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CELL SCIENTISTS TO WATCH

Cell scientist to watch – Elif Nur Firat-Karalar

Elif Nur Firat-Karalar studied molecular biology and genetics at Bilkent University, Turkey. She then moved to the USA for her PhD work at the University of California, Berkeley, where she investigated the mechanisms of actin nucleation under the supervision of Matthew Welch. During her postdoctoral work in the laboratory of Tim Stearns at Stanford University, she used proteomics approaches and identified the centriole proteome and proximity interactome that revealed novel regulatory pathways for centriole biogenesis. In 2014, Elif became an Assistant Professor at Koç University in İstanbul, Turkey. Research in her lab focuses on studying the structure and function of the mammalian centrosome/cilium complex, with a particular focus on centriolar satellites. Elif is the recipient of an ERC Starting Grant, EMBO installation grant and Royal Society Newton Advanced Fellowship.

Elif Nur Firat-Karalar

What inspired you to become a scientist?

My father is an engineer. He's the first college graduate in the family so I can't say science is part of our family tradition. I started thinking about biology as a career alternative when I was chosen to participate in a Biology Olympiad team in high school. I learned a lot about how cells are organized into different compartments and how they mediate key functions. The more I read, the more curious I became about how textbook knowledge is generated through actual research in a laboratory. This curiosity led me to study molecular biology and genetics as my undergraduate major. Although I didn't know which specific research questions I wanted to pursue during my undergrad time, I realized I wanted to study cell biology when I rotated to Matthew Welch's lab at UC Berkeley.

How did your transition from Turkey to the USA come about?

In my second and third year in college, I did two internships: one with Philip Tucker at UT Austin on molecular immunology and another with Jon Beckwith in Harvard Medical School on bacterial cell division. These experiences gave me great exposure to academia and the research environment in the USA. Then, I applied to various graduate programs in the USA and I got into UC Berkeley. Very few graduate schools in the USA interview international students in person – most of them prefer Skype. Without a visit, I found it tough to select schools, because you really don't know where you're going (laughs). It's hard moving from Turkey to let's say… Cornell. Like, as a student you think, "Where is Cornell? What kind of research environment is there?" When I visited Berkeley for the interview, I thought it just had the right fit somehow, the right feeling. Then, the flexibility of doing several lab rotations in very different disciplines gives you the chance to try to find what you are passionate about.

How did you discover your passion for the cytoskeleton and subsequently centrosomes?

In Matt's lab, one of the first experiments I performed was live imaging of neutrophils migrating towards a chemo-attractant and it was just amazing: watching directed migration happen under the microscope and wondering how it would be achieved. This really drew me towards the cytoskeleton and actin in particular. In the last year of my PhD, thinking about what I could work on for my postdoc, I happened to go to Maxence Nachury's (UCSF) seminar in Berkeley. He talked about primary cilia and ciliopathies, which was very inspiring. Now, thinking about cilia leads you to centrosomes and centrioles and I joined Tim Stearns' (Stanford) lab to move in this direction – centriole duplication and licensing are conceptually amazing research topics.

After a short and productive postdoc, you established your own research group at Koç University in Istanbul. What was your motivation to move back to Turkey?

Of course, some people would question a decision to move from the USA to Turkey given the resource differences for academic research. However, I'm happy to highlight why early-career scientists decide to move back to their home countries, especially those considered 'developing', or with a challenging political or economic climate. One aspect was our family – our three sons were born at each of my career steps – to which we are very much attached. Also, in 2014, Turkey was investing a lot in research and there was real support for starting your own group. There's also the generous support given by the EMBO installation grants and the Marie Skłodowska-Curie reintegration grants. Most importantly, when I interviewed at Koç University I felt that the environment was very similar to the one that I had in Stanford, in a much smaller context. I gave a seminar in Koç and they offered me the faculty job

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Elif with her husband Tufan and her sons Mehmet, Kerem and Mert.

although I had been a postdoc for just two years. Initially, it felt like it wasn't the time to leave Tim's lab yet, but I couldn't let such a job opportunity pass. I'm very happy that I took the job and moved, although in a country like Turkey, any fluctuation in politics or the economy has a bigger impact on your research than it is the case in big research countries like the USA.

Following up, what challenges did you face when starting your own lab?

At the beginning, it's nearly impossible to recruit anyone from abroad, especially postdocs. Also, with the recent changes in Turkey, there's a growing number of Turkish students who want to go to Europe or the USA; they just want to leave. This puts you in a position where candidates tell you, "Your research is great, but it's in Turkey." It's tough to break that circle until you establish a name. Another challenge that I had not expected was the slow progress of reintegration into the European scientific community. I was nobody when I moved to Turkey so I had to invest a lot of time to build new networks. For example, it took me quite a while to figure out what is expected for each research proposal to secure funding compared to the NIH proposals I was used to. After five years of travelling – a lot of travelling – I think I'm feeling more comfortable and confident now.

Having established your lab now, are the challenges that you're facing different today?

My lab expanded to ten people, which is a bit beyond my ideal lab size but is required so we can accommodate pursuing new ideas. When you expand your group, it's a challenge to create an atmosphere that's nurturing for everybody. You have to try to be the best mentor to everyone, although your research group members are very different, with different weaknesses and strengths.

What questions are your lab trying to answer just now?

We are interested in understanding how cells compartmentalize to mediate key processes at the right time and place and we address this question in the context of different cytoskeleton-based structures. We're studying the biology of mammalian centrosomes, cilia and centriolar satellites. The centrosome–cilium complex has key functions ranging from cell division to cellular signalling and its deregulation results in cancer and ciliopathies, which are characterized by a wide range of symptoms. We investigate how centrosomes and cilia assemble and function in response to different stimuli or across different cell types. One major axis of research in my lab is studying these questions by focusing on the biology of centriolar satellites, which have remained mysterious structures for many years. During my postdoc, through unbiased proteomic screens, I found new ways of how centrosomes are regulated by centriolar satellites. They are membrane-less structures near the centrosome and we know that a majority of centrosome proteins localize to centriolar satellite proteins, but we don't know how, why and when. What we are moving towards is to study the biology of centriolar satellites during development and disease, which potentially will provide new insight into the regulation of centrosomes and cilia in different cell types and tissues.

"You have to try to be the best mentor to everyone, although your research group members are very different, with different weaknesses and strengths."

So you would argue that centriolar satellites form very differently depending on their developmental or cellular context?

Yes. By studying centriolar satellite dynamics, distribution, functions and the proteome, we have seen differences in all these aspects depending on the tissue context. We'd like to understand why and whether this has any influence on how centrosomes and cilia adapt to accommodate the needs of that specific tissue, which requires us to adapt new research tools. So far, we have used mammalian cell lines as tools for most of our work, and now we are moving towards mouse models through collaborations, or possibly stem cells and organoids in the future.

They're somewhat associated with centrosomes; would it do centriolar satellites justice to call them protein reservoirs?

Good question. I think there are several injustices we do to centriolar satellites, starting with their terminology – are they really centriolar? When you remove centrioles from a cell, there are still satellites in the cytoplasm and in muscle cells, where centrosomes are not the main microtubule-organizing center (MTOC), centriolar satellites are all around the nuclear envelope. We are just scratching the surface; we have been focussing on what centriolar satellites do for the centrosome, but I feel we haven't looked at them in the right context. Calling them reservoirs is partially true, but the 'why' is important. Except for cilium assembly in some cell types, we haven't yet found an essential function for satellites, but I think it's more about regulating cellular processes such that they happen at the right time or place with high efficiency, which brings you back to the developmental context.

What is the best science-related advice you ever received?

Simply working with great scientists and mentors like Matt and Tim, and now also with my EMBO mentor Monica Bettencourt-Dias

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(Instituto Gulbenkian, Oeiras, Portugal) was and is really influential to me – just watching them do their science, how they mentor and care about people in the lab. However, there's one key piece of advice that has really stuck with me over the years, which was about the importance of compartmentalization of my roles: as a mum at home, and as a scientist in the lab. Thus, early on in my career I started to be efficient and effective in how I use my time in different aspects of my life and this also helps me to achieve work–life balance.

"We are just scratching the surface; we have been focussing on what centriolar satellites do for the centrosome, but I feel we haven't looked at them in the right context."

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

It's important to find a mentor you're inspired by and don't hesitate to ask a lot of questions to as many people as you can to learn from their experience – both their failures and their successes. Again, I have to acknowledge the importance of a mentor for me; for example, Monica has been very supportive since I started my lab. When I passed to the second stage for the ERC, she invited me over to Portugal, shared her experience and went through my proposal with me. This is huge and it also makes you realize how much support you should give to your own people in the lab or to other investigators.

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

When it's about science I'm not hesitant to approach people, which is very different to my personality in my private life. Being in Turkey, I had to try harder and travel frequently to different meetings or give talks in different universities or research institutions, which exposed me to different kinds of research and helped me to find collaborators. It's generally easier through face-to-face contact, rather than emailing somebody you haven't met. Going to conferences helps you to realize that people are there for you – for the sake of science, for sharing the common scientific interest.

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

Much like many researchers, I am quite keen on cooking and baking. As scientists, we love doing experiments and that translates to food. During my time in the USA, there were only a few Turkish restaurants in our area so I was just cooking the Turkish recipes in a very creative way at home. When I started my lab, I turned to baking because then you can follow the recipe with high precision. Every week I have one or two recipes that I synthesize from reading many different recipes and then I execute it in my kitchen, which is the lab, with my three boys who are the team members – our version of quality time! A recent recipe is for baking French macaroons, which are very challenging regarding the consistency and texture. I'm not there yet but I'm working on it! [laughs]

Elif Nur Firat-Karalar 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.