Anthony Roberts studied biochemistry at Imperial College London, UK. He then pursued a PhD in molecular and cellular biology with Peter Knight and Stan Burgess at the University of Leeds, UK, where he studied the mechanism of the dynein motor protein. After this, Anthony moved to Boston, USA, for his postdoctoral work with Samara Reck-Peterson, at the Harvard Medical School, focussing on cytoplasmic dynein regulation. In late 2014, he returned to London, UK to start his own lab at the Institute of Structural and Molecular Biology at Birkbeck, University of London, and University College London (UCL), where he is now a Wellcome Trust Senior Research Fellow and Proleptic Senior Lecturer. Anthony received the Biochemical Society Early Career Research Award in 2016, a Biotechnology and Biological Sciences Research Council New Investigator Award in 2017, and was elected to the EMBO Young Investigator Programme in 2018. His lab is focussing on the mechanisms of microtubule-based transport within cilia and flagella.

What inspired you to become a scientist?
Well, my first aspiration was to be an artist. I loved drawing as a child. I think the scientific side of my brain kicked in a bit later, perhaps in my mid-teens. I remember at school, we were shown a clip from Carl Sagan’s Cosmos TV programme. He laid out on the table all of the chemical components found in the human body in the appropriate amounts. With dramatic flair, he mixed them all together in a pot and stirred, and… of course nothing happened. I suppose that was my first exposure to a failed in vitro reconstitution experiment [laughs]. It got me thinking about how the atoms are put together. Also, I have an older sister who is a big inspiration. I remember she would distil the information from her chemistry books into very elegant flow diagrams. She actually did a PhD on kinesin. She took some time out between her undergraduate degree and PhD, so we were doing our PhDs at similar times. She was working from a different angle, on yeast genetics, while I was working on structural biology. Somehow, we both naturally gravitated towards motor proteins. She moved into science communication after that, but we joke that for a while there we had both ends of the microtubules covered [laughs].

What questions are your lab trying to answer just now?
We want to understand how motor proteins create spatial organisation and movement within eukaryotic cells. We focus on dynein and kinesin, the families of microtubule-based motors that use ATP to transport components within the cell interior. Fascinatingly, they also have a critical role in assembling larger structures, such as the mitotic spindle, cilia and flagella. Our current goal is to try to understand how dynein and kinesin work together to form useful bidirectional transport systems. We’re studying this in cilia and flagella, which have a beautiful transport system – intraflagellar transport – that is highly regulated and biomedically important. I’m astounded by the diversity of biological functions of cilia - they’re involved in everything from development to vision to appetite control to fertility.

You rely on cryo-electron microscopy (cryo-EM) to visualise motor proteins and the cytoskeleton. Do you think this technique has had a period of ‘renaissance’ in recent years?
It’s an incredibly exciting time for cryo-EM. It’s true that the pace of progress quickened sharply in the last seven years, mainly thanks to direct electron detectors and maximum likelihood-based image processing. That said, when matched to the right biological question, cryo-EM was also providing some wonderful insights before. What is most inspiring to me is that there was a relatively small, dedicated group of researchers who were chipping away at the problems, well before cryo-EM was garnering the attention it does today. There was just a strong belief that the technique had great potential. It’s exciting to think there’s plenty more to come.

What has been the most influential publication or work in your field recently?
I was excited by a recent finding that the transport of signalling receptors within cilia is regulated by ubiquitylation. That was a discovery made independently by the labs of Gregory Pazour (doi: 10.1083/jcb.201912104) and Maxence Nachury (doi: 10.1101/2020.03.04.977090). It had been clear for a while that the
dynamic localization of receptors in and out of cilia is crucial for signal transduction. The finding that ubiquitylation is a key event in coupling the receptors to the transport machinery is a striking one. As with all good discoveries, it raises some fascinating new questions.

What challenges did you face when starting your own lab that you didn’t expect?
The volume of decisions. There were big decisions, there were small decisions, and they all needed making and they all sort of ran together. Which research question to focus on first? Which grants to apply for? What type of people to hire? What type of pipettes to buy? It’s a lot. I think the good thing is that when it happens, you’re just in the moment dealing with things. It’s only really afterwards that you look back and think ‘oh, that was a lot’. And there can be great pleasure in those small things. I think you definitely have to take joy in the small victories; for instance, when you get an aspect of a lab layout right, so it’s a bit easier for people to do their experiments. I believe one of my main jobs is to try to lower the activation barrier for people in the lab to make discoveries. I was surprised how rewarding I found that to be.

How are the challenges that you’re facing now different?
Well, the decisions are still there. They’re different in nature now, I suppose. Probably less day-to-day tactics and more long-term strategy. Is the lab steering in the right direction? Are the research questions important? Are we focussing our energy in the right technologies? Those are things that I spend a lot of time thinking about.

“One is really lucky when one gets a mentor who’s generous with their time.”

What elements, inside or outside the lab, have been key to your success so far?
I was fortunate in that I had phenomenal mentors, in Stan Burgess, Peter Knight, and Samara Reck-Peterson, who are inspiring scientists and human beings. Even now, I hear their voices in my head, like Peter Knight riffing about motor protein kinetics! I can still appreciate how they might look at situations, so they continue to shape me and my approach to science. One is really lucky when one gets a mentor who’s generous with their time. That has certainly been the case for me; both while training, and in my institute now.

What was the best advice you received regarding the transition to starting your own lab?
One piece of advice that stuck with me was from Sheena Radford in Leeds; she introduced me to the ‘three Ps’ of fellowship writing. I found it very helpful to know that fellowships are often assessed in terms of person, project and place. I was very focussed on the project, but I had given less thought about explaining why I might be the right person to do it and or why the environment would give it the best chance of success. Doing those things in a way that felt comfortable was a learned skill for me; it was really valuable to know that all three of those things are taken into account.

“…there isn’t a single route to success.”

What would be your advice for someone starting their own lab?
Firstly, there are some great resources out there now for new group leaders, for example Slack groups for sharing information, articles surveying the experiences of young PIs, videos on iBiology, and guidebooks from Wellcome and HHMI. I think those resources are brilliant. The second thing is that, amidst the sea of opinions out there in our internet age, I find it good to remember that there isn’t a single route to success. There is so much advice out there that if you try to follow all of it, I think you’d soon go crazy. I find it heartening that there are different types of lab that contribute to science in different ways. Even careers that look linear from the outside had their own internal twists and turns. With that sea of information out there, one of the most important things is actually to be true to yourself and to your passions. It’s important not to let your own internal voice get drowned out. You should listen to the advice given to you but don’t forget what you’re excited about. Otherwise, you could end up in a job that you don’t like so much. You have to love what you’re doing and stay true to yourself.

Are you still doing experiments yourself?
I am, in a small way. Actually, one of the reasons I chose the fellowship path was because I wanted to maintain some time at the bench, because I really enjoy it. I wouldn’t run a full experiment in the same way I did in my postdoc days, but I hope I can contribute by seeding things that other lab members can pick up. Also, I hope that having a small presence at the bench helps me stay in touch with the issues that members of the lab are facing.

In your lab’s website you highlight molecular animation. Has this interest come from your artistic side?
I love the process of attempting to animate a molecular mechanism. I was massively inspired by animations from people like Drew Berry, Janet Iwasa, and Graham Johnson. I learned a lot from watching their animations. Then I had the opportunity to train with Janet Iwasa during my postdoc fellowship, which was amazing.
Recently the lab had a really fun collaboration with Bara Krautz, who is a friend from my PhD days who moved into science visualization. When you try to animate a molecular process, it forces you to confront things that maybe you hadn’t previously thought about. I see value in it as a research tool, because it can raise questions that you hadn’t appreciated before.

**Do you think molecular animation also plays a big part in science communication?**

Yes, I think so. That’s actually one of the main motivations; to make versions of the animations that can be understood more broadly by the public. Then we also gain value from it for our research questions. It’s been interesting to see the educational visualisations that have sprung up around viruses due to COVID-19. Those have been very useful for communicating the science behind it.

**Given the recent circumstances, how did you and your lab cope with the lockdown due to the SARS-CoV-2 pandemic?**

It’s challenged everyone in different ways; people have loved ones in different situations, projects are in different places, and we had new lab members joining the lab who had to relocate during lockdown. I’m proud of how everyone has coped. I found the best way for us to support each other was to have frequent and very informal video chats. Kat, my wife, is a scientist and our children are two and five. For us, juggling childcare and home working was definitely the main challenge. Thankfully, the lab is open again now and we’re using face masks and distancing. Speaking of appreciating the small things, everyone was so happy to be pipetting again! We are braced for more changes. We’ll see how it develops. More broadly, it was troubling, to say the least, to see the evidence that the pandemic has amplified some of the pre-existing inequalities there are in science. I hope that the funders will be very cognizant of this.

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

My music taste usually raises a few eyebrows! I grew up in Bristol, which is a relatively small city with an incredible musical output. Artists like Massive Attack, Portishead, Smith & Mighty, and Reprazent. It was the era of drum and bass music when I was growing up. It’s this incredibly fast electronic music and it comes in lots of different styles: melodic, jazzy, futuristic or just plain noisy. I actually DJ-ed throughout school and university. Now, the closest I get is contributing to the music playlist in the lab! Each year, we have a big lab organisation day and we make a playlist of everyone’s favourite songs. I usually try to slide a few drum and bass tunes in there.

**So when it starts playing, they know it’s your music!**

Yes, there’s no doubt about that! [both laugh]

Anthony Roberts was interviewed by Inês Cristo, Features & Reviews Editor at Journal of Cell Science. This piece has been edited and condensed with approval from the interviewee.