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SPOTLIGHT

An interview with Abigail Tucker

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Abigail Tucker is a professor at King's College London, UK and her lab works on various aspects of craniofacial development – from basic, evolutionary and clinical biology perspectives. This year, Abigail will be awarded the first Cheryll Tickle Medal by the British Society for Developmental Biology (BSDB). We chatted with Abigail about her research, her commitment to public engagement and the challenges and rewards of working with emerging model systems.

This year you will be awarded the first Cheryll Tickle Medal by the BSDB. What does it mean to you to receive this prize?

It really is fantastic. Throughout a scientist's career there aren't a lot of moments when people come up to you and say 'that was really excellent science'. There are many awards that you can win when your career is beginning, like PhD or poster prizes and then at the end of your career there are lifetime achievement awards. So it is very nice to have a prize in the middle of my career. To have that recognition, to know that people appreciate the kind of research that I do, is really a great feeling.

This medal is awarded to female scientists. Do you think there is the need for awards that specifically recognise the contributions of women in science?

It would be great if there wasn't the need for this award, and I think things are changing, but women still face problems that men don't, particularly with regards to having children and taking that time out. I think we want to encourage women not to worry and to know that taking time out is not going to disadvantage them, but I do hope that at some point the BSDB will find that there isn't the need for prizes that specifically recognise women. I recently read the Chair's message in the BSDB newsletter, about how this medal is slightly controversial. It will be interesting to hear other people's opinions when I give my talk, and find out whether there is support for this initiative.

How did you first become interested in developmental biology?

I did my undergraduate degree in biology at the University of Oxford, and one of the course topics that I studied was developmental biology. I absolutely loved it. It was an extremely interesting subject and it helped that it was taught by really enthusiastic people. I was quite lucky that at that time at Oxford there were lots of wonderful developmental biologists working on all kinds of model organisms. Because of that I decided to stay and do a PhD in developmental biology.

You studied tail bud determination in *Xenopus* during your PhD, but you now work on craniofacial development. How did your research interests change during your career?

After my PhD I wanted to try a different animal model, specifically the mouse because I was quite interested in genetics. I visited several labs looking for mouse projects and Paul Sharpe had a tooth project that was not at all what I was thinking of. At the time I was more interested in general patterning of the embryo, rather than specific organs. It sounded like a really interesting project though and it turned out extremely well. This project also moved me towards craniofacial development. This is a really interesting area to work on, because there are so many different organs crammed into your head. A kidney is just a kidney, but a head includes the sensory organs, the brain, the skull vault, the jaw, and all the teeth and glands inside it. It is extremely complex and I like that a lot.

What are the scientific questions that interest you at the moment?

We have previously done some work looking at the lineage of different structures in the head and the germ layers that they come from. Now, we are examining whether the origin of a tissue matters in a disease situation. When you tell someone that a specific structure is derived from endoderm or neural crest, their reaction is, 'and why should I care?' Actually, it makes a difference. The cells respond differently depending on their origin.

The lab is divided in two halves. There are people who are interested in more evolutionary aspects, asking, 'why does something develop like this?' The other side of the lab, mostly clinicians, wants to know what happens when development goes astray. In areas such as the ear or the jaw, we have been able to combine these two aspects together. We now know that things go wrong because of the way the structure evolved in the first place.

Your lab is physically located in a hospital. Does this increase the pressure to introduce a clinical angle into your work?

There is definitely pressure to have a more clinical side to our work, and from a funding point of view it is much easier to get funding for the clinical questions than the evolutionary ones. However, one of

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Development (2016) 143, 1060-1062 doi:10.1242/dev.136473

the big positives of working in a hospital is that you can actually talk to the clinicians who are working with the patients. You can ask them what the big questions are that they would like to have answered, and that are important to patients. If you are going to be working on a scientific problem you want to make sure that you are asking the right questions, and that your answers will have an impact. We are trying to encourage these interactions between scientists and clinicians by giving honorary contracts to clinicians so that they are members of the department. About half of my graduate students are clinicians who have decided to do a PhD, and they bring that approach to our research.

Your lab works with a wide range of organisms, from more established systems like mouse and chick to curious creatures like snakes, geckos, chameleons and opossums. Why do you use such a variety of systems and what are the advantages and disadvantages?

It is great working with non-model organisms, but everything is a lot slower. When you want to look at the expression of a gene in the snake you have to clone it first, so you always have to add an extra couple of months to any experiment. I hope that other scientists appreciate that experiments are not as quick as they are in other systems. We have had a corn snake colony here at the hospital for over 10 years. They are common pets – so easy to get hold of and nice and friendly. However, they only breed twice a year. So when a reviewer says, 'could you just repeat that experiment?', I reply, 'yes, but we will have to wait until next year when we have eggs again'. That is not ideal. In fact, I have started writing the details of the breeding seasons in our methods sections, so that reviewers appreciate that it is quite difficult to do certain experiments immediately.

There are some questions that you need to go outside the model organisms to answer. The mouse has a really strange derived pattern of tooth development. It only has molars and incisors and it doesn't replace its teeth. Its incisors are also continuously growing, which is interesting in its own right, but very different from us. If you want to know what is happening in patients missing their second set of teeth, then mouse is not really the model to use. We have to move to something like the mini-pig, that has a full complement of teeth, and we have also recently looked at fruit bats and opossum. There are questions that have not been addressed in the past because scientists were focusing on model organisms. Once you move out into non-model systems you find that the number of unanswered questions suddenly increases dramatically, and that there is enough work to keep you busy for many years.

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How do you choose the organisms that you work on? Do you try to find a system that will help you answer your question or does the availability of the organism play a role?

A bit of both. When we wanted to compare marsupial and placental mammal ear development we were very lucky to find the opossum. There are only two or three opossum colonies in the world, and one of them is based in Mill Hill, here in London. That is fantastic. More recently, we wanted a reptile system and we ended up choosing the Madagascar ground gecko. This is not a normal pet gecko that you can easily get hold of, but its eggs have hard shells, which means that you can window an egg as you do in the chick. Being able to do this kind of experiment was worth going through the effort of getting that particular lizard. We actually had a colony here for a while, but because they have hard shells the females very easily get calcium depleted, especially if you are trying to breed them a lot to have access to eggs. After some time, we set up a collaboration with a group in Prague. They have around 2000 Madagascar ground geckos, so it is much easier to collect the eggs from them, rather than trying to raise the animals here.

You are involved in a variety of outreach projects, including science evenings and festivals, and even collaborated with Channel 4 and the BBC. What do you think is the value of such initiatives and would you encourage other scientists to do the same?

I really like talking to the public about my research and I've had great feedback. People are really interested when they understand what you are trying to do. It is exciting to share your findings and all the amazing things you can do in science with a different audience that will not read your papers. My lab and I try to participate in three or four activities every year and when I ask for volunteers I am always inundated with replies. I think this is great because it means there is a will on both the side of the scientists as well as the public to come to these events.

Some scientists worry that outreach activities take time away from research, but you can get involved at different levels

Some scientists worry that outreach activities take time away from research, but funding bodies are requesting these initiatives more and more and you can get involved at different levels. I was recently at a local school's careers day where I talked about working as a scientist. This is a very easy thing to do, whereas if you go to a big festival you have to design a stand, with props and hands-on activities. I really enjoyed our most recent stand about cell death in developmental biology – the idea that cells actually die to shape different organs. There are several good examples throughout the body and it is a concept that people are surprised about – it isn't something that they thought could happen. We also have an activity about making bioteeth. We discuss what you can learn from animals that replace their teeth all the time, what cells and signals are needed and about the possibility of creating bioteeth from stem cells. This is a lot of fun.

In 2011 you were awarded the King's College Supervisory Excellence Award. Is mentoring an important part of what you do?

It is. I think it is really important that PhD students have a project that they really like, using techniques that they can do. They should come away from their PhD not only with knowledge of their particular area but also other skills that they have learnt along the way – a whole package. Then they can say, 'I have a PhD but I can really go out into the world and do many different things'. It is really important to mentor someone through that process.

My PhD supervisor, Jonathan Slack, was supportive but generally had a hands-off approach, but there were lots of people in the lab, like Betsy Pownall and Harv Isaacs, who I could chat to and ask silly questions. I think I am a bit more hands-on. I meet my students every week to discuss what's been happening and I make sure that everybody knows how to do the techniques. They are shown once or twice what to do and then they carry on at their own

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pace, without someone looking over their shoulder the whole time. I try to be very encouraging when things are not working out. In science, lots of things can go wrong, so from a PhD project point of view, it is key to have different avenues of ongoing research. Then if one thing doesn't work, you have another way of looking at the problem. I have also found that PhD students have different interests and you need to tailor a project to the particular student while they progress through their PhD. Flexibility is quite important in mentoring.

What is your advice for young scientists?

I think that old papers are not read as much as they probably should be. When I was doing my PhD, I spent quite a lot of time translating 100-year-old papers from German into English (very badly, I've got to say!). It is amazing how many things have already been done and it is really important to know what has been done so that you can start asking new questions. At a recent meeting, someone presented work that made me think 'I have read this before, but in a paper from the 1970s'. Part of the problem is that the older papers are really long. Normally you quote the paper, or a review that referred to it, but when you read the original you have all the details and you know all the experiments that were carried out. I think it is really important to have as good knowledge of the subject as possible.

What would people be surprised to find out about you?

I was once bitten by the head of a decapitated snake!