© 2021. Published by The Company of Biologists Ltd | Journal of Cell Science (2021) 134, jcs258531. doi:10.1242/jcs.258531

First person – Juan Flores and Peter M. Takvorian

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. Juan Flores and Peter M. Takvorian are co-first authors on 'Human microsporidian pathogen *Encephalitozoon intestinalis* impinges on enterocyte membrane trafficking and signaling', published in JCS. Juan is a PhD student in the lab of Nan Gao, at Newark, New Jersey, USA, investigating the role of the underappreciated intestinal microbiome and pathogens by profiling their metabolic and transcriptional impacts on host cells. Peter is a Visiting Research Associate Professor (Rutgers) and Visiting Assistant Professor of Pathology (Albert Einstein College of Medicine) in the lab of Ann Cali (Rutgers, Newark, USA) and Louis M. Weiss (Albert Einstein College of Medicine, New York, USA) investigating ultrastructural studies of the host cell interaction and pathological effects of intracellular parasites and viruses.

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

J.F.: Microsporidia are a group of unicellular spore-forming parasites, and *Encephalitozoon intestinalis* is a microsporidian that mainly infects the gastrointestinal tract of humans. Normally, it does not affect healthy human adults, but, in immunocompromised individuals, they can cause serious health complications. The current treatments for microsporidian infections are limited and not specifically targeted. Our work sheds light on how the parasite interfaces with host cellular machinery and propagates inside the infected cells. Our work indicates that some of the most dramatic changes include cellular energy production and membrane trafficking. Treatments in the future can potentially use this information to produce more mechanistically based and targeted therapeutics.

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

J.F.: Studies on microsporidia are limited and *E. intestinalis* has been known to be one of the more difficult species to propagate. Earlier studies used rabbit RK-13 cells because they are known to be a suitable host for most of the microsporidian species. We thought that growing them in the human colonic epithelial Caco2 cell line would facilitate a mechanistic understanding of this pathogen, as human enterocytes are its primary target for infection. After multiple optimization of cell seeding and infecting conditions, we were able to identify an optimal procedure to recapitulate the *in vivo* life cycle of *E. intestinalis* in this cell line.

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

J.F.: The first moment was when I observed robust infection through immunostaining of a spore protein, and the second exciting moment was when Peter (the co-first author) showed me beautiful transmission electron microscopic images of the *E. intestinalis* inside Caco2 cells.

Juan Flores

P.T.: Although I have been studying Microsporidia ultrastructure and cell pathology for over 40 years, I was surprised at how effectively this species modified the host cell nucleus shape and recruited the host mitochondria for the parasite's energy needs. Additionally, the ability to correlate host cell signaling changes with the ultrastructure was a major improvement in how we study these parasites.

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

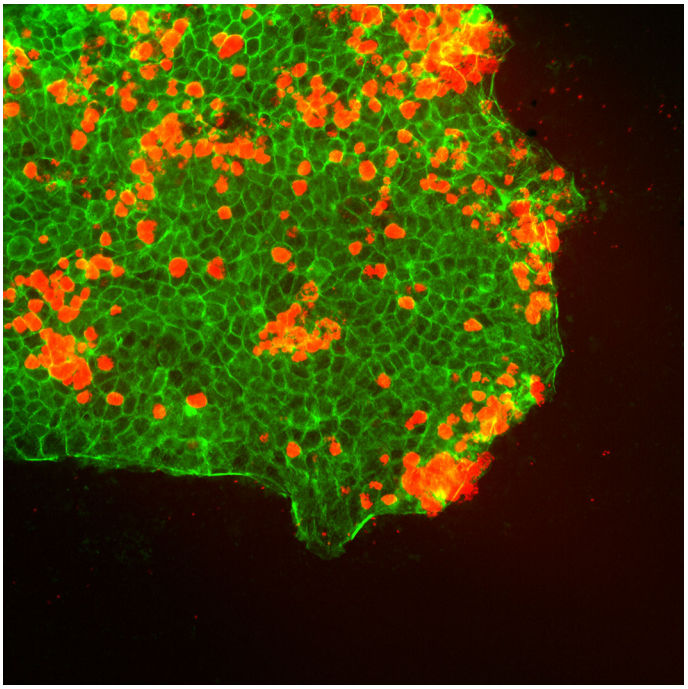
J.F.: Our lab focuses on microbiome interactions between the host intestinal epithelial cells and microbiota, and we had a very delightful experience interacting with JCS editorial team in the past. We noticed JCS was calling for articles on host–pathogen interactions. My work that was ongoing with *E. intestinalis* fit perfectly with this request, as it highlights how this human pathogen interfaces with enterocyte machinery. This special issue will provide a platform for *E. intestinalis* to reach cell biologists and microbiologists as a relatively underappreciated gut pathogen.

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

J.F.: Dr Ann Cali is a prominent figure in the microsporidian world. She and her research assistant Dr Peter Takvorian helped me

Juan Flores's contact details: 195 University Avenue, Boyden Hall Suite 206, Newark, NJ 07102, USA.
Peter M. Takvorian's contact details: Department of Biological Sciences, Rutgers University, 195 University Ave., Newark, NJ 07102, USA. Division of Parasitology and Tropical Medicine, Albert Einstein College of Medicine, 1300 Morris Park Avenue, Room 504 Forchheimer Building Bronx, New York, 10461, USA.
E-mail: jaflores@newark.rutgers.edu; petetak@newark.rutgers.edu

Journal of Cell Science (2021) 134, jcs258531. doi:10.1242/jcs.258531



This image highlights *Encephalitozoon intestinalis* (red) infection in Caco2 (cell periphery highlighted by phalloidin staining in green) culture.

understand all the complexities of this relatively unknown parasite. They were very patient with answering all the questions I had concerning the organism. Another person I would like to mention is Dr Edward Bonder, a professor in our department who attends our weekly lab meetings. He helps me and others in our lab to critically think about our work and give us an outsider's perspective. Today's high-throughput techniques have enabled us to work with massive amounts of information. Dr Bonder has always helped us stay grounded by putting our large-scale data in a biological and cellular context.

P.T.: While a junior in college, my cell biology professor Dr Sasha Koulish asked me if I was interested in learning electron microscopy as a special projects course. He taught me the fundamentals of dissection, fixation, sectioning and use of the electron microscope. I continued the course during my senior year which allowed me to enhance my skills and led to my career. Dr Koulish also encouraged me to continue my education. My second mentor, and now colleague, Dr Ann Cali, was my PhD mentor and the person who introduced me to the Microsporidia, the most interesting organisms I have ever studied.

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?

J.F.: My parents are immigrants in this country and they always reminded us to take advantage of the educational opportunities they never had. I think this and my passion for learning drove me to explore the sciences. Biology was one of my first real exposures to the sciences, when I took a course geared to elementary school students at a local university. Honestly, I was completely lost at the beginning of course but I remember that as I read more about the material, I had more and more questions, and it has never stopped since.

P.T.: My mother, Rose Takvorian, always encouraged my curiosity about how things worked, nature and my love of reading. She always showed me science-related pictures in magazines, such as dinosaurs, fish and cells/microscopes. My parents bought me a small microscope when I was 8 or 10, and I probably looked at every leaf, flower, insect, and drop of water I could find in our yard. In addition, I had fish, turtles and even a small alligator as pets. This early interest in nature continued through high school and college. My first professional position as an electron microscopist was to design timed experiments to study the development and release of Cytomegalic Virus and provide the ultrastructural images of the process. I was amazed at how much virus was produced and the damage it did to the cells. This motivated me to focus my career on pathogens.

Who are your role models in science? Why?

J.F.: Hans Clever's work is a big influence in our field. His work made possible all the discoveries in the intestinal stem cell/regeneration field. He's made a big impact on my ideas for what is possible in the lab.

P.T.: Dr Jonas Salk. I was a 5- or 6-year-old child during the great Polio outbreaks of the 1950s, and one of my friends, Judy, a 5-year-old girl, was infected and had to walk with braces and crutches. Eventually, the infection caused her to be permanently disabled. At that time, I never understood why the doctors couldn't make her well. When the Salk vaccine was subsequentially produced, the nation was finally freed from this disease, but I always thought about Judy. In 2015, I finally had the opportunity to study the Polio virus and contribute my expertise to help us understand a small aspect of the virus that overshadowed my childhood.

What's next for you?

J.F.: I am currently working on another microorganism that is a resident gut commensal bacterium both in humans and mice. The experiments I am working on are challenging but the results are exciting.

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

J.F.: I really enjoy learning about subjects outside of biology and science. I listen daily to wide range of material from university lectures about human language, art, history, etc. This passion for learning has even motivated me to independently build my first PC during the pandemic. I find learning about things outside your comfort zone gives you the skills needed to handle challenges in the lab and beyond.

P.T.: I love boating and fishing. I have a 1966 wooden speed boat and have restored a 1931 wooden speed boat with an old Ford Model A engine.

Reference

Flores, J., Takvorian, P. M., Weiss, L. M., Cali, A. and Gao, N. (2021). Human microsporidian pathogen *Encephalitozoon intestinalis* impinges on enterocyte membrane trafficking and signaling. *J. Cell Sci.* **134**, jcs253757. doi:10.1242/jcs.253757