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A dive into barophysiology research: an interview with Ingrid Eftedal

Ingrid Eftedal is a senior scientist at Norwegian University of Science and Technology Department of Circulation and Medical Imaging, Norway, and a leading expert in baromedicine. In this Q&A, we talk about what started her career and the challenges of conducting niche research.

Credit: Karl Jorgen Marthinsen. Pictured Ingrid Eftedal

Can you briefly tell us about your research?
I chose diving as my research field because I am fascinated by the physiological responses in human–environment interactions. The balance between successful acclimatization and homeostatic disruption interests me, and diving lends itself beautifully to such explorations. Most of my research lately has been on professional saturation diving, along with an interdisciplinary team of colleagues and students. I have a background in biophysics and molecular biology, which led me to choose approaches that involve molecular analyses and computational systems biology for my part of the work.

Your work on barophysiology takes a modern approach (molecular genetics) to the classic physiology question of "how do we breathe?". Can you tell us what was your entry point into the research field? Do you see yourself more like a "lab rat" or being in Jack Cousteau's "The Silent World"?
I more or less stumbled into the field as a biophysics student at a time when doppler ultrasound cardiovascular imaging was a hot new field. Cardiologist and physiology professor Alf Brubakk was a local ultrasound pioneer in Trondheim, and I went to his office to ask him to be my supervisor. He convinced me to look into diving instead. So, my entry was neither that of a lab rat or an oceanographer, but of an impressionable student. After my Masters, I did a PhD and post doc in molecular biology and spent some years in hospital medical genetics before I decided that what I really wanted was to study how humans cope with the underwater environment in diving.

You sometimes employ rodent models in your research. However, one could argue that decompression sickness is very specific to humans. I wonder if it has been challenging to convince the research community and funders of your research approach.
My focus is human divers, primarily those working in Norway's offshore industries. But we sometimes use rodents for exposures that lie beyond safe human limits or when we need material that cannot be harvested from human divers. However, there are drawbacks to rodent models, as they differ from humans in important ways. For one thing, rodents normally don't develop atherosclerosis, so their vasculature doesn't undergo the aging process that humans experience. And we don't submerge the rats in water, which limits their relevance to real-life diving situations. So, while rodents have their place when humans are not an option, we limit their use to those instances.
It is also worth mentioning that decompression sickness may not be limited to humans. Studies on diving mammals suggest that they too may experience it, even though they are thought to be evolutionarily adapted to decompression. My friend and colleague Yara Bernaldo has done interesting work on stranded beaked whales, showing that they might suffer from decompression-induced gas bubbles as well. There are indications that underwater noise pollution may cause the whales to decompress too quickly, increasing their bubble load to levels that may be problematic.

Decompression sickness is a truly terrifying condition, but there's little awareness of it in the general public. Can you tell us of your experience in getting your work funded and potentially some advice to other researchers that are fighting to get their work funded?
Your point about capturing the general public's imagination is spot-on. Niche fields are hard to fund, but in Norway we probably have an advantage when it comes to public awareness of decompression sickness since diving has a long and at times dramatic legacy in our history of offshore exploration. However, there are clearly more things to consider to obtain research funds. Well-crafted applications are essential, but as many of us experience, it is often not enough. Beyond drawing attention to our fields through popular media and public outreach, we need to be active in the arenas where research strategies are made. I learned this from my mentor that you need to find your way into those arenas, and it has on at least one occasion helped me get words into a call that kept the research funded for the next four-year period.

You are a very well-established researcher in your field, yet, surprisingly, you struggled to obtain tenure. You have been very candid about the process, which is extremely invaluable to young researchers. From your experience, what would you like to see change in the current scientific career model?
The competition for funding and academic positions has always been challenging, but it seems to be getting tougher with time. I believe the change lies not so much in the nature of the competition, as in the volume of applicants and increasingly strict requirements of the calls. The inherently creative and uncertain nature of academic research requires a lot of trust and does not always fit easily into strict systems of accounting and reporting. However, it seems that the balance has shifted in favor of the control, and the "slack" we used to rely on to bridge research groups over to the next grant is no longer available.
Norway probably reached this point later than many other countries. Because we are used to keeping senior research personnel for long periods outside of permanent positions, we may not

have fully acknowledged the difference between tenure and temporary positions in our universities. It seems we are now trying to address the challenges of limited funding by creating a system where scientists are expendable, "plug-and-play researchers", kept as long as they bring in the overhead. We need to keep reminding ourselves and the public that some of the science we take pride in is performed by temporary and at times underappreciated colleagues.

There is also a personal side to the process from student to scholar that universities need to acknowledge, regardless of funding. It is heartbreaking to see talented, dedicated young people give up part of their self-esteem in the process. We need to acknowledge this and speak up for young scientists. Academia needs them, and they need support.

Not many people call themselves physiologists these days. The last decades saw a big bet on reductionist approaches to gain/acquire new knowledge. As a physiologist, where can we find physiology these days?

I grew up in awe of physiology, with a grand-uncle who was a zoophysiology professor. Part of my childhood lore consisted of stories about long periods of fieldwork dedicated to studies of thermal regulation in arctic birds and hibernating mammals. The stories had a dreamlike quality that installed in me an interest in nature before science. My own fieldwork takes place in controlled and comfortable surroundings on board dive support vessels, and my research projects have shorter timeframes with fixed aims. The closest I come to that childhood feeling of adventure is when I sit on deck watching the ocean on a vessel at sea. It puzzles me a bit to see classic physiology losing ground, partly because I can think of few things more fun to engage in as a researcher.

However, I think the most important role for physiology today may be less romantic. With rising temperatures, pollution, and shrinking habitats pushing the earth towards its tipping points, we need to understand and communicate how this affects all life. Knowledge of how climate changes impact physiological states and processes must be part of the information that guides policy towards action, and I can't see that being accomplished without physiologists.

This interview was conducted by Senior Editor Joao Valente.

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