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ECR SPOTLIGHT

# ECR Spotlight – Luke Flewwelling

ECR Spotlight is a series of interviews with early-career authors from a selection of papers published in Journal of Experimental Biology and aims to promote not only the diversity of early-career researchers (ECRs) working in experimental biology during our centenary year but also the huge variety of animals and physiological systems that are essential for the 'comparative' approach. Luke Flewwelling is an author on 'Thermoregulatory trade-offs underlie the effects of warming summer temperatures on deer mice', published in JEB. Luke conducted the research described in this article while a graduate student (MSc) in Dr Graham Scott's lab at McMaster University, Canada. He is now a PhD student in the lab of Dr Arthur Cheng at York University, Canada, investigating muscle physiology and the mechanisms by which exercise can create physiological change in individuals. Currently he is studying how various types of exercise training impact muscle fatigue tolerance and calcium signalling in single muscle fibres.

Luke Flewwelling

**Describe your scientific journey and your current research focus**

I have always had a love and passion for biology. In high school, I knew I wanted to do my undergraduate degree in biology, and that is precisely what I did. I became enthralled with animal physiology during my time at Queen's University. I had incredible professors who inspired and pushed me despite never having the best grades. In the fourth year of my undergraduate degree, I had the privilege of completing an honours thesis project, where I studied aquatic snails and their ability to be used as a bioremediation tool. Learning how to conduct proper research and having a motivating supervisor opened several doors for me. I was fortunate to have been introduced to Dr Graham Scott, who later became my supervisor during my MSc at McMaster University. There, I started studying deer mice and the impact of climate warming on their physiology and activity levels. This project became a massive undertaking for me. I learned several new techniques, including specialized surgeries to implant telemetry devices. Learning these skills became a huge asset as I had a wide breadth of knowledge and utilizable skills, which I will take with me in the future. As I was reaching the end of my Master's, I knew that I had a drive and love for research and wanted to continue in academia, specifically in the field of muscle physiology. This led me to search for a position for my PhD. When I came across Dr Arthur Cheng at York University, I became captivated with understanding more about muscle fatigue and its relationship to calcium. After reaching out and connecting with him, I was sure that the lab would be an excellent fit for my PhD. While I've only just begun my research, I am currently studying the impacts of various types of exercise training on muscle fatigue and how calcium plays an essential role in fatigue resistance.

**How would you explain the main finding of your paper to a member of the public?**

Global climate warming is a predominant issue, causing dramatic changes in animals' behaviour, physiology and overall health. However, relatively few studies investigate the impact of these increasingly high temperatures on small mammals. My thesis focused on the physiological effects and activity changes that occur with heat exposure and acclimation when small mammals are transitioning into the summer environmental temperatures. To address this, I exposed North American deer mice to environmentally realistic summer temperatures and examined several physiological, activity and behavioural changes. Exposure to warming temperatures up to 38°C led to the dysregulation of body temperature, where their body temperature variation became more extreme. These warming ambient temperatures also decreased activity levels and were associated with a decrease in their ability to produce heat during the night when ambient temperatures are cooler. Body mass and food consumption were also reduced, while water consumption was increased in these warm temperatures. However, after this heat acclimation period, the mice had a greater ability for evaporative cooling. This has many implications for the overall fitness and health of deer mice and small mammals around the globe that are experiencing climate warming.

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A photo of a deer mouse from our colony that is about 3 times larger than the average (for some unknown reason).

**What are the potential implications of this finding for your field of research, and is there anything that you learned during this study that you wish you had known sooner?**

We found critical trade-offs in animals' ability to heat and cool themselves during heat acclimation, which may limit night-time activity. This may have dramatic impacts on the ability of mammals to perform critical behaviours which are essential for fitness in the wild. I wish I had known how dramatically the ability to produce heat would be impaired in these mice. This opens up doors for future research to study the impacts of heat acclimation on the ability to thermoregulate.

**Which part of this research project was the most rewarding/challenging?**

Learning all the new techniques was extremely challenging, especially learning the surgeries to implant telemetry devices. It took months to be confident and seamless, but it was gratifying once I had mastered the skill. Also, writing my first publication was quite challenging as it was entirely new for me. However, I had vast amounts of help from several people. Having my first publication received so positively and in JEB was highly gratifying.

**If you had unlimited funding, what question in your research field would you most like to address?**

I am incredibly interested in the mechanisms and signalling pathways involved during and post-exercise. Specifically, the mechanisms of hypertrophy still need to be examined as they are poorly understood. This is extremely shocking as we have known the principles by which we can grow muscles for decades. However, the specific mechanisms involved in muscle growth are not entirely clear in the literature. I am also very interested in what physiological changes occur, and what benefits arise from various types of exercise training modalities.

**What changes do you think could improve the lives of early-career researchers, and what would make you want to continue in a research career?**

I think that having more funding opportunities could be incredibly beneficial for early-career researchers. Having an appropriate income to match the amount of work being done could be very valuable and attract many more individuals into research. This could also help start an individual on a path to continue in research, as income is often an issue that is mentioned among graduate students. I also think that having a sense of community is extremely important. Ensuring that researchers have a connection to people within their lab is essential, but also forming relationships with people in other faculties or industries could be necessary for finding the best path to continue a career in research.

**What's next for you?**

I am completing my PhD at York University under the supervision of Dr Arthur Cheng. I am part of the muscle health research centre, learning new skills and pursuing my passion for research. During this time, I continue to use many of the same skills I learned during my MSc, but I am also learning many new techniques. I am learning how to mechanically cut down to a single muscle fibre in the flexor digitorum brevis (in the foot of a mouse). This is an extremely difficult task, and only a few people know how to do this technique in the world. With this technique, I will investigate more of the impact of exercise on muscle fatigue and calcium signalling.

**Reference**

**Flewwelling, L. D., Wearing, O. H., Garrett, E. J. and Scott, G. R.** (2023). Thermoregulatory trade-offs underlie the effects of warming summer temperatures on deer mice. *J. Exp. Biol.* **226**, jeb244852. doi:10.1242/jeb.244852