ECR Spotlight – Phoenix Quinlan

Describe your scientific journey and your current research focus

I have wanted to become a scientist since I was a young child. I majored in neuroscience as an undergraduate at The Ohio State University, during which I worked as a clinical research assistant. I also worked as a peer leader for several peer-led team learning biology courses, where I developed a passion for animal evolution and development. It was at this time I decided that I wanted to switch from clinical to basic research. I began my PhD in the lab of Dr Paul Katz, who had just started a new lab at the University of Massachusetts Amherst studying the neuroethology of the nudibranch mollusk *Berghia stephanieae*. When reviewing what was known about nudibranchs, I discovered many reports that nudibranchs were blind, but this had never actually been tested in the laboratory. This led to me investigating whether nudibranchs truly are blind and thinking about how their sensory systems function. I now use behavioral experiments and neuroanatomical tools to investigate how *Berghia* uses visual, olfactory and mechanosensory cues to navigate its environment.

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

There has been a longstanding presumption that nudibranchs are blind and instead rely on other senses, such as smell and touch, to get around. My research demonstrates that nudibranchs are not blind, and vision is likely an important cue that these animals use to navigate their environment.

What are the potential implications of this finding for your field of research?

While most gastropods possess a retina with thousands of photoreceptor cells, nudibranchs are unique because they have only five or fewer photoreceptor cells in their retina. Nudibranchs have been presumed blind in the literature, so there have been no studies examining vision in these animals. However, our research shows that at least one nudibranch species uses vision as an important sensory cue for navigating its environment. In addition to opening the door for future studies on the use of vision in nudibranch mollusks, I hope that my research demonstrates that even structurally simple eyes with very few photoreceptor cells can be used for important visual tasks.

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

The most challenging part of this research was figuring out how to analyze the behavioral data. Thankfully, recent tools such as DeepLabCut have made it much easier to compute locomotor trajectories in a variety of animal species. However, it was challenging to figure out how to analyze the trajectories of a nudibranch because they have a different pattern of locomotion than many other animals that are commonly studied. Nudibranchs do not move in discrete bouts like fruit flies and zebrafish, but rather have slow, continuous locomotion. I am thankful to my lab members and our collaborators for their support and feedback on this project, which helped immensely in figuring out how to analyze the data in a meaningful way. It was rewarding to see how these experiments fit together to form a cohesive story about *Berghia*’s behavior.

Why did you choose JEB to publish your paper?

Before I began writing this paper, I knew I wanted to submit this research to JEB. Many of the research articles that were influential for this project were published in JEB. I really appreciate that JEB publishes research articles focused on the comparative physiology of a variety of animals, not just common laboratory species.

Are there any modern-day JEB papers that you think will be the classic papers of 2123?

In 2018, John Kirwan and colleagues published a research article in JEB entitled ‘The sea urchin *Diadema africanum* uses low resolution vision to find shelter and deter enemies’ (doi:10.1242/jeb.176271). Sea urchins have a distributed visual system with photoreceptors at the base of their tube feet. Kirwan and colleagues...
demonstrated that *Diadema africanum* uses spatial vision to respond to visual stimuli in its environment. In particular, it was found that these animals move toward dark objects in what is likely a shelter seeking behavior. They also point their spines toward looming stimuli, which is likely a defensive behavior. The researchers measured their visual resolution for each behavior and found that it was similar to the estimated resolution that could be produced by the receptors at the base of the tube feet, suggesting that sea urchin vision could be mediated by the tube feet. In addition to demonstrating that distributed visual systems without true eyes can be used for ecologically relevant visual tasks, I think this research will be useful for future studies exploring the mechanisms of visually guided behaviors in animals with different types of visual systems. This research was influential for me when designing my study on visually guided behaviors in *Berghia*.

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

I have recently been fascinated with the diversity of eye types and visual behaviors across gastropods. There is still a lot that we don’t know about the mechanisms of visual processing in different gastropods and how these systems evolved. If I had unlimited funding, I would love to do a comparative study examining the neural mechanisms of visual processing across nudibranchs and other gastropods. I would ask how visually guided behaviors and visual systems evolved across different gastropod groups.

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?

One of the biggest challenges of being an early-career researcher is how much PhD students and post-doctoral researchers are paid. The wages of PhD students and post-doctoral researchers have not kept up with inflation, especially in high cost of living areas. In my personal experience as a student parent, I have found it challenging to afford the increased costs of living plus childcare costs. While I plan to continue in academia, I have noticed that many of my peers have chosen to leave academia for industry positions after graduation because of the higher pay. I think one step toward a solution is the formation of graduate student and post-doctoral unions.

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