ECR Spotlight – Jamie McCoy

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. Jamie McCoy is an author on ‘A phenomics approach reveals interspecific differences in integrated developmental responses to chronic elevated temperatures’, published in JEB. Jamie is a postdoctoral research associate in the lab of Dr Oliver Tills at the School of Biological and Marine Sciences, University of Plymouth, UK, investigating the use of bioimaging and computer vision approaches to examine the impacts of environmental change on the development of marine and freshwater invertebrates.

Describe your scientific journey and your current research focus

How and why animals grow and function in the way they do has always fascinated me. My journey into scientific research began at the University of Plymouth, UK, where I got to experience research first-hand and build a foundation for my interests in environmental physiology and experimental biology. Here, I also developed a keen interest in early animal development. My Master’s research investigated the effects of mild hypoxia on embryos of Littorina littorea, a marine snail, with a focus on how reduced oxygen affected its functional morphology, and timings of development (https://doi.org/10.1242/jeb.221895). Having a window into this fascinating period of life, and developing interests in bioimaging, led me to pursue a PhD at the University of Plymouth. During my PhD I aimed to understand what ‘phenomics’, the acquisition of phenotypic data at the scale of the whole organism, could contribute to comparative developmental physiology, in terms of how evolutionary and environmental change drives the development of physiological function in aquatic embryos. This involved using some exciting bioimaging hardware and computer vision software to extract huge quantities of physiological and behavioural data from developing embryos of freshwater snails, data which formed the basis of the current JEB paper. I’m currently a postdoc in the EmbryoPhenomics research group at the University of Plymouth, continuing to develop and apply these approaches to aquaculture settings.

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

Climate change is having unprecedented impacts on animals in marine and freshwater habitats, and whilst we have a good understanding of how adult life stages will respond to this change, how the very earliest life stages of these will respond is much more poorly understood. Early life stages change dramatically as they grow and develop, and when they are exposed to a change in their environment, they show changes to a huge number of ‘phenotypes’, traits relating to their shape, size and the way they function and behave. In our study, we use a new computer-vision-based approach to measuring the phenotype, and were able find major differences in the sensitivities of embryos of three species of freshwater snail to higher temperatures.

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?

In the current paper we use a new approach to phenomics termed ‘energy proxy traits’ (EPTs) to compare the thermal sensitivities of embryos of three species of freshwater snail with major differences in the timings of their development. This approach allowed us to find differences in thermal sensitivities continuously during the entire developmental period of each species, as well as interrogate responses at specific windows in development. Crucially, EPTs allowed us to assess thermal sensitivities in a way that was transferable between species that vary markedly in their early development, and between windows of development with vastly different observable physiologies and behaviours. As far as we are aware, this is the first study implementing phenomics for a robust cross-species comparison of environmental sensitivities during early development.

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

Bioimaging, analysis of video data and calculation of EPT data produced a small suitcase worth of hard drives, and managing and presenting this data in a research article was a real challenge!
However, having this video and data resource has proven really valuable, and interrogation of the EPT data gave some really interesting insights into the development of these three species. For example, whilst we were predominantly measuring thermal sensitivities in the form of the magnitude of change of EPTs to elevated temperatures, we found that by measuring responses continuously throughout development, the entire developmental period in two of the species was shifted forward in relative time, something we wouldn’t have otherwise detected had we just measured responses at specific points in development time. It’s these kinds of emergent findings that can be some of the most interesting.

If you had unlimited funding, what question in your research field would you most like to address?
Predictive phenomics has led to some very cool advancements in plant and medical fields, allowing us to predict based on huge amounts of phenotypic information whether individuals possess particular genotypes, or to detect very early on whether an individual is exhibiting a decline in its performance. Whether we can use phenomics in a similarly predictive capacity to understand whether an individual is likely to survive or have higher fitness in a new environment, based on the phenotype during its development, is something I would really like to investigate.

What’s next for you?
I’m currently working as a postdoc in the EmbryoPhenomics research group at the University of Plymouth, and hope to continue in biological research. We are currently developing open-source bioimaging units and aim to apply these to aquaculture research settings in collaboration with the University of Exeter. Continuing to develop and apply phenomics approaches to environmental physiology and comparative developmental physiology is an area of research I hope to continue in for some time!

Reference