First Person – Rodolpho Ornitz Oliveira Souza

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

Inside our cells, we have tiny structures called organelles, and these small things are in contact with each other. Using these contacts, the organelles can transfer things, such as metabolites. Understanding the structure and function of these contacts is important, as their disruption can lead to dysfunction and disease. In unicellular organisms, such as protozoan parasites, we can also observe these contacts between organelles. Toxoplasma gondii, the parasite that causes toxoplasmosis, has just one mitochondrion, an organelle responsible for generating energy. The Toxoplasma mitochondrion is very dynamic, changing its shape and positioning depending on the environment where the parasite is. This peculiar mitochondrion is the target of some drugs to treat toxoplasmosis, so understanding its dynamic can give us more clues on how to treat this disease in the future. In this work, we are showing that Toxoplasma’s mitochondrion forms a contact site with the cell periphery using two proteins – LMF1, located in the mitochondrion, and IMC10, at a particular structure called the pellicle. We are showing for the first time that these proteins form a tethering complex that mediates mitochondrial morphology and positioning when the parasites are inside our cells. When we remove IMC10, it is possible to observe changes in mitochondrial morphology, division defects and accumulation of mitochondrial material outside of the parasite. We have uncovered the importance of the formation of mitochondrion–pellicle contact site in Toxoplasma’s mitochondrial division.

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

Confirming the efficiency of the IMC10 knockdown was challenging. In this work, we replaced the original promoter with a tetracycline-inducible one to decrease the transcription levels of our gene of interest. We could see the decrease in the mRNA, but we needed to confirm disruption at the protein level. We were trying to either make a knockout or add a C-terminal tag in our IMC10-inducible knockdown cell line, which was quite tricky. Luckily, during a conference, I met Peter Back, one of the co-authors on this paper, and his lab had an IMC10-specific antibody, which they were generous to share with us. Despite all the challenges in terms of genetic manipulations and establishing the cell lines that I needed, I believe the biggest challenge for me was learning how to work in cell biology: how delicate coverslips are, how an image can give you ten different answers and questions at the same time, and how fascinating microscopy can be. I had a mind entirely focused on metabolic pathways and enzymes during my PhD, so changing from metabolism to cell biology was challenging but also delightful.

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

The use of ultrastructure expansion microscopy (U-ExM) has brought me several ‘eureka’ moments. In the latter part of the work, we show with U-ExM that the LMF1–IMC10 tether is formed right when the mitochondrion enters the daughter cells, which explains why we see parasites lacking a mitochondrion in our knockdown cell lines, for example. That image was in my mind for a couple of days, leading to my new projects in the lab in trying to understand the machinery behind mitochondrial inheritance in this parasite.

Why did you choose Journal of Cell Science for your paper?
Journal of Cell Science is a traditional journal with a broad audience that has always been receptive to research on non-opisthokont organisms.

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

I had several good influences in my academic career, including many brilliant colleagues and co-workers. Dr Gustavo Arrizabalaga is my postdoctoral supervisor, and he’s a brilliant mentor. He is always open to my opinions and ideas, caring about the whole lab and our futures. Dr Ariel Silber (University of São Paulo), my PhD supervisor, always gave me the freedom to work on my ideas and taught me how important collaborating and sharing are in science. In both labs, I’ve always felt like part of a team. Last but not least, Dr Flávia Damasceno, the person who brought me to the molecular parasitology world, shared her passion for research and travels, and taught me how to work with cell culture. I value the people who shared their knowledge and laughs with me during my days in the lab.

What motivated you to pursue a career in science, and what have been the most interesting moments on the path that led you to where you are now?

Honestly, before my undergraduate studies, I’d never seen myself as a scientist. I always enjoyed reading and learning new things but being a first-generation college student in a small city in Brazil, science was too far away from my thoughts. I was sure I wanted to be a schoolteacher (chemistry), but biology was my hometown’s only available option. Since I started studying it, biology has brought me to a world I would never imagine, and I don’t regret it. For sure, several incredible scientists, teachers and professors I’ve met inspired me to pursue a career in science.

Who are your role models in science? Why?

My role models in science are BIPOC scientists and Diversity, Inclusion, Equity, and Justice (DEIJ) advocates for both making great scientific discoveries and bringing very important discussions to academia.

What’s next for you?

For now, I will focus on some other projects, but I have wanted to become a professor since day one in my undergrad. I like teaching and research, so if I can find a position in an institution where I can have both activities, that will be perfect. I’m still not sure if I will be going back to Brazil or staying abroad in the future, but I’m open to all possibilities.

Tell us something interesting about yourself that wouldn’t be on your CV

I love beer, wine and having a good time with friends. I am also addicted to movies, so the closest movie theatre is a likely spot to find me in.

Reference