something they want to do. The second thing that I probe is their attitude. I want people to have a positive attitude. They should show respect to their colleagues, and not just to me as a group leader. These are the two criteria that I prioritise during the recruitment.

A mentor is a person that you can go to when you have reached a mental state where you doubt yourself

How important has mentorship been in navigating your academic career? Do you have a particular approach for your own mentorship of your colleagues?

Mentorship is an essential component in becoming a scientist. A mentor is a person that you can go to when you have reached a mental state where you doubt yourself. For me, a good mentor has the ability to guide and bring you out from that all! I had really good mentors during my academic career. During my undergraduate studies, I had a professor called Laurent Theodore; he influenced a lot in my career. During my postdoc, one of my mentors was Alejandro Sanchez Alvarado at Stowers Institute. He's a very charismatic scientist. You can go and talk to him when you are in a really bad mindset, and he is like a therapist! It's like you have a therapy session with him, and he rejuvenates you. I told him one day that he should offer the 'therapy sessions' as a service! I would say my mentoring style is that I try to understand what people care about. I'm not trying to convince someone to do something that they are not interested in. It's a waste of time. Instead, I try and focus on what the person cares about, and then build on that. That's my approach for mentoring.

What advice would you give to people starting their own labs?

As a new PI, you should discuss your ideas with people that you scientifically trust and respect as early as possible. These discussions will help you to shape your ideas and make them sharper. That's very important, to discuss your future projects as early as possible, and particularly with colleagues who challenge your ideas.

You tweeted that your recent bioRxiv paper was the result of a prolific collaboration. Do you have any advice on setting up collaborations for junior PIs?

Actually, the collaborations that my group establishes are often spontaneous! Our collaboration with Robert, to develop new microscopes, began when we co-organised a summer school. The summer school targeted scientists coming from unusual backgrounds for biologists, like mathematicians, engineers and computational scientists. We discussed how we could attract these talents to biology by planning a programme where we would teach them how to build a microscope from scratch, how to use the microscope to capture the biology of an organism during development and, finally, how to extract data and analyse the movies with the support of our colleague, Anna Kreshuk, a computer scientist who co-organised the school with us. The summer school was very successful, and it was during this process that we initiated the collaboration to overcome the limitations of the current microscopy approaches for studying *Nematostella*. Another collaboration we have is with L. Mahadevan at Harvard, who specialises in modelling biology. He has a quantitative understanding of biology. When he came to give a seminar at EMBL, I shared some of my projects and discovered that he was interested in similar questions. These discussions led to more conversations and eventually the collaboration evolved on its own. Coming from very different scientific backgrounds was also quite a challenge. In the beginning, it felt like we didn't speak the same scientific language and spent a lot of time finding a common language to be able to understand each other. Once you go through this process, you might expose your weaknesses, but this also helps you grow as a scientist. I would definitely encourage people to go and explore other fields, move out of their comfort zones and bring new dimensions to their work.

On the theme of collaborations, your lab is part of the EIPOD4 programme. Can you tell us a little about this scheme and the benefits for your lab?

Yes, the EIPOD programme is an excellent programme. It allows postdocs to propose an interdisciplinary project between two labs at EMBL, where they can combine biology with another element, like biophysics, engineering or computational biology, so they can gain an interdisciplinary skill. The programme is highly collaborative because the postdoc needs to justify why these two seemingly different labs are well suited for working on the research project together. Through this programme, I was able to recruit a mathematician and engineer, who would not normally have gravitated towards developmental biology, and I don't think I would have attracted these people if I was by myself. I love the programme and I strongly encourage future postdocs to consider it!

Did you ever consider an alternative or non-academic career path?

At each transition in my life, I had doubts about continuing science. From PhD to postdoc, I wasn't sure I wanted to do a postdoc and had to think about other options. And even during the transition from postdoc to PI, I had doubts as well. But, for me, the motivation and curiosity for science was so strong that I could not see myself leaving it behind. However, if I was not a scientist, I can see myself being a travel guide in the Atlas Mountains in Morocco, exploring nature every day. I would love that as well!

And then the final question: is there anything that Development readers would be surprised to learn about you?

As a child I raised pigeons on my parents' roof. They were my first biological subjects; I studied their behaviour, how they mate, how much they can travel. I had fun doing those kinds of experiments, and I was doing so unconsciously. I was not even aware I was engaging in science. I was just focused on having fun testing things with pigeons!

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