THE Physiologist MAGAZINE

JANUARY 2022

MASTERY IN A MICRO WORLD

Renal physiologist Pablo Ortiz, PhD, is obsessed with studying the molecular mechanism of salt-sensitive hypertension.

APPLY FOR SOCIETY AWARDS

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The American Physiological Society (APS) provides more than $1 million in awards and fellowships each year as part of our mission to encourage excellence in physiological research and education. These awards are a vital investment in our researchers and educators of all career levels.

View all available awards and apply for our highlighted awards by the deadlines below at **physiology.org/awards**.

January **10**

ADInstruments Macknight Innovative Educator Award

$1,500 honorarium. Honors early- to mid-career member who incorporates innovative teaching techniques and utilizes technology resources in student engagement in physiology education.

January **15**

Porter Physiology Development Fellowship

$28,300 stipend. Honors students of diverse backgrounds interested in pursuing full-time studies toward a PhD in the physiological sciences.

January **24**

Graduate Student Ambassador Fellowship

A two-year program awarded annually to five graduate students enrolled in a doctoral program. Students serve as liasons between their local community and APS by demonstrating the importance of involvement in professional societies.

February **1**

Summer Undergraduate Research Fellowship

$4,000 stipend. Provides students with the opportunity to participate in hands-on research in the laboratory of an established researcher and APS member for 10 weeks.

CONTENTS

FEATURES

Cover photo: Matthew LaVere

CONTENTS

DEPARTMENTS

16

14

40

12

Find Job Candidates Within Your APS Network

Access the full power of your American Physiological Society (APS) membership. Recruit those passionate about the field of physiology by promoting job listings at your university or institution via our members-only job site. Posts are free and unlimited for Society members.

Log in and access the Members-only Job Listing at **physiology.org/memberjobpost**.

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A New Inside Look

BY STACY BROOKS

Dear reader:

Welcome to 2022 and the January issue of *The Physiologist Magazine*! We're excited to kick off a new year delving into the interesting, unexpected and cutting-edge stories of the physiology community, both about your research and about you as individuals.

This year, you'll notice several changes, including the addition of this Editor's Desk column, which is intended to give you an inside look at the feature articles and highlighted topics in each issue.

We'll soon be introducing a new column called "Evolution" by APS Executive Director Scott Steen, CAE, FASAE. He will share his thought-provoking conversations with physiologists who are making a difference in their own communities and the world at large.

We'll soon be introducing a new column called "Evolution" by APS Executive Director Scott Steen, where he will share his thought-provoking conversations with physiologists.

OUR FEATURES

In every issue of *The Physiologist Magazine (TPM)*, we aim to include at least one feature article that digs into the science of a particular area of study. This issue, it's cannabis. We have been fascinated by the variation in cannabis laws from state to state, the speed with which marijuana use has become more accepted and legal, and the growing use of CBD products. But despite what you might see in your local communities, using, possessing and selling marijuana is still illegal under federal law.

On page 24, one of our go-to science journalists, Dara Chadwick, dives into current physiological research on marijuana in the article "The Curious Case of Cannabis." She spoke with researchers in the U.S. and Canada who are exploring new biomedical uses for the plant. We also include a sidebar on the complex regulations and Schedule 1 classification that complicate additional study of cannabis and the newly announced changes that could help scientists gain easier access to the plant for research purposes.

Our second feature article shines a light on #PostdocLife. APS members often tell us about the myriad challenges they face during the transitional postdoctoral period. After years of hard work, study and schooling, they enter a demanding stage that can have huge implications on the direction and trajectory of their career. Then, enter the pandemic. Training was upended. Labs were shuttered. Animal colonies were lost. Years of research was halted.

On page 30, education writer Glenn Cook tells the stories of several postdocs and what some people are doing to improve the postdoc experience for up-and-coming researchers (hint: talk of unions and higher salaries).

Finally, we have an in-depth conversation with our cover scientist, renal physiologist Pablo Ortiz, PhD. In his wide-ranging interview on page 18 with *TPM* Managing Editor Melanie Padgett Powers, Ortiz shared how he fell into renal physiology, how a serendipitous job ad set him on a path to the U.S. from his native Argentina, and the meticulous study it took for him to master the technique of tubule perfusion—a very specific skill that only a few dozen people in the world have mastered in the lab.

And there's so much more inside. I hope you enjoy this issue!

TELL US WHAT YOU THINK

Remember that without you, there is no *TPM*. I invite you to email us at tphysmag@physiology.org to share your feedback, suggestions and story ideas. I look forward to hearing from you.

Stacy Brooks is the editor-in-chief of *The Physiologist Magazine* and APS director of marketing and communications.

APS Career Gateway

Succeed at Every Step of Your Physiology Career

Now live! The American Physiological Society (APS) has launched Career Gateway—a new member resource to enhance your professional skill set. Find streamlined access to critical leadership and career advancement content designed to round out your scientific expertise. Resources include tips on:

- leading and managing a team,
- funding and communicating your science,
- intentionally designing your career,
- teaching and mentoring today's students, and
- maintaining scientific integrity.

APS provides professional development for every step of your career journey. Access the Gateway and start moving forward.

Access these critical resources at
physiology.org/careergateway

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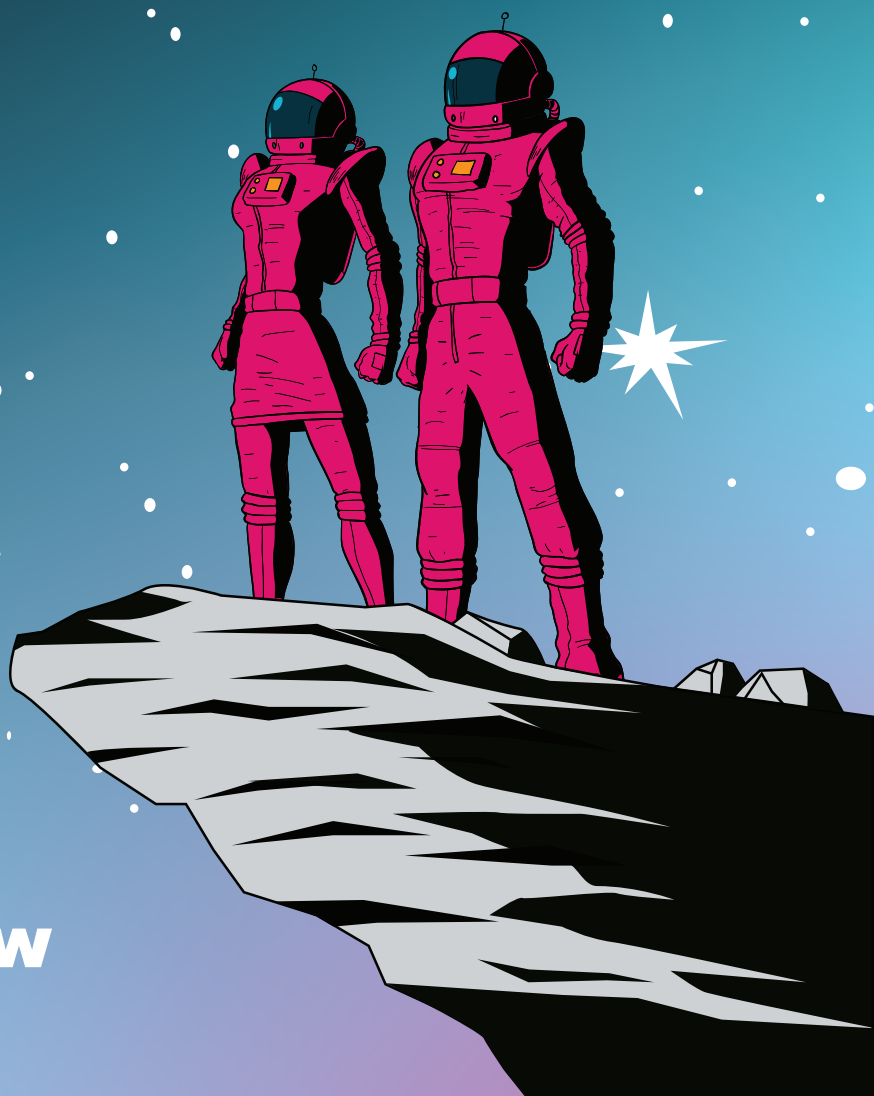

physiology.org/renew

Two APS virtual conferences last fall had strong showings and generated buzz on Twitter. Enjoy these highlights from the 17th International Conference on Endothelin (ET-17) and the New Trends in Sex and Gender Medicine conference.

Share your story with us and it may appear in the next issue of *The Physiologist Magazine*. Email your thoughts—and links to your tweets and posts—to tphysmag@physiology.org.

Alex Juffre
@Alex_Juffre

I have my first ever conference talk tomorrow at @endothelin17!! 🥳🎉 Super exciting @MLGumz @hannahmcostello @DoumaPhD.

6:00 PM · Oct 3, 2021

Dr. Kelly Hyndman
@DrKeeksPhD

#ET17 was a huge success and thanks to @MLGumz and @APSPhysiology for helping make this virtual conference engaging all while we heard the latest research related to Endothelin. This field is full of vibrant and talented scientists and clinicians!!!! 💕

7:42 AM · Oct 7, 2021

Lauren Biwer, PhD
@drlaurenbiwer

Great presentations by @DasingerJh and @VincentRK at the #SexGender21 meeting! I'm still an #AcademicTwitter newbie so it's nice to hear perspectives about how to learn/share science on Twitter and promote yourself. (Thanks to @TMHalePhD and @mgood695 for making me join Twitter!)

1:42 PM · Oct 19, 2021

Dr. Michelle Gumz
@MLGumz

Happening now! @BeckerPhD presenting on his lab's work with renal denervation in Endothelin B receptor-deficient rats #ET17.

11:22 AM · Oct 5, 2021

Dr. Kristen Zuloaga
@Zuloaga_Lab

Frantically trying to toggle back and forth between 2 exciting overlapping conferences—so much great science crammed into 1 week! 💫 @APSPhysiology #SexGender21 and @alzassociation #APOEImmunity21

10:48 AM · Oct 20, 2021

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Read the comparative physiology blog

Life Lines

by

Dr. Dolittle

SPONSORED BY AMERICAN PHYSIOLOGICAL SOCIETY

lifelinesblog.com

Interested in contributing?
Email communications@physiology.org.

Dianna H. Nguyen
@DiannaHNguyen1

Time flies when you're having fun! Can't believe today is the last day of #SexGender21! First time at this conference, and I've been blown away by all the amazing sessions. Thank you to @APSPhysiology for this opportunity to learn from and connect with incredible scientists! ❤️

8:50 AM · Oct 22, 2021

Olivia Gannon
@OliviaGannon2

Such a cool talk by Dr. Jaffe at the APS conference today! Sex differences in mineralocorticoid receptors in endothelial cells 😍😍😍 #SexGender21 @IrisJaffeLab @APSPhysiology

11:53 AM · Oct 20, 2021

Licy Yanes Cardozo
@LicyYanes

Thanks @MilaNBecker (Endo Society) and Rebecca Osthus (APS) for a phenomenal session this morning. I found my voice when I joined this Society. Use your voice for the good fight. #SexGender21 @APSPhysiology #research

5:52 PM · Oct 20, 2021

Stella Goulopoulou, PhD
@SGoulopoulou

Excited to talk about our work in #preeclampsia at @APSPhysiology New Trends in Sex and Gender Medicine #SexGender21. Cheers to @Spencer_Cushen @DrJLBradshaw @contessa_ricci and my amazing collaborator Nicole Phillips for their hard work.

1:31 PM · Oct 22, 2021

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GRADUATE PHYSIOLOGY & BIOMEDICAL SCIENCE CATALOG

The American Physiological Society (APS) is pleased to announce our new **Graduate Physiology and Biomedical Science Program Catalog**. The catalog is a resource for your students and mentees as they contemplate graduate school and the next step in their education and careers.

This online directory provides undergraduate biology and life science students and early-career physiologists with graduate program profiles that facilitate their search for the ideal institution. We encourage you to share this catalog with your undergraduate and postbaccalaureate students to help grow the next generation of physiologists.

Check out the catalog today at physiology.org/GraduatePhysiology.

Interested in listing your program?

Contact **Jacob White** for more information.

Jacob White
APS Development & Strategic Partnerships Manager
jwhite@physiology.org
301.634.7991

LAB NOTES

STATS & FACTS

42%

The portion of surveyed institutions that created a postdoc office in the past 10 years.

National Postdoctoral Association Institutional Policy Survey

RESEARCH FIZZ

Reinforcing rigor and reproducibility expectations for use of sex and gender in cardiovascular research

This editorial provides an update on the reporting and use of sex and gender in studies published by the *American Journal of Physiology-Heart and Circulatory Physiology*.

***American Journal of Physiology-Heart and Circulatory Physiology*, November 2021**

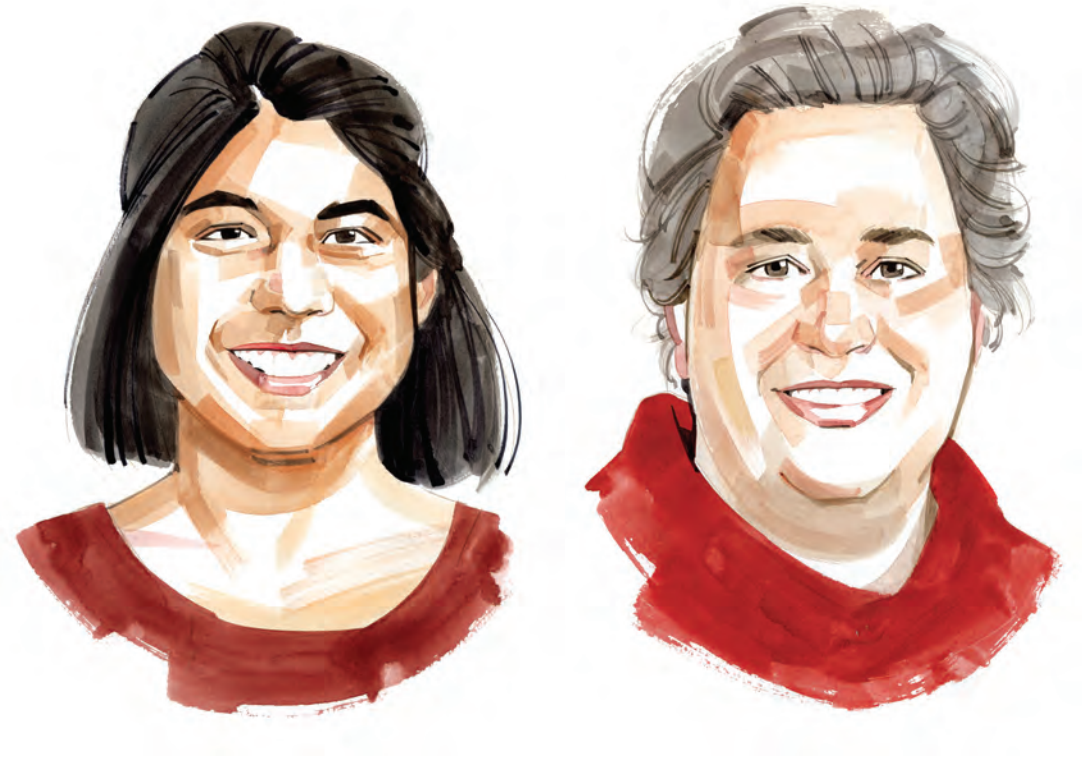
https://doi.org/10.1152/ajpheart.00418.2021

STATS & FACTS

>145 million

The number of people living in states that have legalized marijuana.

U.S. News and World Report



MENTORING Q&A | EXPANDING YOUR NETWORK

Conference Connections

How to make the most out of virtual and in-person meetings.

Each issue, we ask a trainee member to pose their career questions to an established investigator and mentor. Here, Michelle Herrera, APS 2020–2021 Porter Fellow and PhD candidate at the University of California, Irvine, asks Lynn Hartzler, PhD, associate professor at Wright State University in Dayton, Ohio, about building a network early in your career.

Q: How can we maintain connections we made during conferences or meetings and continue to expand our network?
A: Search functions on meeting websites have certainly made making and maintaining those con-

Illustrations by Kagan McLeod

nections at conferences a lot easier. As I prepare my meeting schedule, I make a list of people I want to meet. For some, it's a matter of making sure I have their talk or poster on my schedule, but for others, I'll email ahead and see if we can find a few minutes to chat during the conference.

of Comparative Physiology and Biochemistry in Mount Buller, Australia. After his session, I approached him and introduced myself with an explanation of why I wanted to meet him, asked him to come see my poster and discussed why I was interested in working in his lab.

"An often-overlooked way to expand your network is to become acquainted with retired scientists. They have a lifetime of experiences to share, plus large networks, including their own trainees to whom they can get you connected."

However the connection is made, I like to follow up with email later. Sometimes it is as simple as a "nice to see you (again)," and sometimes it is more involved, such as following up with a link to a paper or some ideas for experiments.

The keys seem to be context and intent. For example, I start my communication with a brief reminder of when and where we met and what I appreciated about the connection we made. Then, I like to be clear on why I want to maintain the connection. Maybe it's to visit their lab to learn a technique, to establish a collaboration, or just to be on their radar as a scientist in my field who may someday review my grant proposals or manuscripts.

As an example, I met my postdoctoral adviser at the International Congress

Two years later, I finished my PhD and began working on a postdoctoral fellowship with him. I point out the two years because establishing relationships (and funding grants) takes time, so it's important to be thinking and planning years in advance. Having multiple networks helps give options.

An often-overlooked way to expand your network is to become acquainted with retired scientists. They have a lifetime of experiences to share, plus large networks, including their own trainees to whom they can get you connected. What I have found especially wonderful about retired scientists is that many have the time to spend with you in conversation and a great interest in new ideas. They can take a long view on a research topic and provide insights into why we know what we know or why a particular question has remained elusive.

Q: Do you have tips on motivating yourself to write during that phase of your research?
A: The approach I have found most helpful is to have some kind of accountability established. For one project, I had a writing partner at a neighboring university with whom I connected once a week to discuss our writing accomplishments from the past week and our writing plans for the next. When I was an assistant professor, I was fortunate to have my department chair be in the same field as me. He read all of my grant proposals and drafts of manuscripts and provided a strong motivation because I had told him I would get him drafts by a given date. Now, it is my students who provide accountability to me as the next steps in their careers depend on our mutual manuscript preparations. The networks I discussed above are ideal for providing some writing accountability. If you are lucky enough to be self-motivated, that is a fantastic advantage. But figuring out what motivates you is a crucial step.

Got a career question you'd like to submit? Email it to tphysmag@physiology.org. We may use it in an upcoming Mentoring Q&A.

STATS & FACTS

18

The number of states that have legalized marijuana for recreational use as of October 2021.

U.S. News and World Report

RESEARCH FIZZ

CD38 in the age of COVID-19: a medical perspective

This review addresses how using CD38-targeted therapies may be a new and viable treatment option for severe cases of COVID-19.

***Physiological Reviews*, October 2021**

https://doi.org/10.1152/physrev.00046.2020

STATS & FACTS

57%

The portion of postdocs in the U.S. who are international visa holders.

National Postdoctoral Association Institutional Policy Survey

Right: iStockphoto

RESEARCH FIZZ

Interaction of exercise bioenergetics with pacing behavior predicts track distance running performance

This study examines the relationship between pacing, speed and bioenergetics in distance runners.

Journal of Applied Physiology, October 2021

https://doi.org/10.1152/japplphysiol.00223.2021

STATS & FACTS

46%

The portion of adults in the U.S. who report ever having used marijuana.

Pew Research Center

RESEARCH FIZZ

Regulation of cerebral blood flow in humans: physiology and clinical implications of autoregulation

This review explores autoregulation in aging and with conditions such as hypertension, stroke and cognitive impairment. The reviewers also discuss autoregulation in the context of common daily activities, including changes in posture and exercise.

Physiological Reviews, October 2021

https://doi.org/10.1152/physrev.00022.2020

POLICY IQ | FINDING FUNDING

Funding Opportunities Available for Early-career Investigators

Making the leap from trainee to investigator is a daunting task. Federal agencies such as the National Institutes of Health (NIH) and the National Science Foundation (NSF) have programs in place to help researchers make the transition and secure independent funding.

NIH

Early-career researchers applying to NIH for independent research funding can take advantage of early-stage investigator (ESI) status. NIH defines ESIs as principal investigators (PIs) who are within 10 years of completing their terminal degree or postgraduate clinical training and who have not received a substantial independent research award from NIH. Meritorious applications from ESIs are prioritized for funding by the institute or center receiving the application.

ESI status can be extended upon request for lapses in research due to family care responsibilities, natural disasters, medical concerns or disability. Of note, delays and lapses in research due to the coronavirus pandemic may also qualify for extension of ESI status; NIH recently clarified guidance about how requests for multiple extensions are considered. See the NIH policies and FAQ for more information at **https://bit.ly/NIHESIGrants**.

NSF

In contrast to the defined time period for ESI status at NIH, NSF generally defines an early-career researcher as someone who holds the rank of assistant professor or the equivalent. Career stage is certified by the applicant's institution, instead of the funding agency. Early-career researchers are eligible and encouraged to apply for NSF core grants, but they are also eligible for a number of other programs, including the Faculty Early Career Development Program, known as CAREER.

For more information on grant mechanisms appropriate for new and early-career investigators, visit **https://bit.ly/NSFECFunding**.

Top left and bottom: iStockphoto

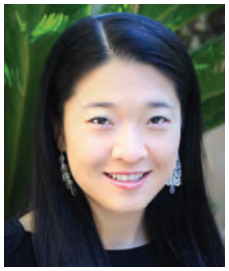
POLICY IQ | RESEARCH ADVOCACY

Lack of Research Grants Inspired Me to Fight for Federal Funding

BY EILEEN CHANG, PHD

As early as my undergraduate days working as a research assistant, I learned that a critical part of being successful in academia is competing for funding from federal agencies and private institutions. If there is no funding, there is no research progress.

As a principal investigator, you are not only responsible for purchasing equipment and supplies, but also responsible for the salaries of everyone who works in your lab. This message became even more clear as I went through graduate school and experienced firsthand how competitive the federal funding environment was and still is. But was there something I could do? I was only one person. What could I possibly do to help increase federal government funding for research?



As a postdoctoral fellow, getting funding from federal agencies is a big challenge. PhD graduates applying for support from the National Institutes of Health face a lack of sufficient training grant options when seeking transition to independence. Moreover, the risk of the shrinking government budget for research is real. This inspired me to take action. Instead of just being a bystander, I started to explore my options for advocacy. My interest in science policy and advocacy led me to apply for a position on the APS Science Policy Committee (**www.physiology.org/SciencePolicyComm**).

I was fortunate to join the committee in 2019, which allowed me to experience my first Capitol Hill visits in person—before the COVID-19 pandemic started. I was not sure what to expect, and I was extremely nervous before heading to the congressional meetings.

Before traveling to Washington, D.C., we had all been asked to contact our U.S. senators and representatives to set up meetings. The day before our meetings, APS staff and senior committee members shared their experiences to help the new members and Early Career Advocacy Fellows prepare.

During the meetings we met with congressional staffers, sharing with them how federal grants funded our research and training programs and providing them prepared packets with data and facts about the importance of federal funding for scientific research. Most of the staffers we met with understood the importance of advancing science and were genuinely interested in our work.

In 2020, after the pandemic hit and laboratories across the country shut down overnight, the Capitol Hill visits turned virtual. Based on my previous experience, I knew that having a small group of people at the congressional meetings would be more effective than meeting with congressional staff by myself. At the time, I also knew that there were other researchers on campus who needed to share their personal stories about the challenges they were facing as a consequence of the pandemic shutdown. International graduate students and postdoctoral fellows were also facing mounting questions about their visa status and renewals, and I wanted to give them a chance to voice their concerns directly to congressional staff.

To build a group of fellow advocates, I emailed all the postdoctoral fellows in Colorado who were also APS members. I asked if they were interested in joining me to advocate for federal funding for scientific research. I received enthusiastic responses and was able to identify six colleagues who were interested in joining my efforts.

The seven of us met beforehand to go over our talking points, plan the speaking order and discuss how to contact congressional representatives to request appointments. With a big group of people in a virtual meeting, planning ahead is key to allow everyone enough time to share their own personal stories while keeping within the meeting time frame.

The group ended up meeting virtually with staff of two senators and two representatives. Even though the virtual meetings felt more casual in comparison to the in-person Capitol Hill visits, they were just as meaningful and impactful.

Capitol Hill visits were still virtual throughout 2021, with considerable uncertainty about when there can be a return to in-person visits. However, no matter what format science advocacy takes, it is important to for us to pay attention to the polices and legislation that have big impacts on the availability of federal funding for research.

Eileen Chang, PhD, is a member of the APS Science Policy Committee. She is a postdoctoral fellow at the University of Colorado Anschutz Medical Campus.

RESEARCH FIZZ

A model of anemic tissue perfusion after blood transfusion shows critical role of endothelial response to shear stress stimuli

Researchers have developed a mathematical model that provides physiological support for the practice of transfusing one unit of blood instead of two to treat anemia. This increases the potential to expand interventions without increasing blood availability.

Journal of Applied Physiology, October 2021

https://doi.org/10.1152/japplphysiol.00524.2021

STATS & FACTS

36 The number of states that have legalized marijuana for medical use as of May 2021.

National Council of State Legislatures

RESEARCH FIZZ

Multi-omic analysis defines the first microRNA atlas across all small intestinal epithelial lineages and reveals novel markers of almost all major cell types

This study is the first comprehensive profiling of miRNAs across all major cell types of small intestinal epithelium in mice.

American Journal of Physiology-Gastrointestinal and Liver Physiology, October 2021

https://doi.org/10.1152/ajpgi.00222.2021

The "fab four" of the Farquhar laboratory in 2019. Left to right: Watso, Austin Robinson, Kamila Migdal, Matthew Babcock and William Farquhar.

UNDER THE MICROSCOPE

Rapid Fire Q&A

Joseph C. Watso, PhD, reluctantly shares his college nickname, proudly shares the technique he mastered and explains why being a chimpanzee would be great.

Q: What do people call you?
A: I will likely regret sharing this, but some of my colleagues from undergraduate research sometimes call me "Joe ripped lats Watso." Story: I came into our undergraduate research laboratory to be a pilot subject for a planned bench press study and, unfortunately, decided to highlight how sore I was by saying I "ripped" my lats the previous day. We must have been learning about the microscopic muscle tears that occur with exercise, bringing "ripped" to the forefront of my mind. Who knew this sarcasm would not be forgotten. You're welcome Alec, Marty, Josh, et al.

Q: What inspired you to become a scientist?
A: My interest was piqued by Scott Mazzetti, PhD, inviting me to join the Laboratory for Human Performance at Salisbury University in Maryland while I was an undergraduate student.

Q: "Old school" technique you're most proud of mastering?
A: Running a stopwatch, particularly during studies with resistance exercise and indirect calorimetry as I did in undergrad. It seems easy until you realize you have to remember to look at the stopwatch approximately every 15 seconds for about an hour to direct the flow of the study—including "up, down, down" for each rep—and forgetting to do so once effectively invalidates the calorimetry data for an entire active or rest period.

Q: Items on your lab bench that you are most possessive of?
A: Pens. Good ones are hard to come by, and they disappear quickly.

Q: If you could do a sabbatical with any scientist (living or dead) who would it be and why?
A: Charles Spence. I read his book "Gastrophysics: The New Science of Eating" a few years ago. I could envision his colleagues and me going around the U.S. (or world) appreciating and discussing the sounds, sights and tastes of what we're eating.

Q: If you were a model organism, which model organism would you be?
A: Chimpanzee. Eating fruit all day in green spaces sounds awesome. Plus, the longest-lived male chimpanzee is only about 10 years lower than the expected lifespan of an American male. Seems like a good deal to me.

Watso and his wife, Jen, at Yellowstone National Park wearing matching T-shirts from the 2018 American College of Sports Medicine meeting.

Watso at the Cliffs of Moher in Ireland with his wife, Jen.

Photos courtesy of Joseph C. Watson, PhD

Q: One thing every researcher should try at least once in their life? A: Submitting things well before deadlines. It's an incredible feeling.

Q: No. 1 guilty pleasure?
A: Not carrying anything, even in my pockets. This likely means that I am outside, active and with at least one other person.

Q: Most influential scientist on your career?
A: Benjamin Franklin, not because of electricity (as I type on my candle-powered computer) but because he generated the first "pros and cons" list, which contributed to the revolution of decision-making. While perhaps a second- or third-order consequence, I would guess that I have benefited from this or related developments.

Q: Favorite science-related TV show (fictional or factual)?
A: "Breaking Bad." I also love seeing the elemental symbols highlighted in the credits (for example, I would be Joe W**At**so for astatine).

Q: The scientific discovery or invention (made by someone else) that you wish you had made?
A: Neuralink (from Elon Musk, et al.). While there has been some criticism, it's hard to imagine how this doesn't revolutionize the application of, or at least the thinking behind, preventing or treating neurodegeneration.

Q: Biggest misconception about physiology/physiologists ... in five words?
A: We fully understand the body.

Q: Favorite way to spend a free hour in quarantine?
A: I'm not sure any of my "favorites" from peri-quarantine are favorites anymore. I have thoroughly enjoyed being around people, particularly playing sports.

Q: Most valuable quality in a colleague?
A: Curiosity.

Q: Tell us a surprising fact about you.
A: I used to snowboard several times a year when I lived in and around New York, but not since moving to Dallas—the place I experienced the coldest days of my life (February 14–16, 2021).

Q: Favorite part of your job?
A: Questions that can't be answered and the discussions they bring.

Q: How would you describe your job to a child?
A: I study how to keep the body healthy.

Q: Go-to tech device?
A: I recently purchased the Garmin Forerunner 435 Music watch. I am loving it so far.

Q: The question we didn't ask that we should have?
A: What was your favorite cartoon? "SpongeBob SquarePants."

Joseph C. Watso, PhD, is a postdoctoral fellow in the Department of Internal Medicine at the University of Texas Southwestern Medical Center in Dallas and works within the Institute for Exercise and Environmental Medicine at Texas Health Presbyterian Hospital. He is interested in studying the role of lifestyle habits, such as diet and exercise, for preventing and/or treating cardiovascular disease.

PUBLISH WITH POLISH | BETTER RESEARCH

Improving Research Rigor and Reproducibility

In recent years, the National Institutes of Health (NIH) has emphasized the importance of rigorously designed preclinical studies. NIH has emphasized two cornerstones of science advancement: rigor in designing and conducting experiments and the ability to reproduce scientific findings. As such, APS implemented new strategies to help authors improve the rigor and reproducibility (R&R) of their work.

Original research published in APS journals must report experimental methods in sufficient detail to allow for replication by others. The R&R Checklist was released in early 2021 to help APS authors meet the transparency and reproducibility requirements of APS journals. The checklist consists of reporting requirements for animal experiments, human studies, cell lines and reagents, among other data elements. The checklist is available at **https://bit.ly/RnRChecklist**.

As a further step, all original research articles are also assessed using an automated artificial intelligence tool called SciScore, which examines the methods for R&R items on the checklist. SciScore was tested in-house prior to launch and deemed of high quality for detecting R&R-related items in scientific papers. When authors receive a revision decision letter, they are also provided a link to the SciScore report with notes on how to improve the work.

Authors can review the SciScore report and make the necessary R&R-related edits prior to resubmitting their manuscript. APS has implemented this program as a one-year pilot and will evaluate the program in summer 2022.

If you have any questions about R&R, please contact the APS Ethics Office at **ethics@physiology.org**.

APS' experienced publishing staff share their tips and know-how to help you improve the polish of your scientific manuscripts. Got a scientific publishing or style question that you want us to weigh in on? Email it to tphysmag@physiology.org.

Mastery in a Micro World

Renal physiologist Pablo Ortiz, PhD, is obsessed with studying the molecular mechanism of salt-sensitive hypertension.

BY MELANIE PADGETT POWERS

As Pablo Ortiz, PhD, was about to graduate from college, he spotted a newspaper advertisement for a research lab assistant. The ad was unusual because Ortiz is from Argentina, yet the ad was in English. But Ortiz was fluent in English, thanks to his year as a high school exchange student in Pretoria, South Africa. So, he applied for the position.

Little did he know that job ad would set him on a course to become, not a clinical biochemist as planned, but a renal physiologist. In fact, Ortiz would become so proficient at a specific technique that he is now one of only about 30 scientists in the world who have mastered it.

Photography, pp. 18-22, by Matthew LaVere

Garvin's lab was "the first exposure for me to how difficult it was to study renal physiology and also how complex the work was. I got hooked when I came here and I had to learn all the basic aspects of transport physiology."

—Pablo Ortiz, PhD

Ortiz is now division head and Earl Ward Endowed Chair of Hypertension in the Hypertension and Vascular Research Division at the Henry Ford Hospital and an associate professor at Wayne State University in Detroit. He arrived in Detroit in 1999, and the city has been his home ever since. He has been running his own lab for 15 years.

When Ortiz was growing up in Argentina, his father was an endocrinologist, but he also had to make house calls as a family doctor to make ends meet. Sometimes, his young son tagged along, which piqued the boy's interest in medical sciences. When it was time for college, Ortiz enrolled in a dual bachelor-master's program in biochemistry at the National University of Córdoba in Argentina.

That job advertisement Ortiz responded to was from Nestor Garcia, MD, PhD, an Argentinian nephrologist who had trained at Henry Ford Hospital in Detroit and the Mayo Clinic in Rochester, Minnesota. He had returned to Argentina to set up a kidney tubule perfusion research lab. Ortiz got the job and began to learn to dissect and microperfuse kidney tubules. Garcia told him that this would make him stand out as he sought lab positions in the U.S.

After working with Garcia for a year, Ortiz was offered a position in the lab of Jeffrey L. Garvin, PhD, then at Henry Ford Hospital in Detroit. Ortiz enrolled in a PhD program through the University of Buenos Aires that allowed him to do his coursework and dissertation outside the country.

Garvin's lab was "the first exposure for me to how difficult it was to study renal physiology and also how complex the work was," Ortiz says. "I got hooked when I came here and I had to learn all the basic aspects of transport physiology."

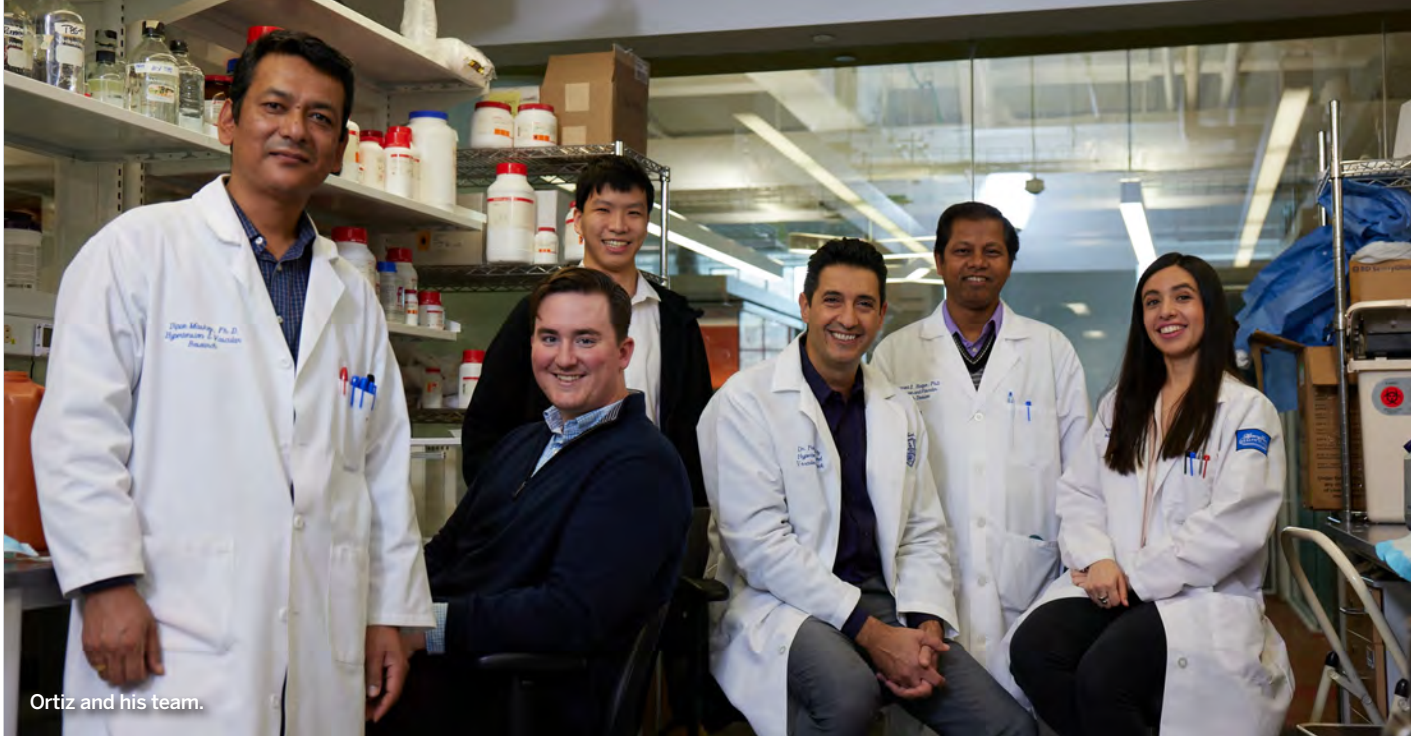
NOTORIOUSLY DIFFICULT TECHNIQUE

Tubule perfusion is the gold standard for measuring renal tubular ion transport in the various nephron segments. But the technique is notoriously difficult to learn, and the success rate at the beginning is often very low. It can take up to two years to pick up, with multiple steps in which the trainee can fail and may never get past, never mastering the technique at all.

Most trainees don't want to spend 18–24 months working on a low-productivity skill they may never truly learn in the end, Ortiz says. It's tedious and takes tremendous patience.

"You learn your limitations very fast," he says. "It's a specific set of people that can do it. You're fighting a specific mindset. I've tried to train other people, and you have to be able to have someone that is going to fight with the method every day for a year until they realize, 'Yes, I've got an experiment.'"

So, why is it so difficult? First, you have to learn to make forceps for microdissection. The tubules, with a diameter of 20–25 microns and a length of about one millimeter, are difficult to identify. There are 15,000 nephrons in each mouse or rat kidney, so when you



Ortiz and his team.

cut a slice of a kidney and put it in the dissecting scope, you have to learn to identify the nephron segment. Then, it takes long days and many months as you learn to pick up a specific tubule segment that you want to microdissect, one that is not damaged and can be perfused.

At the same time, you're learning how to make glass micropipettes, for which there is no automated method. "For example," Ortiz says, "for patch clamping there's an automated puller machine to make a patch pipette. You can't do that with a glass pipette for microperfusion, so you have to manually make them with a rotary puller and heat, and you shape and polish the pipette." It can take up to four months just to learn how to make the pipettes so that you have a usable set.

The micropipette size and setup will depend on what you plan to measure, such as chloride, sodium or water absorption. In a collection pipette, the tiny amount of fluid may only be in the range of 10–15 nanoliters, which you use to measure ion concentration.

On top of all that, tubules die easily, so you have less than 30 minutes to select and microdissect a good tubule.

Only after you learn all those steps, do you move on to the microscope. You use one specific pipette to transfer the dissected tubule so that you can actually perfuse it through the lumen with a micropipette of about five to eight microns in diameter.

He encourages students, after they've learned basic physiology, to find and zero in on conditions in which a specific area of physiology isn't working, to study the mechanisms of that disease.

Ortiz toiled away in this micro world by himself, without doing actual experiments, for a year. Even after he celebrated learning the technique, it took multiple experiments before he mastered tubule perfusion. In fact, it was another three years of everyday work before he regularly achieved an 80–90% success rate. Because of all of that, he says, there are only about seven labs in the U.S. and maybe four outside the country that currently do tubule perfusion. But his is one of them.

THE KIDNEY'S ROLE IN HYPERTENSION

Ortiz' lab research focuses on the ion transporter NKCC2, which is found only in the kidney, specifically in the thick ascending limb. It is essential in sodium and chloride reabsorption and for maintaining water balance. The medication furosemide, which inhibits NKCC2, is given to patients to decrease edema, or fluid buildup.

Furosemide was also sometimes given for the treatment of hypertension, but it is too potent as a diuretic. Ortiz believes that NKCC2 overactivity is generally involved in hypertension. "A lot of previous data that has been generated suggest that the transporter activity is increased in rat models of hypertension," he says. "Instead of

starting to study how to inhibit it better, we started studying why its activity is enhanced in hypertension. In reality, I became obsessed with trying to understand the molecular mechanism of salt-sensitive hypertension."

When COVID-19 hit the U.S. in spring 2020, Ortiz's lab, like so many, was forced to shut down and lost several of its animal models. His team quickly pivoted and began working with the translational research center and the infectious diseases and nephrology groups at Henry Ford Hospital to set up a COVID-19 biobank. Ortiz remembers the first time, early in the pandemic, that he heard that the so-called respiratory disease also attacked the kidneys: New York City nephrologists were reporting on Twitter that they had several COVID-19 patients with acute kidney injury (AKI). Doctors in Detroit started noticing the same thing.

"The truth is that every physician became a physiologist because they were trying to figure out what was going on," Ortiz says. "At the beginning, it was just a respiratory syndrome, but … they realized that they were getting higher rates of secondary disease, including AKI, at a much higher rate than other respiratory syndromes."

It's still debatable whether SARS-CoV-2 directly attacks the kidney, but Ortiz believes it does in some cases. "Our data supports it in severe AKI patients, and there are a number of publications that support this, but there are also a number of studies where they have found nothing when they look, with different methods, in the kidney."

REMAINING EXCITED BY PHYSIOLOGY

Ortiz's lab has begun its transition back to researching the mechanisms of hypertension and kidney function. As division head, he is also overseeing the challenge of getting all the labs back to full capacity, restarting animal colonies and writing grant submissions. And while there's not much time for teaching, he fits it in where he can. This fall he taught two graduate courses, advanced renal physiology and advanced cardiovascular physiology at Wayne State.

After students have learned basic physiology, he encourages them to find and zero in on conditions in which a specific area of physiology isn't working to study the mechanisms of that disease.

"What is happening now is the more we have better tools, the more we discover the level of complexity and integration between organs, and it is mind-boggling," he says. "You'll never be able to take physiology out of the medical curriculum. If you do, you stop understanding or teaching how all of the organs are integrated."

Ortiz tries to reserve Fridays as research days. "My best days are the days that I get to sit down and study and I find something new that I can apply or discuss with a postdoc or a graduate student about how we can incorporate that into our research," he says. "I like to tinker, so even though I have a heavy administrative load and I have five people in the lab, I try to do experiments once a week, mostly develop new methods. That excites me and keeps me connected with how difficult it is to develop something new."

Both photos, this page, courtesy Pablo Ortiz, PhD

Ortiz with his mentor Jeffrey L. Garvin, PhD. Ortiz with his family, left to right, son Santiago, wife Mariela Méndez and daughter Victoria, on the Ponte Vecchio in Florence, Italy.

The Curious Case of Cannabis

Cannabis has the potential to both harm and help the human body. Here's what physiologists are learning about this controversial substance.

BY DARA CHADWICK

Ever pulled at a loose thread in a piece of cloth and been fascinated by its unwinding path? That's how the science feels for researchers studying the physiology of cannabis.

"Like any area of science, the more you find out, the more you find out how little you know," says Norbert Kaminski, PhD, professor of pharmacology and toxicology and director of the Center for Research on Ingredient Safety and Institute for Integrative Toxicology at Michigan State University in Lansing.

Scientists have identified more than 100 naturally occurring compounds in the plant known as cannabis sativa. The two most studied of these compounds, known as cannabinoids, are delta-9-tetrahydrocannabinol (THC) and cannabidiol (CBD). THC is the main psychoactive component in cannabis, responsible for making users feel "high," while CBD does not appear to have psychoactive effects.

Illustration by Chris Gash

"Cannabinoids have always been controversial. People have had a hard time accepting the fact that the molecules present in cannabis may have therapeutic activity."

—Norbert Kaminski, PhD

Humans have an extensive history of using cannabis for both recreational and medicinal purposes. Identified as a potential drug of abuse, research efforts have long focused on why—and how—cannabis is harmful. But in 1990, a National Institute of Mental Health researcher named Lisa Matsuda, PhD, published a seminal paper identifying mechanisms responsible for how cannabinoids affect the central nervous system. This work opened the door to a new line of research into the potential benefits of cannabis, according to Kaminski.

Today, physiologists are studying everything from how cannabis can help athletes recover after tough workouts to its potential to reduce inflammation associated with neurodegenerative diseases and with aging. Yet this research can be fraught not only with regulatory hurdles, but with stigma and misperceptions—from fellow scientists and the public.

"Cannabinoids have always been controversial," Kaminski says. "People have had a hard time accepting the fact that the molecules present in cannabis may have therapeutic activity."

According to Kaminski, the targets through which these molecules mediate their activity—known as cannabinoid receptors—are "bona fide therapeutic targets that could be exploited again and again."

Researchers currently know of two cannabinoid receptors, CB1 and CB2, that can preferentially be targeted with different cannabinoids, Kaminski says. His laboratory has been studying cannabinoid receptors in the immune system since the early 1990s.

CB1 is highly expressed in the brain, while both CB1 and CB2 are expressed in cells and tissues within the immune system, he says. "CB1 is responsible for the euphoric feeling people get when they smoke cannabis," he says. "When CB1 was first discovered, I was curious about whether that receptor was expressed within the immune system, and we worked quickly to publish an accelerated communication describing the expression of CB1 in immunocompetent cells. Shortly afterward, CB2 was identified, which is even more highly expressed in the immune system than CB1."

Today, Kaminski's work focuses on the anti-inflammatory properties of cannabinoids. "Inflammation is really an underlying component of virtually all diseases," he says. "The disease that we're interested in is what used to be called neuroAIDS and is now called HIV-associated neurocognitive disorder."

Kaminski is studying whether cannabinoids can slow this disorder. People with HIV often have high levels of circulating activated monocytes, which fuel inflammation, he says. In some people with HIV, nearly 60% of circulating monocytes are activated, he adds.

"When we looked at HIV patients who used medical marijuana, their levels of circulating activated mono-

cytes were similar to those of healthy individuals," typically somewhere between 5% and 15%, he says. "It was quite striking. We published that work, and since then, two other laboratories have confirmed that observation."

Kaminski is also looking at inflammatory monocytes that cross the blood-brain barrier, creating responses in the brain that accelerate neurocognitive disorder.

"We are finding that cannabinoids are able to inhibit the production and secretion of certain proteins that drive inflammation," he says, particularly a pro-inflammatory cytokine called interleukin-1 beta. "If you can block production of that cytokine, that is part of the mechanism of anti-inflammatory activity."

Kaminski's lab is culturing monocytes isolated from human blood with astrocytes to learn more about how they interact. "We can do those experiments in vitro and then add different cannabinoids to those cultures to see how we can impair the production of inflammatory mediators," he says.

AN 'UNCONTROLLED' EXPERIMENT

Kaminski's focus on studying HIV developed somewhat by accident, he says. His National Institutes of Health funding came from the National Institute on Drug Abuse, which he says was funding only cannabinoid work focused on combatting drug addiction. "It was recognized early on that drugs of abuse were a cofactor for AIDS," he says. "But many of the mechanisms we're studying could be applicable to other neurodegenerative diseases like Alzheimer's and multiple sclerosis. These are all diseases where the immune system plays an important role, especially by inflammatory cells."

Jennifer Bizon, PhD, professor and chair of the Department of Neuroscience and co-director of the Cognitive Aging and Memory Center at the University of Florida in Gainesville, recently received funding to conduct preclinical studies focused on cannabis' impact on age-related cognitive function. She and her husband and research partner, Barry Setlow, PhD, professor in the Department of Psychiatry at the University of Florida College of Medicine, are collaborating on this work.

"Overactive inflammatory processes have been linked to Alzheimer's disease and memory dysfunction," Bizon says. "There is reason to think that cannabis may actually have some neuroprotective effects or the ability to stave off cognitive decline."

But both Bizon and Setlow express concern about the pace of medicalization (and legalization) of marijuana and about the targeted marketing of products containing THC and CBD to people over age 65.

"It's an uncontrolled experiment because the vast majority of research concerning cannabis has been on teenagers and young adults," Setlow says. "Legalization and medicalization have opened up this whole new population that is availing themselves of cannabis. But the research has not caught up."

The couple hopes to change that. One area of their research focuses on the influence of cannabis on GABAergic signaling systems. "We know that certain GABAergic signaling systems in the aged brain are altered," Bizon says. "An acute mechanism of action of cannabis could be influencing those GABAergic signaling systems that are altered and pushing them in a direction that is beneficial."

The Burdens of Studying Cannabis

Conducting research on cannabis in the U.S. can be challenging because of barriers put up by its drug classification. The U.S. Drug Enforcement Administration (DEA) classifies cannabis as a Schedule I drug, the most restrictive regulatory category, as defined by the Controlled Substances Act of 1970. This designation indicates that regulators view a substance as having both a high potential for abuse and no medical value.

In addition to undergoing the standard funding application processes, scientists who want to study cannabis in the U.S. are required to register with the DEA, and for human studies, the U.S. Food and Drug Administration. DEA registration can include a requirement to meet facility inspection and security standards. Researchers may also have state regulations to navigate. After these approvals, researchers must apply to the National Institute on Drug Abuse (NIDA) for access to research-grade cannabis.

Historically, a single DEA-licensed producer, the University of Mississippi, Oxford, has supplied all cannabis for research use in the U.S.—and then only for academic research, not for prescription drug development. Critics say this research-standardized cannabis is not representative of the variety of cultivars and products available to users via dispensaries. On May 14, 2021, however, the DEA announced it was expanding the number of licensed cannabis producers. Accepted applicants are undergoing the approval process and, once approved, will be able to begin production. Learn more at **https://bit.ly/DEACannabisExpansion**.

"Legalization and medicalization have opened up this whole new population that is availing themselves of cannabis. But the research has not caught up."

—Barry Setlow, PhD

They are using rat models to gather full-dose response curves of a range of cannabis doses, noting that dosing of animals in research tends to be higher than the dose a person might consume. "Some of the doses in which we're seeing pretty robust effects on cognitive tests are actually of a dose that is very low relative to what has been published in young rat populations or other preclinical studies," Bizon says.

They are using both smoke and edibles to deliver THC to the rats. Bizon says they hope to determine the potential impacts of both routes of administration and of using cannabis over time. "Our current hypothesis is that there are acute mechanisms whereby cannabis may be acting that may be beneficial in the aged brain," she says. "But also, there is a lot of potential for the chronic use of cannabis to reduce inflammation."

One notable observation from their initial results is the difference in how cannabis affects the young and old. "In our older rats, we see an enhancement of performance," Bizon says. "But the same dose of drug in young animals impairs performance. So, it's having very different effects in the context of aging."

Bizon also notes that another important exploration is how a person's sex influences the effects of cannabis. "We do see fairly robust sex differences in terms of how the drug acts," she says, adding that female rats show stronger effects than male rats. "I don't know that we have the data yet to say for sure that it's cognitively enhancing in one sex and not the other. But I think that is worth mentioning, particularly in the context of aging, where there's also hormonal changes in midlife in women and certainly changes in men."

EVOLVING RESEARCH

Researchers are also studying the effects of cannabis on cardiovascular function. Christian Cheung, a graduate student who works in the laboratory of Jamie Burr, PhD, associate professor in human health and nutritional sciences at the University of Guelph in Ontario, Canada, published a study on whether cannabis use precedes greater cardiovascular disease risk in healthy people. As exercise physiologists, Cheung and Burr are curious about the impact of cannabis on the physiological effects of exercise. "But there was also a large gap on the fundamental cardiovascular function side of things," Cheung says. "That's how we ended up applying cannabis in that context."

The team looked at cannabis users and non-users cross-sectionally, matching individuals in each group outside of their cannabis use. The cannabis user group included people who self-identified as smoking cannabis at least once a week for at least three years. Those in the control group never smoked.

The paper, "Habitual Cannabis Use Is Associated with Altered Cardiac Mechanics and Arterial Stiffness, but not Endothelial Function in Young Healthy Smokers," was published in the January 2021 issue of the *Journal of Applied Physiology*. It found that while young healthy cannabis smokers demonstrated lower apical rotation and greater aortic stiffness than the

control group, endothelial function and cardiac responses to certain exercises didn't differ between cannabis users and nonusers.

"A lot of our hypotheses were built on the fact that cigarette smoking would negatively impact our outcomes, so we hypothesized that cannabis smoking might as well," Cheung says. "We measured vascular function in this study. We know that this function is well-established to be reduced in cigarette smokers, but not in cannabis users. That's one finding that certainly surprised us, and we're hoping to follow up to get an idea of why there might be a discrepancy there."

The study itself faced some challenges, Cheung says. "As a university lab, we're recruiting from a young population," he says. "They may not have had enough exposure to cannabis. A regular cannabis user who's young is still going to have used much less cannabis than one who's maybe used a bit less but is much older."

Another challenge was finding people who openly use cannabis recreationally, even though cannabis is now legal for recreational use in Canada. "I think there's still a lot of stigma associated with recreational cannabis use," Cheung says.

Burr says the two hope to study more about cannabis' role and effect in exercise. "What we've concluded is that we know a lot less than people probably assume we do, based on the fact that this has been a banned substance for a long time," he says. "There's actually very little evidence for or against cannabis use. A lot of the research that's been done comes from the 1970s, and techniques and understanding have evolved since then."

CHALLENGES ABOUND

The evolution of cannabis research—and how it's done—is a topic of great interest to physiologists. Kirsten Thornhill, a researcher pursuing a doctorate in health sciences from Rocky Mountain University of Health Professions in Provo, Utah, is the first in her program to propose cannabis research. She's just beginning to design her study, which hypothesizes that CBD will have a positive effect on the duration of delayed onset muscle soreness and athlete recovery. "From what I've seen in the literature, clinically, CBD has been shown to have anti-inflammatory effects," she says. "We hypothesize that CBD will have anti-inflammatory effects at the skeletal muscle level. Hopefully, we'll be able to do muscle biopsies to analyze the different anti-inflammatory markers within individual skeletal muscle fibers to physiologically determine if it does have an effect."

Thornhill, who has a background in exercise physiology and metabolism, welcomes the opportunity to pioneer this research, noting the many moving parts of designing a cannabis study. "We're looking at what dosage we should give these athletes," she says. "Do we go with traditional oil or an edible? There's so much variability."

With a part-time role as a CBD educator, Thornhill is well-versed in some of the misconceptions and challenges that exist around cannabis, including cultural differences. "Being a born-and-raised Cali girl, I didn't realize how normalized and part of the culture it really is," she says. "Here in Utah, cannabis is only legal with a medical marijuana card, unless it has a THC content of less than 0.3%."

These differences create challenges for researchers. While the U.S. Food and Drug Administration has softened its stance on cannabis research somewhat, the field remains tightly regulated. "Designing a study and bringing it to fruition is hard enough," Thornhill says. "But when you layer in all these regulatory factors … it feels like an extra layer of avenues you need to navigate."

Yet, research can help shift the narrative around cannabis' potential benefits and overcome misconceptions about what cannabis can and can't do. Opinions are quite split between overly favorable and overly harsh, Cheung says. "What I hope to get out of our research is to actually develop a body of literature that people can properly evaluate and get a better idea about where cannabis lies in between those opinions," he says. "Because as the saying goes, there's two opinions and the truth probably lies somewhere in the middle."

"Designing a study and bringing it to fruition is hard enough. But when you layer in all these regulatory factors … it feels like an extra layer of avenues you need to navigate."

—Kirsten Thornhill

Illustration by Olvind Hovland

Staying Afloat

The demands of the postdoc life were already a struggle for some, but then the pandemic hit.

BY GLENN COOK

Meli'sa Crawford, PhD, was "confident, anxious and excited" when she moved to Riverside, California, in February 2020 to start her postdoctoral studies. As she would be working with three senior postdocs, three graduate students and a lab manager at the University of California-Riverside, she felt she would get thorough training in new techniques.

A month later, as the pandemic reached its first peak worldwide, her trajectory—and that of other postdoctoral researchers—was altered dramatically.

"My training and research project were temporarily postponed, the senior members of my lab were moving on to new opportunities, and I was facing the uncomfortable reality that I was going to be the only PhD in my lab," says Crawford, a gut microbiome researcher. "This meant that not only did I have to learn how to be a postdoc from reading blogs, but I also had to deal with the unexpected and seemingly unobtainable expectations of those around me."

Completing a postdoctoral fellowship is a rite of passage in research careers, allowing early-career researchers to hone their skills and prepare for becoming an independent researcher while under the direction of more experienced scientists. However, the grind of postdoc life, combined with the aftereffects of a pandemic still being felt throughout academia and the workplace, has left many in the field feeling uneasy about their future prospects.

"A lot of postdocs feel they're more an afterthought, that they're doing a lot of work for very little credit. They don't get the appreciation they deserve. They are spending far more than 40 hours a week in the labs. Many times they're very isolated."

—Stephanie Eberle, MEd

Some universities are taking steps to improve workplace conditions and further define ill-defined roles, but postdocs as a rule continue to feel "rather invisible," says Stephanie Eberle, MEd, executive director of BioSci Careers at Stanford University in California and chair of the National Postdoctoral Association.

"A lot of postdocs feel they're more an afterthought, that they're doing a lot of work for very little credit," Eberle says. "They don't get the appreciation they deserve. They are spending far more than 40 hours a week in the labs. Many times they're very isolated, very often doing a lot of the mentoring of graduate students and undergrads as well as their own work. They're often not getting the support and feedback and mentorship they feel they deserve and that they certainly need."

The stress Crawford has been feeling has been amplified by the pandemic, but it is not new in the postdoc world. According to a December 2020 survey by *Nature Portfolio*, postdoctoral researchers have long had widespread concerns about an unrelenting workload, poor compensation and the culture where they work. More than half, at 56%, said they view their career outlook negatively, while fewer than half said they would pursue a scientific career if they could have a do-over.

"We have people who do feel that they're spending an inordinate number of hours at work, spending time on weekends and feeling like, 'I can't even take a break. I can't take maternity leave,'" Eberle says. "Then, to top it off, they don't feel like they're getting paid equally to make up for this."

Crawford says finding mentors "who are willing to devote their time and expertise to another trainee" has been one of her biggest challenges. "I believe proper mentorship is lacking once new PhDs reach the postdoc phase of their careers," she says. "Early-level postdocs are still in a critical training period. We are not only acquiring new laboratory techniques but are also learning how to mentor students, run a lab and work on committees. Not all of that much-needed training happens in graduate school."

THE IMPORTANCE OF MENTORS

Navigating the postdoc world during the pandemic came with "an enormous amount of pressure," says C. Brooks Mobley, PhD, CSCS. But, he had a strong support system at the University of Kentucky that included a principal investigator and peer

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—Meli'sa Crawford, PhD

mentors. His success earned him a position in the fall of 2021 in the School of Kinesiology at Auburn University in Alabama. Also critical to his success, Mobley says, was finding the right work-life balance and understanding the amount of time that would be required.

"While all areas of research are competitive by their own nature, I find physiology overwhelmingly frustrating, yet surprisingly rewarding, when it comes to the execution of projects and acquiring data for publication," says Mobley, now the director of the TigerFit Health and Fitness Laboratory at Auburn and associate director of the university's Molecular and Applied Sciences Laboratory.

"When the pandemic hit, the grind came to a minor halt for most, if not all, postdocs," he says. "But for some, it continued outside the laboratory with getting data analyzed and written up for manuscript submission. Once restrictions began being lifted, it came back in full force."

When it comes to her postdoc experience at Simon Fraser University in Canada, Vicki Komisar, PhD, MSc, feels lucky. Her supervisor was supportive and encouraged her to write grants. Early in the third year of her postdoc, she received an offer for her current role.

"My adviser was 100% supportive of my application, and I started getting ready to transition into my position during the pandemic," says Komisar, now an assistant professor in the School of Engineering at the University of British Columbia's Okanagan campus. "After the offer came I had eight months to get ready for my new role. My supervisor helped me use part of my postdoc time to apply for grants and set up my lab for my faculty position, so he showed his support not just in principle but in actual terms."

Two decades ago, the average postdoc experience was around three years. Today, the average is closer to five and in some cases is up to seven, according to the *Nature Portfolio* survey. Fear about post-pandemic job prospects is adding to what Eberle describes as "a bottleneck problem."

"You take a job market that is already saturated, or becoming close to it, and then you add in the effect of a one-year, maybe two-year, delay due to the pandemic, and that really puts a lot of fear into our postdocs," Eberle says. "They are really more worried than ever about whether or not they'll get jobs, can they get jobs and where the jobs will be."

Wide disparities in postdoc compensation continue to exist, according to a 2019 peer-reviewed report by the Future of Research, a science-advocacy group based in Boston. The report, which looked at the salaries of nearly 14,000 postdoc researchers working at 52 U.S. institutions, says the average pay is about $47,500. While that number is close to the starting figure set by the National Institutes of Health for those who receive National Research Service Awards, figures ranged from as low as $23,600 to well over $100,000.

Eberle says postdocs already make a large sacrifice by delaying the start of their careers for several years. Most are not able to start saving for retirement until they are 25 or 26, and many are just then starting to pay off student loans.

"Everything is delayed," Eberle says. "Think of an undergrad leaving school at the average age of 21. Maybe I get my first job, and I start contributing to a 401(k) or 403(b) right away, but most postdocs don't have a 401(k) or 403(b) option. They are trying to figure out what they want to do and how they want to do it, whether it's academic jobs or with a research company or consulting. If they want to have a family, even that is impacted."

Komisar says postdocs should receive the same benefits as university staff regardless of their funding

"Postdocs are key to making labs and science function, and engaged postdocs demonstrably improve the outcomes for graduate students. At the same time, research funding has not increased to support the postdoc salary."

—Vicki Komisar, PhD, MSc

source or classification, noting that their qualifications—the minimum is a PhD—should be recognized. She notes housing costs, especially in smaller cities like the one where she lives—Okanagan Valley is about four hours from Vancouver—have exponentially increased.

"Postdocs are key to making labs and science function, and engaged postdocs demonstrably improve the outcomes for graduate students," Komisar says. "At the same time, research funding has not increased to support the postdoc salary. You want to treat your team humanely, but instead of recruiting several postdocs, I can only recruit two students because they need to have enough money to eat."

INSTITUTING CHANGES

Workplace culture is being discussed and, in some cases, redefined in all aspects of society. The same is true in the postdoc world. Some universities, such as University of California-Riverside, have labor unions organized specifically for postdocs, and a push for broader unionization is gaining traction on social media.

Meanwhile, other institutions are experimenting with different compensation models and packages, but responses in the postdoc community have been mixed. George Washington University in Washington, D.C., for example, recently announced that postdoctoral researchers will be reclassified into a new trainee category in January 2022. The university says a competitive salary and benefits package will be available for those who qualify.

As long as it addresses equal pay and benefits, Eberle says creating a new classification can help solve "a problem we've been grappling with probably since the postdoc was created." While the National Postdoctoral Association does not take a stance on unions, Eberle is not surprised the topic has been resurrected.

"There's so much activism in the workplace right now in general and rethinking in the workplace about what needs to be done and what should be done," Eberle says. "We do need to find that balance of equal pay, of support for career interests, for personal interests, and provide that academic mentorship so they can get through the program and their training successfully."

Another critical component is finding a way for traditionally marginalized groups to be recognized and heard at predominantly white cisgender institutions.

"There is a lot of talk about what it means to be a person of color or about gender in the lab and in the workforce, as well as how they're supported and how they're seen," Eberle says. "We know that the people who get left out of the story nine times out of 10 are minorities, LGBTQ people and first-gen postdocs and students. Money, time, space and resources should definitely be going to those areas so people have a community to go to."

As the only Black postdoc at her university's medical school, Crawford says it "can be incredibly isolating and very hard to make connections when you feel like an outsider." She says more institutions need to hire and support more Black and African American faculty.

"Even though I have the amazing support of the few Black and African American faculty on campus, having other Black and African American postdocs to collaborate with, vent to and learn from would have made transitioning into this position easier," Crawford says. "Not only would the community benefit from inclusion, having better representation would create an environment in which Black postdocs would feel more welcome."

Despite the stress that all postdocs are under these days, Eberle says it's important for them to remember that there are a lot of career options. "Your independence, understanding of your craft, knowing and being able to research and study a topic to its deepest level is very useful in a lot of fields, in consulting and teaching, in finance, in policy, etc.," Eberle says. "You might not be able to see that because of the immense amount of work that you're putting into both research as well as that practical component of the work, but the opportunities are there."

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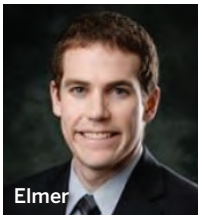
Elmer, Hydock Become American Kinesiology Association Leadership Institute Fellows


Elmer


Hydock

Steven Elmer, PhD, and **David Hydock, PhD**, have been named to the American Kinesiology Association's class of 2023 Leadership Institute. This program uses a mentoring model to provide new department chairs, associate chairs and emerging faculty leaders with training and networking opportunities.

Elmer is an associate professor in the Department of Kinesiology at Michigan Technological University and has been an APS member since 2015.

Hydock is a professor and director of the School of Exercise Science at the University of Northern Colorado and has been an APS member since 2011.

Ogola Named Prestigious MOSAIC Scholar

Benard Ogola, PhD, a postdoctoral fellow at Tulane University in New Orleans, is a recipient of the National Institute of General Medical Sciences' Maximizing Opportunities for Scientific and Academic Independent Careers (MOSAIC) Postdoctoral Career Transition Award to Promote Diversity, funded by the National Heart, Lung and Blood Institute. He was also selected as a scholar of the Association of American Medical Colleges (AAMC). The AAMC MOSAIC program is designed to enhance diversity in the academic biomedical research workforce and facilitate the transition of postdoctoral researchers who have been traditionally underrepresented in the biomedical and related fields. Ogola's research focuses on the interplay of sex hormones and sex chromosomes in vascular oxidative stress and arterial stiffening. He is the incoming APS Cardiovascular Section representative to the Trainee Advisory Committee and has been an APS member since 2015.

OPPORTUNITY KNOCKS

Check out this featured job listing. To find your next career opportunity or to list your job announcement with us, visit www.physiology.org/jobs.

BIOLOGY FACULTY POSITION

NORTHWESTERN COLLEGE

Northwestern College (Orange City, Iowa) invites applications for a full-time tenure-track faculty position (assistant or associate professor) in biology to begin August 15, 2022.

Read more at www.physiology.org/northwesterncoll.

APS ELECTIONS

Vote for Your APS Leaders

Elections for the next slate of APS leaders—president-elect and councilors—are open for voting. Check your email for your ballot (sent on January 5, 2022) and cast your vote by **February 2, 2022.**

PRESIDENT-ELECT CANDIDATES

Robert Hester, PhD, FAPS
Billy S. Guyton Distinguished Professor, professor of physiology, data science and orthopedic surgery, University of Mississippi Medical Center

Willis K. "Rick" Samson, PhD, DSc, FAPS
Professor of pharmacology and physiology and director of biomedical science graduate programs, School of Medicine, Saint Louis University

APS COUNCIL CANDIDATES

Heddwen Brooks, PhD
Professor of physiology, University of Arizona

Nisha Charkoudian, PhD
Research physiologist, U.S. Army Research Institute of Environmental Medicine, Natick, Massachusetts

Jon Harrison, PhD
Professor, School of Life Sciences, Arizona State University

Wolfgang M. Kuebler, MD, PhD, FAPS
Chair of physiology, Charité Berlin, Germany; professor of physiology, University of Toronto, Canada

Evangeline Motley-Johnson, PhD
Interim dean, School of Graduate Studies and Research; professor, Department of Microbiology, Immunology and Physiology, Meharry Medical College, Nashville, Tennessee

Jeffrey L. Osborn, PhD
Professor of biology, University of Kentucky

APS COMMITTEES

APS Committee Applications Now Open

It's an exciting time at APS, and it's a great time to get involved. Apply before the February 7, 2022, deadline for APS committee service. Terms will begin in spring 2023. Members serve a three-year term that will begin and end at the Society's annual meeting. Committee members are appointed by the APS Council at the recommendation of the Committee on Committees. Review the list of committee vacancies at **https://bit.ly/JoinAnAPSCommittee**.

READERS SURVEY

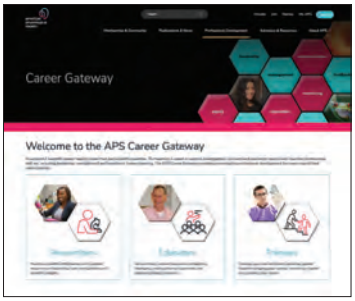
Who Do You Want to Read About in *The Physiologist Magazine*?

The Physiologist Magazine readers survey is a chance for you to tell us what you think about the magazine and what you want to learn more about. We would especially love to hear your recommendations on what APS members and topics we should feature—we cover the science of physiology but also education, career issues and more. Please share your suggestions and ideas! Fill out this short survey at **www.physiology.org/TPMSurvey**.

APS RESOURCE

The APS Career Gateway Can Help with Your Career Goals

In November, APS launched Career Gateway—a new member resource to enhance your professional skill set. The Gateway provides leadership, management and career advancement content and courses customized specifically for researchers, educators and trainees. We've streamlined access to critical leadership and career advancement resources in a curated, easily accessible structure. Resources include tips on leading and managing a team, funding and communicating your science, designing your career intentionally, mentoring today's students and maintaining scientific integrity. Visit **www.physiology.org/CareerGateway** to begin your leadership and career advancement journey.



DATES & DEADLINES

AWARDS

ADInstruments Macknight Innovative Educator Award (January 10)

Dependent Support Travel Award (January 10)

Barbara A. Horwitz and John M. Horowitz Outstanding Undergraduate Abstract Awards (January 14)

Graduate Student Ambassador (January 14)

Porter Physiology Development Fellowship (January 15)

Dale J. Benos Early Career Professional Service Award (January 24)

August Krogh Distinguished Lectureship of the Comparative & Evolutionary Section (February 1)

Summer Undergraduate Research Fellowships (February 1)

Carl J. Wiggers Award (February 8)

Gabor Kaley Memorial Lectureship Award (February 8)

Robert M. Berne Distinguished Lectureship (February 8)

Joseph Erlanger Distinguished Lectureship (February 15)

2023 Carl W. Gottschalk Distinguished Lectureship (February 28)

Renal Section Young Investigator Award (February 28)

Environmental & Exercise Physiology Section Edward F. Adolph Distinguished Lectureship (March 1)

Environmental & Exercise Physiology Section Honor Award (March 1)

Environmental & Exercise Physiology Section Impact Award (March 1)

Carl Ludwig Distinguished Lecture of the APS Neural Control & Autonomic Regulation Section (March 19)

Hugh Davson Distinguished Lectureship (Apply anytime)

Local Undergraduate Research Awards in Physiology (Applications accepted on an ongoing, year-round basis)

More details: www.physiology.org/awards

CALLS FOR PAPERS

American Journal of Physiology-Cell Physiology (March 1, 2022)
- Inward Rectifying K+ Channels

American Journal of Physiology-Gastrointestinal and Liver Physiology (no expiration)
- Adaptations of Physiologic Systems to Promote Cancers
- The Chronification and Treatment of Visceral Pain
- Coronavirus Disease (COVID-19) and Digestive System
- Gastrointestinal Issues in Neurological Diseases
- Microbiome-based Therapeutics and Their Physiological Effects
- The Physiology of Cellular Organelles

American Journal of Physiology-Heart and Circulatory Physiology (no expiration)
- Getting It Right

Journal of Neurophysiology (JNP) (March 31, 2022)
- Society for the Neural Control of Movement
- Spinal Networks and Spinal Cord Injury: A Tribute to Reggie Edgerton
- The Neurophysiology of Consciousness

More details: www.journals.physiology.org/calls

MEETINGS & EVENTS

CONFERENCES

Experimental Biology 2022

Conference dates: April 2–5, 2022, Philadelphia
- Last-chance abstract deadline: February 1
- Early registration deadline: February 7
- Advance registration deadline: March 18

More details: www.physiology.org/EB

WEBINARS

APS-Alzet Osmotic Pumps Webinar February 9, 2022

APS-ADI Translational Research Panel February 16, 2022

More details: www.physiology.org/webinars

Tapping Social Media to Gain Visibility in Science

BY MINDY ENGEVIK, PHD

According to a 2014 *Nature* survey, approximately 50% of scientists regularly use Twitter to discover peers, identify relevant papers, post content, share links to authored content, comment on research and engage in scientific and ethical discussions.

Tweets are associated with increased citation rates, which gives scientists a strong argument for using Twitter. Three other recent studies have confirmed that publications promoted on the platform have higher citation rates, with one study finding up to 75% more citations. Twitter mentions are also positively correlated with rapid article download. One of these studies found that tweets can predict highly cited articles within the first three days of publication.

After reading these studies, I decided to be more intentional about tweeting my manuscripts. My papers are starting to accumulate citations, and I think Twitter may have contributed. It's afforded me a better ability to engage in a community that focuses on my particular niche.

Tweets are associated with increased citation rates, which gives scientists a strong argument for using Twitter.

I study the interaction of microbes and mucus, which is frequently discussed on the hashtag #MucusMatters. By joining the conversation on social media, I have connected with many researchers with a similar focus on the gut and other organs such as the lung or pharynx. I was also recently invited to speak at a conference where all the researchers were on Twitter! And one of my tweets led to a graduate student selecting my article to present at their local journal club. This provided increased visibility of my work and allowed me to interact with a graduate student that I might not have met through traditional methods.

Importantly, societies such as APS and research journals—including most of the journals in the APS portfolio—are also on Twitter and are seeking opportunities to engage with their members and authors and amplify their work.

As great as Twitter has been professionally, it's been a lot of fun, too. My two sisters, who are also APS members and gastrointestinal researchers, worked with me to create the hashtag #SisterLab and #EngevikEmpire. Using these hashtags, we have curated scientific content and been tagged in related posts. Through the hashtag #WomenInSTEM, I have connected with several prominent female researchers, and it has been incredibly valuable to see their perspective and get their advice.

Based on my positive experience, I believe that investigators—particularly those in early-career positions—should participate in social media platforms such as Twitter. Getting started, finding researchers in your space and figuring out what you'll tweet about takes some thought and planning in the beginning. But it won't take long to get the hang of it once your account is established. Pro tip: I tend to tweet and post content during incubations, examine my feed during breaks and schedule posts in the evening.

I have found the scientific community on Twitter to be diverse, welcoming and engaging, and I have personally benefited from the articles, content and people I have encountered. I highly encourage all early-career investigators to join this dynamic online community.

Mindy Engevik, PhD, is an assistant professor at the Medical College of South Carolina. She is chair of the APS Trainee Advisory Committee.

Illustration by Brett Affrunti

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APS annual meeting at EB 2022

For over 60 years, Experimental Biology (EB) has been the world's largest interdisciplinary meeting in the life sciences, covering biochemistry and molecular biology, anatomy, pharmacology, physiology and pathology. The 2022 meeting marks the end of an era and will be the last EB meeting. We'll appreciate our past, look forward to the future and plan to go out with a BANG! You won't want to miss out.

The American Physiological Society (APS) annual meeting at EB is being held April 2–5, 2022, in Philadelphia. Present your research, network with colleagues, advance science and build your career.

Register, submit your abstract and learn more at **apsebmeeting.org**.

Last-chance abstract submission deadline: January 27

Early-bird registration deadline: February 7

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EB Experimental Biology

2022 PHILADELPHIA APRIL 2–5