JCB Journal of Cell Biology

PEOPLE & IDEAS

Laura Lackner: Passing on the scientific baton

Marie Anne O'Donnell

Lackner investigates the tethering processes that position mitochondria.

Laura Lackner's career in science began with an undergraduate degree in life science chemistry at John Carroll University, University Heights, Ohio. John Carroll is a Jesuit Catholic college that emphasizes values many scientists are quite at home with, such as using analytical and rational approaches to decision making and an openness to change. Staying in Ohio, Lackner joined Piet de Boer's group at Case Western Reserve University in Cleveland, where she studied how dynamic changes in the localization of the Min proteins that control division site selection in *Escherichia coli* are regulated by their interaction with membrane phospholipids (1). For her postdoc, Lackner moved from studying bacteria to investigating their eukaryotic symbiotic counterparts—the mitochondria—with current *JCB* editor-in-chief Jodi Nunnari at the University of California, Davis. Here, her research focused on understanding how the dynamin-related proteins that control mitochondrial fission drive changes to the mitochondrial membrane required for membrane scission (2). After initially focusing on understanding the mechanisms of mitochondrial division, Lackner became more interested in the molecular processes governing mitochondrial positioning. Using cells that have static mitochondria resulting from inhibition of mitochondrial division and fusion, Lackner identified the Num1 protein as a key requirement for positioning the mitochondrial network in dividing yeast (3). Num1 turned out to be a component of a novel tethering complex that Lackner termed the MECA for "mitochondria–ER–cortex anchor." Lackner recently set up her research group at Northwestern University in Illinois to continue exploring the tethering mechanisms that position mitochondria within the cell.

We contacted Lackner to find out more.

When did your interest in science begin?

I grew up in Eastlake, OH, which is a Cleveland suburb. As far back as I can remember, I have always had a fascination with nature. As a child, I loved the outdoors and all of the creatures that lived within it. My mother remembers that I would always be picking up and inspecting insects, spiders, and toads. I would go out after a rain and save all of the earthworms that found themselves stuck on the sidewalk before they were baked in the sun. My first true experience with science that I can vividly remember was asking for a microscope for my 10th birthday. With the microscope came a kit for making a slide of onion skin. Looking at that slide through my brand new microscope was the first time I saw a cell. I did not think for a moment at the time that I would be visualizing cells as a career. I was very excited by what I saw and wanted to share that excitement with my family. Luckily the microscope came with an attachment that could project images on the wall. Thinking back on that time, I realize how supportive my parents were. My parents are not scientists and do not share the same scientific curiosity I have, but they encouraged me to find more specimens to visualize with my microscope and display each and every one on the wall for the entire family to see.

"Mitochondria are not bean-shaped structures chilling in the cytoplasm but instead form beautiful, dynamic, tubular networks."

What first drew you to study mitochondria?

I became fascinated with the mitochondrial structure the first time I saw the mitochondrial network of a yeast cell. I was in graduate school at the time and shocked that I had made it so far in my education without knowing that mitochondria are not

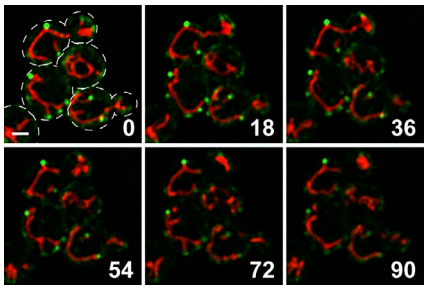
Laura Lackner. IMAGE CREDIT: SADIE WIGNALL.

bean-shaped structures chilling in the cytoplasm but instead form beautiful, dynamic, tubular networks. I wanted to understand how and why these beautiful structures are maintained. I got to pursue these fascinating questions in Jodi Nunnari's laboratory where I initially focused on mitochondrial division. As time progressed, I became not only interested in the dynamics of the mitochondrial network but also in how mitochondria are maintained at specific cellular locations. There is a lot of attention paid to the dynamics of the mitochondrial network but far less to understanding the mechanisms that anchor the organelle.

What are you currently working on? What is up next for you?

My laboratory is currently focused on understanding mechanisms that anchor mitochondria to specific cellular sites. We are working to identify the proteins that anchor mitochondria and understand how these

modonnell@rockefeller.edu.



Mitochondrial anchoring in yeast. A time-lapse series depicting MECA (green) anchoring mitochondria (red) to the cell cortex. Time is shown in minutes. IMAGE CREDIT: LAUREN KRAFT AND LAURA LACKNER.

proteins are regulated to properly position mitochondria to meet cellular needs (4, 5). Excitingly, we are beginning to understand that mitochondrial anchors do more than just position mitochondria. For example, we have found that an anchor that tethers mitochondria to the plasma membrane, called MECA, also functions to anchor dynein to the cell cortex and that its role in dynein anchoring requires mitochondria (5). The consensus in the laboratory is that sites of mitochondrial anchoring will serve as hubs to integrate a variety of critical cellular functions and we are actively pursuing that idea.

What kind of approach do you bring to your work?

I have always been very driven by the question and not the technique. Because of that, I was drawn to laboratories that used a wide variety of experimental approaches and continue to use a range of techniques to answer the questions I find exciting.

What did you learn during your training that prepared you for being a group leader?

I had fantastic mentors during my PhD and postdoc and really learned the importance of active mentorship. I consider myself extremely fortunate to be a member of both the de Boer and Nunnari families. I choose the word families with purpose. Both Piet and Jodi create atmospheres in their laboratories that are caring, compassionate, and supportive, all while being scientifically rigorous. That is something I have worked very hard to reproduce in my own laboratory.

I was most unprepared for the difference in how my days are now spent. During my graduate and postdoctoral work, so much of my time was spent at the bench designing, executing, and analyzing experiments. It took time to adjust to the fact that I no longer have multiple days a week that are wide open. While I still try to get to the bench as much as possible, I have to adapt the type of experiments I do to the time I have available. I enjoy all aspects of my job—mentoring, teaching, performing experiments, writing, traveling to meetings, and so on. But it did take time to figure out how to balance everything effectively.

What has been the biggest accomplishment in your career so far?

I am very proud of the body of scientific work I have produced over the course of my career but I am truly most proud of my students. I have been fortunate to recruit a group of very talented, passionate, young scientists who trusted my ability to train and mentor them before I established a track record of doing so. Although my laboratory is still fairly young, I have had the pleasure of watching my students grow to become independent scientists. My students have provided me with many proud laboratory mom moments.

"It is always better to know because knowing then allows you to view your results and the underlying biology in a new light."

What has been the biggest challenge in your career so far?

When I take a student into my laboratory, I am making a commitment that I will be the mentor they need during the course of their graduate career. My success or failure as a mentor will influence their future and career path. That is a responsibility I have not had previously, has taken some time to adjust to, and sometimes keeps me awake at night as it is one I take very seriously.

The Lackner Lab in September 2017. IMAGE CREDIT: JENNI BRACE.

What is the best advice you have been given?

"It is always better to know." That is something I have heard Jodi say to me and many others when an experiment does not turn out the way one had predicted. Often times, we feel disappointed when we get a result that disproves our working model. But it is true that it is always better to know because knowing allows you to view your results and the underlying biology in a new light.

What hobbies do you have?

I am an avid runner. I ran throughout middle and high school and got back into the sport during my postdoc when two of my fellow postdocs introduced me to the joys of running a half marathon. After running several half marathons, I made the jump to the full marathon and loved it. I recently completed my fourth marathon and have plans to continue running at least one every year for the foreseeable future. Running serves many purposes for me. It gets me outdoors year-round, which I love. It is a wonderful form of exercise, stress relief, and meditation. When I travel, running is a great way to explore a city and can be done anywhere I go. It is also an excellent way to meet fantastic people. One of the difficult things about moving from one stage of my career to the next has been leaving the wonderful network of friends and chosen family I created in each place and establishing a new and equally wonderful network in my new hometown. To help with the transition when I moved to Evanston, I joined the Evanston Running Club. Through the club, I met a wonderful group of people that share the same enthusiasm for running, the outdoors, and life as I do, and one of those people is now my husband.

Any tips for a successful research career?

Do not do research in a vacuum. In addition to hard work at the bench, success in science involves interactions and discussions with the greater scientific community.

1. Lackner, L.L., et al. 2003. *J. Bacteriol.* 185:735–749.
2. Lackner, L.L., et al. 2009. *Science.* 325:874–877. https://doi.org/10.1126/science.1176921
3. Lackner, L.L., et al. 2013. *Proc. Natl. Acad. Sci. USA.* 110:E458–E467. https://doi.org/10.1073/pnas.1215232110
4. Ping, H.A., et al. 2016. *J. Cell Biol.* 213:513–524. https://doi.org/10.1083/jcb.201511021
5. Kraft, L.M., et al. 2017. *J. Cell Biol.* 216:3061–3071. https://doi.org/10.1083/jcb.201702022