Fiona Macfarlane talks with Benjamin Walker, a Postdoctoral Research Associate at the University of Oxford. Dr Walker is the 2021 recipient of the H. D. Landahl Mathematical Biophysics Award which recognizes the scientific contributions made by a graduate student or postdoctoral fellow who is making exceptional scientific contributions to mathematical biology.

1. What areas of research are you currently working on?

My main research focus is on problems in microscale fluid mechanics and swimming, particularly on the development of accurate and efficient models of slender filaments, motivated by the cilia and flagella found throughout nature. This has mainly centered around coupled fluid-structure interactions and studying swimmers in Stokes flow. I've also been branching out into other areas of mathematical biology, beginning to look at mechanics-driven problems in growth and development as well as a brief foray into reaction-diffusion equations on growing domains.

2. What attracted you to the field of mathematical biology?

During my undergraduate degree, I took a course in mathematical biology, having no idea what that really meant but, as I'd enjoyed biology at school, it seemed like it might be interesting. Fortunately, it turned out to be Philip Maini that was leading the course and I was immediately captured by mathematical biology, from the simplest models of fishing from a lake to the complex dynamics of reaction-diffusion systems. The mystical art of modelling, the types of analysis that it called for, and the back-and-forth between the mathematics and the biology really resonated with me and led me to pursue as much of it as I could.

3. Do you have a favourite research paper that you have been involved in?

My favourite bit of research that I've been involved in is probably formulating and implementing an efficient method for simulating slender filaments in 3D, not just because of the end result, but also because of the exciting experience that me and my coauthors had whilst working on this. Most of the progress we made happened within a short research visit of just a few days, with lots of really vibrant discussion mixed in with prototyping and writing, which led to a great atmosphere and one of my best research experiences. Another close contender is the first problem that I worked on, on automatically identifying flagella from videomicroscopy, which involved some close collaboration with biological colleagues and really drew from the biology of the problem to inspire the final methodology. It's this coupling between disciplines and the resulting interfacial research that I really enjoy.

4. Who is your biggest inspiration in the field?

My biggest inspiration would have to be Philip Maini, to whom I owe my passion for mathematical biology. Whilst everybody knows of Philip's world-leading research, the excitement and interest that he bestows in everyone that he speaks to about mathematical biology is an inspiration to me, and I hope one day to be able to talk about mathematics half as well as Philip does.

5. What do you see as the biggest challenges in your field?

I think a big challenge in my field is keeping pace with the rapid development of improved biological and imaging techniques, presenting us not only with vast quantities of data, but also completely new types of information. For example, whilst 3D imaging of sperm and their flagella is becoming more widespread, we broadly lack the tools to make best use of this rich information. In the coming years, I hope that we'll see the accompanying development of new language and techniques to describe and analyse this information, which might themselves spark new and exciting mathematical and biological questions.

6. What is the best part of your job?

The best part of my job is getting to work with a such a broad array of people in different disciplines and with different skillsets, which has invariably led to exciting and rewarding collaboration. I love that there is always the potential for a meeting to start a whole new avenue of exploration, with maybe just a single comment spiraling into a brand new research project by virtue of the diverse audience and its shared interest in science.

7. What do you do when in your spare time?

When I'm not shepherding my two cats, I try to swim as often as I can, though I've frequently had mathematics interrupt this, much to the detriment of my ability to count lengths.