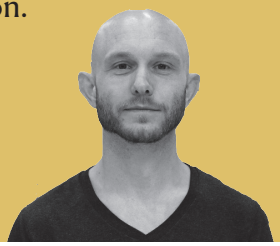
Tommy Norin

Tommy Norin is a Senior Researcher and newly established group leader at the National Institute of Aquatic Resources, Technical University of Denmark. His research focusses on physiological variation in animals, and the functional, ecological, and evolutionary consequences of this variation.



Tell us about your background. How did you first become interested in animal physiology?

As far back as I can remember, I've known that I wanted to be a biologist, but my interest in animal physiology wasn't always there. This began during my Master's studies when I took an advanced hands-on animal physiology class at the Section for Zoophysiology at Aarhus University. This course and its passionate teachers really sparked my interest in how animals work, and how physiological processes integrate to shape whole-animal functioning and performance. That's when I decided to pursue a career in animal physiology and academia.

What is your lab working on currently?

We're currently working on answering one of the big open questions in biology – why metabolic rate changes (scales) with body size the way it does. We've known for more-or-less a century now that metabolic rate generally doesn't increase in direct proportion to body mass, but rather in a curvilinear fashion, so that larger organisms get lower mass-specific (per gram) metabolic rates. However, there are still mixed and very strong opinions about this important metabolic scaling relationship and whether it is governed by fixed physical principles for all organisms or if there is systematic variation in how steeply metabolic rate increases with body size. We're investigating the latter using an individual-based approach, quantifying lifetime (ontogenetic) scaling of, in our case, individual fish as they grow from larvae or juveniles to adults. We hope to determine what roles variation in growth and selection on growth rate play in shaping metabolic scaling. You can read more about these ideas in this recent paper.*

What does a typical day look like for you?

I've only recently transitioned into a role as PI and research group leader, so a large part of my day is currently spent getting my lab set up and established, and helping new students to get their projects up and running. I must admit that I've been a bit surprised by just how much time it takes

* Norin T. 2022. Growth and mortality as causes of variation in metabolic scaling among taxa and taxonomic levels. Integrative and Compara-tive Biology 62, 1448–1459.

Above: Tommy is measuring oxygen uptake rates of small fish using so-called intermittent-flow respirometry to quantify the fish's metabolic rates.

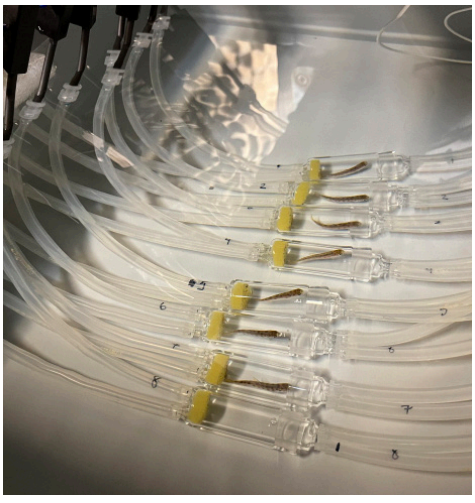
to plan, order and build equipment for structuring and starting up a new lab and research group. So overall, I'm spending less time in the lab myself and more time doing administrative tasks, supervising students, and writing grant applications. As I'm in a researcher (as opposed to a lecturer) position, I don't have a whole lot of teaching right now.

What do you most enjoy about your work?

Although I'm spending less and less time in the lab myself, one of my favourite things as a researcher is the excitement of analysing the data from a new experiment and seeing the results come together. The satisfaction that eventually follows when those results get published and, especially, when they are used by others in their work is worth all the sweat and tears that often come with experimental work. I also really enjoy mentoring students and passing on my knowledge and own excitement about experimental biology. Seeing the students succeed and continue on their chosen career path is very enjoyable. In general, while academia and its "publish or perish" culture can be hard and cut-throat, the collegiality of academia and network of amazing students and colleagues who often become good friends is worth it all for me.

What is your lab hoping to work on in the future?

We'll continue to work on metabolic scaling, trying to answer why there is variation in how steeply metabolic rate increases with body mass across taxa and taxonomic levels. We're currently working on fish and mostly in the lab, but the hope is to secure more funding to expand to other groups of animals and to the field. While lab work under controlled conditions is absolutely necessary to understand



Left: Seven juvenile rainbow trout are having their oxygen uptake rates recorded in small glass respirometry chambers. The empty chamber serves as a blank to control for any background (bacterial) respiration.

> "One of my favourite things as a researcher is the excitement of analysing the data from a new experiment and seeing the results come together"

biological phenomena like metabolic scaling, understanding the biology and, in our case, the energy expenditure and demands of organisms in the wild is ultimately what we aim to do.

What advice would you give to aspiring scientists in this area?

For scientists wanting to work with metabolic rate and metabolic scaling, I would advise them to keep an open mind. There are many theories and strong opinions about how and why metabolic rate changes with body size (or vice versa), and how metabolic rate and body size are affected by environmental change. So reading the literature with an open mind and forming your own opinions is very important.

Who are your scientific heroes?

There are so many amazing scientists out there who have and continue to inspire me. Naming only a few is a tough task, but I'd have to start with my PhD advisor, Hans Malte. Hans is one of the smartest people I have come across in academia, and he guided me down the career path I am on now, which I'm very grateful for. Shaun Killen is another of my scientific heroes. Shaun is not only a great scientist but also an amazingly passionate and inclusive mentor. Shaun took me under his wing when I was a young postdoc in Glasgow, and he helped me kickstart my career and form a strong international network. I also admire people like Josefin Sundin, Fredrik Jutfelt, and Tim Clark, who are strong advocators for scientific integrity. They, and others, have done the field a great service by calling out research misconduct while putting their own careers on the line as whistle-blowers. I did part of my PhD with Tim in Australia, and he has been integral in shaping my career and approach to science.

Selected Publications from SEB or affiliated journals.

Blewett TA, Binning SA, Weinrauch AM, Ivy CM, Rossi GS, Borowiec BG, Lau G, Overduin S, Aragao I, Norin T. 2022. Physiological and behavioural strategies of aquatic animals living in fluctuating environments. Journal of Experimental Biology 225, jeb242503.

Christensen EAF, Norin T, Tabak I, van Deurs M, Behrens JW. 2021. Effects of temperature on physiological performance and behavioral thermoregulation in an invasive fish, the round goby. Journal of Experimental Biology 224, jeb237669.

Ern R, Norin T, Gamperl AK, Esbaugh AJ. 2016. Oxygen dependence of upper thermal limits in fishes. Journal of Experimental Biology 219, 3376–3383.

Jutfelt F, Norin T, Ern R, Overgaard J, Wang T, McKenzie DJ, Lefevre S, Nilsson GE, Metcalfe NB, Hickey AJR, Brijs J, Speers-Roesch B, Roche DG, Gamperl AK, Raby DG, Morgan R, Esbaugh AJ, Gräns A, Axelsson M, Ekström A, Sandblom E, Binning SA, Hicks JW, Seebacher F, Jørgensen C, Killen SS, Schulte PM, Clark TD. 2018. Oxygen- and capacity-limited thermal tolerance: blurring ecology and physiology. Journal of Experimental Biology 221, jeb169615.

Norin T, Malte H. 2011. Repeatability of standard metabolic rate, active metabolic rate and aerobic scope in young brown trout during a period of moderate food availability. Journal of Experimental Biology 214, 1668–1675.

Norin T, Malte H, Clark TD. 2014. Aerobic scope does not predict the performance of a tropical eurythermal fish at elevated temperatures. Journal of Experimental Biology 217, 244–251.

Thambithurai D, Crespel A, Norin T, Rácz A, Lindström J, Parsons KJ, Killen SS. 2019. Hypoxia alters vulnerability to capture and the potential for trait-based selection in a scaled-down trawl fishery. Conservation Physiology 7, coz082.