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CONVERSATION

Early career researchers: an interview with Jeremy Goldbogen

Jeremy Goldbogen is an Assistant Professor at the Hopkins Marine Station, Stanford University, USA, where he studies the integrative biology of vertebrate filter feeders from forage fish to baleen whales. He received his Bachelor's degree in Zoology from the University of Texas, Austin, USA, before moving to the Scripps Institution of Oceanography and then the University of British Columbia for his PhD, which he completed in 2010 in the laboratory of Bob Shadwick. After a short postdoc at Scripps, Goldbogen moved to continue his postdoc training at the Cascadia Research Collective in Olympia, Washington.

How did you become interested in science?

I think I can distil it down to three factors. As a small child I grew up in rural New York State; I grew up on about 10 acres and being able to explore outside was really influential for me. I think that was a big reason I got inspired to think about and explore biology. I remember one of the nearby universities had activities for kids and I specifically remember pulling water out of a lake or stream; we looked at the water under a microscope and I remember seeing this amazing microscopic world. It stimulated my imagination and it has stuck with me to this day. I also had an amazing biology teacher, Mr Wynn, at high school: that is a critical age when you are starting to figure out the world at a more sophisticated level. He would go though the principles of biology, but he would tell stories in such a way that they would just stick with you. To this day I remember different principles of biology related to the stories he told. That demonstrates the importance of great teachers and making sure we value teachers in our society. Also, my father was a math and computer science professor and he would tutor me in calculus. He always brought home the latest Apple computer and different robotic components, which were really fun to explore as a kid. His influence on my career is probably greater than I realise, and I think a lot of my analytical thinking comes from my childhood education, both in and out of the classroom.

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What inspired you to take up research?

I did my undergraduate at the University of Texas at Austin, USA; I was a zoology major. It was an incredible place. It's a huge school; it has about 50,000 undergrads. That is where I got started in research. I signed up for a work–study programme, set up by the university as a way for students to help pay off their loans. In exchange, students would work in a research laboratory. When I signed up I had to pick from a list of different research labs and I saw hummingbird flight biomechanics. I thought that sounded really fun, so I signed up for that in Robert Dudley's lab, working with Doug Altshuler. I worked in the lab for a couple of years, digitising films of hummingbirds flying and doing load-lifting experiments to investigate their wingbeat kinematics. Then Robert Dudley invited me down to the Antarctic to work on Antarctic pteropod locomotion as part of an NSF research experience for undergraduates. When I took that trip I was sold on organismal biology as a career, it was just so inspiring. That speaks to the importance of making sure we have hands-on research experiences for undergraduate students, because it gets them excited at the key moment when they are trying to figure out what they are going to do for the rest of their lives.

You have a reputation for working with the largest animals on the planet; how did you get into whales?

I ended up going to graduate school at the Scripps Institution of Oceanography, USA, where Bob Shadwick, my thesis advisor, was at the time. I planned to work with Bob on muscle mechanics in fish locomotion and my first paper, from my Master's degree, was on fast-start muscle mechanics in rainbow trout. But then data from tagged fin whales landed on my desk and when I looked at it from a biomechanics background, I saw a kinematic goldmine. The data came from Scripps' acousticians led by John Hildebrand. They were trying to record calls from the backs of fin whales with tags, but the whales weren't calling because they were feeding at depth. My interest was in the mechanics of feeding. I wondered, 'Is there a way I can start working on this'? That was the moment when I diverted from the worlds of fish locomotion and flight biomechanics and went into whale biomechanics by chance. The data were just sitting around; no one was looking at them, probably because no one from a biomechanics background had seen it. I think that speaks to

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interdisciplinary research and working with people from other backgrounds. You can find data that no one has been investigating, or someone could give you an idea that you hadn't thought about before.

Have you ever worked outside of academia?

I completed my PhD at the University of British Columbia, Canada, then I did a 1-year postdoc back at Scripps. But then I left and went up to the Cascadia Research Collective. It is a not-for-profit. They focus on whale research and specialise in offshore whale research. It was a great experience for me because it allowed me to see what research was like outside of the academic sphere. It also allowed me to learn more about how research funding was raised outside of academia, other types of funding resources such as the US Navy in particular. I think that has helped me to this day. I also learned a lot of the skills required to do logistically challenging work in remote ocean locations.

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What is your current research focus?

In general, the lab works on the integrative biology of vertebrate filter feeders, from small forage fish, such as anchovies and sardines, to baleen whales. We have to bring the biomechanics lab to the open ocean for the baleen whales and we do that using tag technology that remotely senses and records different kinematic parameters. The really interesting questions that we are interested in focus on the biology of animals at this upper body mass extreme, and how they compare with smaller animals. How do the largest mammals subsist by feeding on some of the smallest food? This is an age-old question that continues to fascinate. Also, because they are air-breathing foragers, we want to know about the mechanisms of feeding and how the energetic consequences of that impact their diving capacity. Also, when did they evolve large body size and what are the factors that drove that? Was it because they evolved baleen and they had this mechanism to bulk filter really small animals, or was it also related to changes in the ocean that may have provided enough food that allowed them to have such high energetic efficiency? Many of these basic research objectives also have conservation and management implications, because many of these large whale species, such as blue whales, are endangered. We want to know how susceptible these large filter feeders are to environmental perturbations, whether that is in the form of military sonar or some environmental change that might affect the abundance and distribution of their food.

Are rewards in science a beauty pageant or an essential component for success?

I think at the most basic level we all like to be acknowledged for hard work, and getting an award of any kind can help boost your confidence, especially if it comes with some funds. I also think that awards can help younger researchers in a field where imposter syndrome [where you undervalue your abilities] is rampant. However, we should also dedicate resources to people that show high potential but haven't been able to turn the corner in terms of their research objectives and success. If people are on the edge and they haven't been able to make that leap into what we define as success, we could use our resources much more broadly to support these people and strengthen the scientific community as a whole.

Do you have any tips for someone trying to build collaborations?

Be persistent. I remember that I approached a parachute physicist, Jean Potvin at St Louis University, USA, when I first started looking into the hydrodynamics of the feeding mechanism in lunge-feeding baleen whales. I realised I needed someone who was an expert in deceleration mechanics and hydrodynamics: I needed a parachute physicist. I first emailed Jean and he replied, 'Yeah, this is very interesting, but maybe later', so it didn't work out at the time. But then I published my biologist's perspective on the hydrodynamics and I sent it to him and he said, 'There's nothing wrong with this paper, it's just not correct'. That is the moment when he said, 'Okay, we need to work together'. So be persistent and also realise that it's okay to fail. I put myself out there, I published a paper that was my best attempt at understanding this mechanism but it was not the right one. I accepted that it was okay to fail and in doing so I was able to gain a new colleague from another discipline, whose expertise was required to investigate that question properly. It has been an extraordinary collaboration, and Jean and I still work together to date on many different biomechanical questions from anchovy to blue whale.

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What is the most difficult experience that you have had during your career and how did you overcome the problem?

When I was a postdoc, one of my fellowships was cancelled unexpectedly with a couple of months' notice. I had gone back to Scripps for a 2-year postdoc and about 9 months in my advisor said, 'If you don't find funding, you're done at the end of this year'. I had just moved, I was just starting to get settled in, and suddenly I had to scramble unexpectedly to get my next position. Your postdoc period is an intense time – you are trying to build up your portfolio, you are trying to get papers out and you are trying to put job applications together – so to have that happen on top was pretty stressful. I had to ask around to see what was available and that was how I ended up at Cascadia Research. I was really lucky and I think it was because I had started to build this network of collaborators and that increased my chances of finding a position that was open.

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I try to remember that experience when I am advising postdocs and graduate students; to treat postdocs with the highest level of respect, to give them commitments, to make sure they clearly know how much funding is available and when it is running out. That is where it could have all ended for me.

What are the biggest challenges facing publishing and how do you think they can be resolved?

One of the biggest problems is the proliferation of journals and the sheer number of papers. You can only predict that quality is being affected. I still love my core set of journals – Journal of Experimental Biology, the Royal Society suite of organismal biology journals and Current Biology. But I think that there are just too many journals out there and the open access journal system has

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gotten out of control; there needs to be a way to reel them in. I love the idea of open access, but I think that we need to remember that quality is the highest priority in terms of academic publishing; I see that as a reviewer for some open access journals. I feel that the quality of peer review can vary extraordinarily between journals and even among editors within journals. Some open access journals are so big that they are unwieldy, so the quality of peer review will vary dramatically. There are great papers in those types of journals, but there are also papers that are clearly much weaker.

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I have been in the situation where I reviewed a paper for an open access journal and I put a lot of time into it. Then it went back to the authors, but they didn't change anything and didn't take into account my comments; then the paper was published essentially unchanged. If that is the case, then reviewers are spending a lot of time trying to improve papers but the editorial quality is such that the editors are not ensuring that those comments are incorporated. That is why when I submit to the legacy journals I know the paper will be peer reviewed rigorously. The editorial quality will be extraordinarily high, the editorial teams are the best in the field, and that assures me that a paper coming out of one of those journals is the best it can be. That is really important, regardless of impact factor.

How useful do you find social media?

I feel it is a mixed bag. I have a Twitter account for the lab, which I find quite useful. It can allow you to find a paper that you otherwise wouldn't find. I get the eTOC for JEB every 2 weeks, so I know what is coming out in that journal, but I may not know about papers coming out in other journals to which I do not subscribe. By following a Twitter feed with a network of colleagues and researchers around the world you can discover new research and other relevant information. You can also feel the heartbeat of the scientific community on social media. For example, it was just announced that the Integrative Organismal Systems (IOS) budget for NSF is going to be cut by a large percentage in 2018. As soon as that came out, scientists that I was following flagged it as an issue. If I wasn't on Twitter I wouldn't have been aware of this potential issue because it is something that I may not have caught in the regular news streams. I think social media is a way to be in touch with what is going on. However, social media can also give you incomplete information, so it is our responsibility to find out more when necessary. To return to that example, I was later informed that the proposed IOS budget cut was mainly due to the plant genome project being moved to a different part of NSF – thus there was no effective cut to IOS.

You can also feel the heartbeat of the scientific community on social media

What do you most like doing outside of the lab?

I'm really lucky to live in central California. In about half an hour you can be in the middle of nowhere looking at redwood trees on a trail run or a hike. I also like to play music; we do this on the research boat at night. When we are anchored in the harbour we get out our instruments and play music into the night. I play a little bit of guitar but usually there is no drummer so I take on that role. You can't bring a drum set on a research vessel, but you can bring this percussion instrument called the cajon; it's essentially a wooden box that you sit on and then you drum on the vertical side. If we're lucky, the captain of the boat also plays bass or sings, so we have a cast of characters playing different instruments and it's a good way to unwind after a long day in the field.

You work at the Hopkins Marine Station, which has the best view in the world; how do you get any work done?

Sometimes I see whale blows from my office window and it is a welcome distraction from writing grants and permits. Seeing the animals again is uplifting when morale is a bit low and you have had a dozen grants rejected. I definitely feel very lucky to be at Hopkins with great colleagues and to have an amazing ecosystem right in our back yard.

Jeremy Goldbogen was interviewed by Kathryn Knight. The interview has been edited and condensed with the interviewee's approval.