First Person is a series of interviews with the first authors of a selection of papers published in Journal of Cell Science, helping early-career researchers promote themselves alongside their papers.

Kara Stark is first author on ‘Precise levels of the Drosophila adaptor protein Dreadlocks maintain the size and stability of germline ring canals’, published in JCS. Kara conducted the research described in this article while an undergraduate research assistant in Dr Lindsay Lewellyn’s lab at Butler University, Indianapolis, IN. She is now a PhD student in the lab of Dr Zhao Zhang at Duke University, Durham, NC, investigating how transposon mobilization interacts with the immune system during development.

How would you explain the main findings of your paper in lay terms?

Support from surrounding cells and tissues is critical for the development of fertile eggs and sperm. In the example of the developing Drosophila egg, the oocyte exists in a syncytium with fifteen supporting nurse cells. The job of these nurse cells is to support the oocyte on its journey to becoming a viable egg by feeding it signals and nutrients through interconnected bridges called ring canals. Ring canals are especially critical towards the end of oogenesis when nurse cell dumping occurs, a process in which the nurse cells empty the entirety of their cytoplasm into the oocyte over a span of 30 minutes. This dramatic cellular process puts tremendous pressure on the ring canals, which require impressive structural stability to facilitate successful nurse cell dumping. Previous studies have shown that errors of nurse cell dumping result in infertility, and these errors can be due to problems with ring canal integrity. Our study investigated the molecular events leading up to nurse cell dumping that bolster ring canal integrity, and thus preserve the fertility of the fly. We found that precise regulation of the adaptor protein Dreadlocks (Dock) is necessary for proper ring canal expansion and stability. Too much or too little Dock expression causes errors in actin accumulation, suggesting that Dock is necessary for the partitioning of actin nucleators between the cytosol and the ring canals. Because Dock is a conserved protein in mammals, we hope our work to uncover its molecular function in Drosophila could further our understanding of the molecular causes of human female infertility.

Were there any specific challenges associated with this project? If so, how did you overcome them?

We faced several challenges during this project, including trying to provide strong evidence for Dock binding partners. We tried to perform an IP-MS to identify Dock binding partners but were unable to obtain definitive results due to off-target interactions. Eventually, we resorted to a candidate-based approach, focusing on proteins that have been reported to interact with Dock in other contexts. While we would have preferred to show an interaction via IP, our candidate approach was sufficient to show a convincing interaction.

When doing the research, did you have a particular result or ‘eureka’ moment that has stuck with you?

When we overexpressed Dock in the female germline, the developing eggs were severely affected, and the flies were infertile. However, when we overexpressed a Dock transgene containing a mutation in the SH2 domain, these deleterious phenotypes were rescued, and the flies produced viable eggs. The SH2 domain is required for Dock to bind to the ring canals; this experiment told us that the deleterious phenotype we observed was contingent on an overabundance of Dock binding specifically to the ring canal. I was very new to research when we made this discovery, and I remember sitting at the microscope stunned, amazed by how a few well-placed amino acid changes could give or take the ability of these flies to produce offspring.

Why did you choose Journal of Cell Science for your paper?

I like that Journal of Cell Science is committed to publishing papers on a broad range of topics within the field of cell biology, as well as fostering a community for cell biology researchers. I also appreciate that JCS takes measures to engage the general public in current science through its Facebook, Twitter and YouTube platforms, making new research accessible to a broad audience. I feel very proud to have my work published here.

Have you had any significant mentors who have helped you beyond supervision in the lab? How was their guidance special?

I had a fantastic high school biology teacher. I specifically remember thinking I was bad at science in middle school because I failed a quiz where we were graded on correctly spelling elements from the period table.
periodic table, so I started high school dreading my science courses. To my surprise, my high school biology teacher was more impressed by creativity than correct spelling; we were not graded on getting ‘the right answer’, but instead on how we interpreted our results based on the background knowledge we learned. My experience in this class changed my view of science from a passive study to an active exploration. The best thing I learned was an excitement for learning that outweighed my fear of being wrong, and this is something that has benefitted me tremendously in my early scientific career.

Who are your role models in science? Why?
My undergraduate mentor, Dr Lindsay Lewellyn, is a huge scientific role model for me. Apart from being a brilliant and accomplished researcher, she is endlessly kind and patient with the undergraduates in her lab. As Butler University does not have any graduate students, she dedicated herself to teaching us everything from experimental design to setting a pipette, all while teaching a heavy undergraduate course load and caring for her family. I admire her organization, selflessness and acceptance of anyone into her lab who has a curiosity for learning.

“The best thing I learned was an excitement for learning that outweighed my fear of being wrong…”

What’s next for you?
Currently, I am a first year PhD student at Duke University, studying stem cell and developmental biology. I would love to stay in academia after I graduate and pass on my enthusiasm for science to others.

Tell us something interesting about yourself that wouldn’t be on your CV
When I’m not in lab, I love to be outside trail running. I love the challenge and community of distance running; it has been a great way to clear my head and get to know the area as a new graduate student.

Reference