THE Physiologist MAGAZINE

JULY 2020

THE WORLD IN HER SIGHTS

Astronaut and comparative physiologist Jessica Meir talks about her adventure off the planet

PhysioScape
Art Contest

american physiological society

2D
Research-based and Interpretive Artwork

YOUR ART HERE

Express your perspective and creativity.

APS Members Only

AUG. 31
Submission Deadline

Enter our inaugural art competition for the chance to have your physiology-themed art displayed at APS headquarters.

Submit Your Original Artwork
physiology.org/physioscape

CONTENTS

FEATURES


16

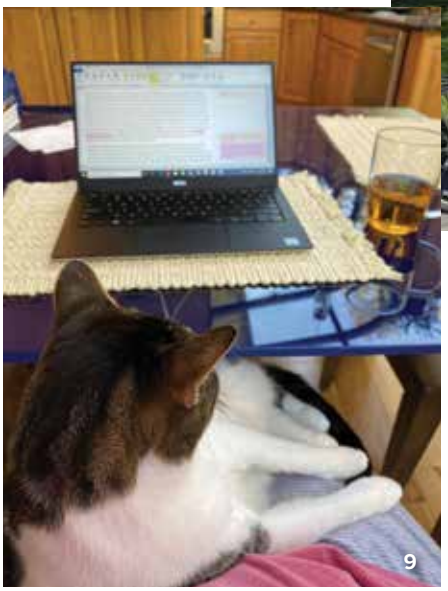

26


22


34

CONTENTS

DEPARTMENTS



9

14

10

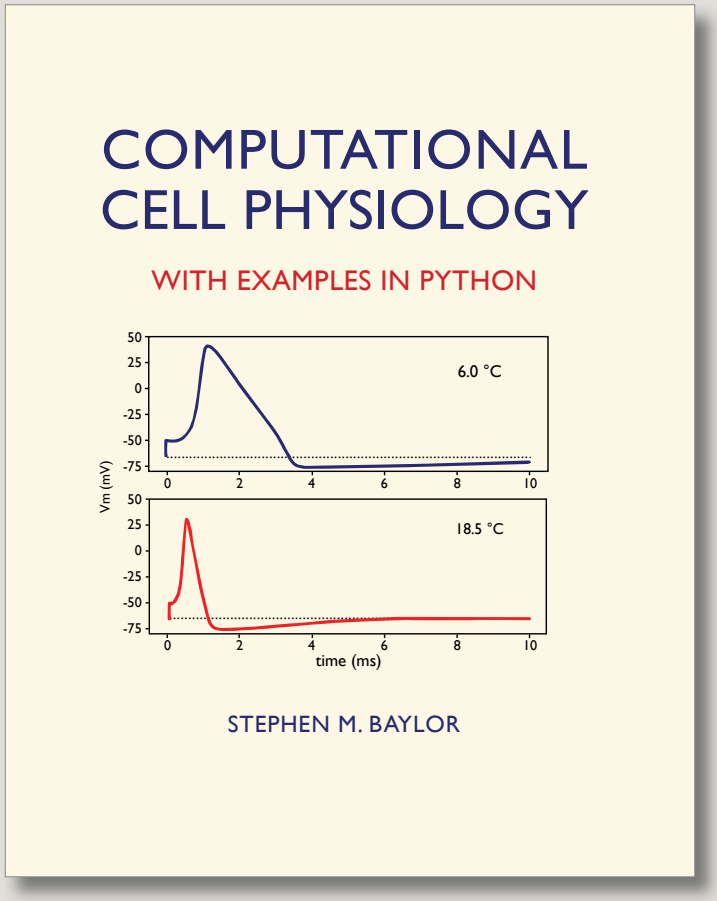
44

NEW TEXTBOOK IN PHYSIOLOGY

Available on Amazon, this book explores the mechanisms that govern the function of nerve, muscle and secretory cells. The laws of diffusion, electricity and mass action are explained and applied to elucidate how cells establish a resting membrane potential, achieve osmotic balance, generate action potentials, initiate secretion and control muscle contraction. Results from a number of historically important experiments are included and discussed. The main text also includes a two-chapter introduction to Python, which is an easy-to-learn modern programming language. Python programs appear selectively throughout the book to illustrate important physiological principles and results. Exercises at the end of each chapter test the student's understanding with quantitative questions, experimental data sets and physiological models. The explanatory text, the Python programs and the chapter exercises provide a unique framework for the exploration of the underlying mechanisms at a quantitative level.

The material is suitable for a one- or two-semester course for advanced undergraduates or early graduate students.

The author is professor emeritus of physiology at the University of Pennsylvania. He is the recipient of a Dean's Award for Excellence in Basic Science Teaching from the University of Pennsylvania and a Javits Neuroscience Investigator Award from the U.S. National Institutes of Health.



No Room for Racism

BY SCOTT STEEN, CAE, FASAE

We are in the midst of a watershed moment. The ongoing list of names of Black people killed due to racist violence—George Floyd, Ahmaud Arbery, Breonna Taylor, Raynard Brooks and so many others—has surfaced a truth that has been denied for far too long: Systemic racism against Black people exists and its consequences are real, wide-reaching and, in some instances, life-threatening or deadly.

Much of the current discussion has centered on much-needed change in law enforcement training, structures and systems, but this is not just a problem of policing. Every industry must grapple with its track record on racial equity, including the scientific enterprise. APS members and staff must do the same work that the rest of society is doing: reflecting on how our systems, attitudes and personal biases work to perpetuate inequality and figuring out ways to remedy these inequities.

"APS members and staff must do the same work that the rest of society is doing: reflecting on how our systems, attitudes and personal biases work to perpetuate inequality and figuring out ways to remedy these inequities."

The APS Diversity & Inclusion Committee, chaired by Karla Haack, PhD, has been working with APS staff leadership to identify specific short- and long-term ideas that can help make the Society more equitable and inclusive. We are in the process of piloting new initiatives that include:

- making diversity, equity and inclusion (DEI) a goal-level item in our 2020 strategic plan, which requires the establishment of specific and separate achievement-based metrics, planning and targets;
- devoting more money to power our DEI programs and initiatives, starting with an initial investment of at least $75,000 in 2020;
- providing diversity and inclusion training for all staff and APS committee members;
- expanding the diversity of the APS Council, committees and section leadership;
- expanding and strengthening mentorship programs to build a pipeline of tomorrow's scientific leaders of color;
- working with organizers and selection committees to expand the diversity among APS marquee award winners and speakers at APS conferences;
- launching a diversity and inclusion symposium; and
- developing resources to empower individuals to create more inclusive workplaces.

We're aiming to get the majority of these initiatives enacted by the end of the year. We will also be soliciting member feedback in an APS inclusivity climate survey later this year and look forward to your honest opinions.

These are just the first steps. In many ways, the tactical details are the easy part. Bringing about a cultural change in science—as with society at large—will be the part that requires the hardest work of self-reflection and individual change. It's time to have the tough conversations, engage in deep listening and explore how best to address the challenges faced by those in underrepresented communities and act as a force for meaningful, positive change.

But in the midst of so much challenge lies opportunity—the opportunity to get to know our colleagues on a deeper level and develop more understanding of where we've come from so we can truly start the journey forward together.

I ask that you all join with us as we accelerate to a more diverse, equitable and inclusive future.

Scott Steen, CAE, FASAE, is executive director of the American Physiological Society.

DSI™
a division of
Harvard Bioscience, Inc.

Visit datasci.com to schedule your free consultation!

Achieve your research potential

Get the data you need with preclinical physiologic monitoring systems and services designed to free you up to focus on your research.

PhysioTel™ Implantable Telemetry

Collect high-quality physiologic data from conscious, freely moving animals with implantable telemetry, the gold standard in cardiovascular monitoring. Available endpoints include blood pressure, ECG, EEG, blood glucose, temperature, and more. Telemetry enables a reduction in stress induced by handling or restraining animals and the number of animals needed to complete a study.

Buxco® Respiratory Solutions

Collect high-quality respiratory data in applications ranging from whole body plethysmography to more in-depth lung function analysis. Available endpoints include respiratory rate, tidal/minute volume, resistance, compliance, and more. DSI's Buxco respiratory chambers can be combined with other research approaches such as telemetry, optogenetics, or infusion to get more out every study.

Looking to perform e-cigarette or vaping research?

Try our new smoke generator with flexible options for delivering smoke from e-cigarettes, vaping devices, or traditional tobacco cigarettes. The generator can be easily combined with Buxco respiratory or inhalation solutions.

Visit datasci.com to schedule a free consultation and let's create a plan to ensure your success!

The Physiologist MAGAZINE

VOL. 63 | JULY 2020

The Physiologist Magazine is published bimonthly and distributed by the
American Physiological Society (APS).
6120 Executive Boulevard, Suite 600, Rockville, MD 20852-4911

SUBSCRIPTIONS
The Physiologist Magazine (ISSN 0031-9376) is distributed to members as part of their membership. Nonmembers in the U.S. (print only): Individuals $260. Nonmembers international: Individuals $315. Tier definitions/custom pricing: www.physiology.org/tiers.
The American Physiological Society assumes no responsibility for the statements and opinions advanced by contributors to *The Physiologist Magazine*. Please notify the APS Membership Department of changes to your address or telephone number.

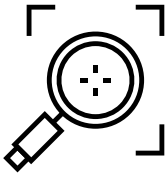
Phone: 301.634.7118 | Fax: 301.634.7241 | Email: tphysmag@physiology.org | www.physiology.org

Printed in the U.S. by Cenveo Publisher Services on acid-free paper.
Please recycle.

FUNCTION™

american physiological society

Function is a new multidisciplinary, high-tier journal publishing **major advances** that extend the physiological understanding of biological function and the changes associated with disease states.

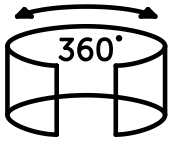


FUNCTION FOCUS

This new type of short focus article reports on a new and important observation. These "quick release" articles allow for solid research to be reported without all the ramifications expected in a full research paper.

NEW STYLE EVIDENCE REVIEWS

These articles will evaluate the factual evidence in a field and, therefore, only cite original articles and not other reviews.



PERSPECTIVE ARTICLES

For full, original research articles, *Function* will include a perspective, opinion or commentary article from a top expert in the field providing an elevated point of view on the scientific impact of the article.

FINAL DECISION AFTER INITIAL REVIEW

Submitting authors will receive a firm decision about acceptance or rejection after the initial review, even if revisions are needed.

Submit Your Research

academic.oup.com/function

The coronavirus pandemic forced education and conferences online and changed everyone's plans. Physiologists and other scientists have been sharing through Twitter how they are learning and living through the pandemic.

How are you dealing with the coronavirus quarantine? 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.

Nique Bruce
@bruce_nique

Hands down, this was the most relevant and practical symposiums I've listened to this far in my academic journey! Thank you @APSPhysiology and @expbio

12:57 PM • May 27, 2020

Chelsea Weaver
@ChelCWeaver

This APS career symposium is already really great, but the fact that Thessa Hilgenkamp has had a meme on pretty much every slide is giving me life today 🙌 #expbio

1:48 PM • May 27, 2020

Christine Lattin
@c_lattin

We took old crayon fragments & put them in a silicone ice cube mold at 275 F for about 15-20 minutes to make NEW AWESOME SQUARE CRAYONS @lsuscience

7:18 PM • May 19, 2020

Angeline Dukes
@FutureDrDukes

Our Italian postdoc taught us how to make pizza from scratch! And she shared her chocolate tiramisu recipe with me 🤗❤️ #LabQuarantineFun 🍕🍫 #AmateurChefs #BakingQueens

1:17 AM • Apr 28, 2020

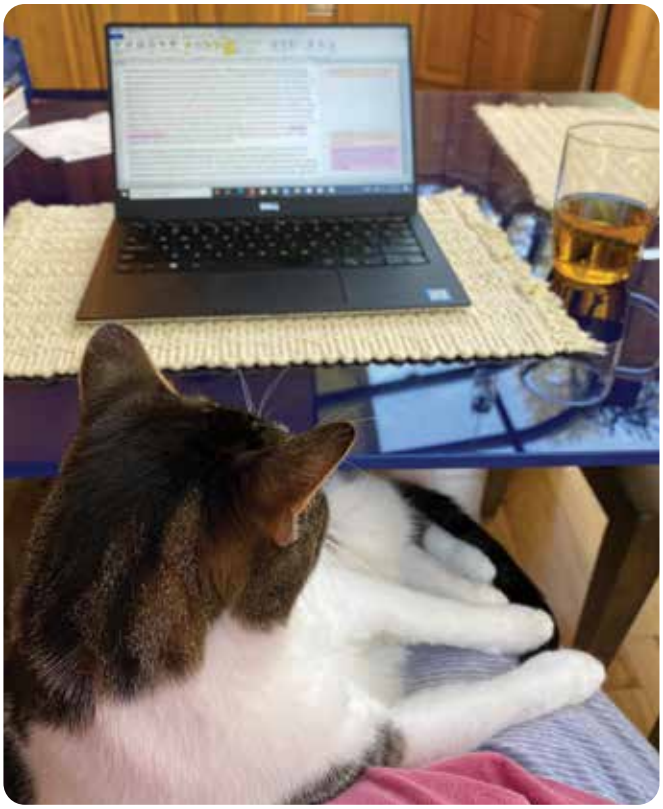
Lindsey A Ramirez
@_La_Ramirez

Dr. Paul O'Connor created a whole virtual trivia game for our joint lab meeting today. It was a blast and a nice way to start a rainy morning. @jensull56139602 @S_Ray_09 @eegillis @ElinorMannon @AbaisBattad @DasingerJh @BelangerKasey

10:49 AM • May 26, 2020

Rebecca
@RebeccaKrisher

This is one furlough morning routine that I do enjoy!



11:30 AM • May 26, 2020

Dr. Bates, At Home
@BatesPhysio

I think I spend 90% of my day wiping surfaces.

1:40 PM • May 28, 2020

Follow APS on Twitter: @APSPhysiology @SciPolAPS @APSPublications

LAB NOTES

STATS & FACTS

10,973

The meters above sea level of the highest recorded flight of any bird, recorded in 1973 when a Rüppell's griffon vulture collided with an airplane

Smithsonian's National Zoo & Conservation Biology Institute

RESEARCH FIZZ

COVID-19 pandemic, coronaviruses and diabetes mellitus

This perspective piece explains how behavior of previous coronaviruses, together with physiological characteristics of diabetes, may be why people with diabetes have a higher risk of developing COVID-19.

***American Journal of Physiology-Endocrinology and Metabolism*, March 2020**

https://doi.org/10.1152/ajpendo.00124.2020

MENTORING Q&A | TEACHING TIPS

Student Support

How to help students struggling in your program.

Each issue, we'll ask a trainee to pose their career questions to an established investigator and mentor. Here, Victoria Halperin Kuhns, PhD, a postdoctoral fellow in renal physiology at the University of Maryland School of Medicine, asks Katie Johnson, PhD, an independent education consultant at Trail Build LLC and a former biology faculty member and chair, how to support students when they appear to be struggling or disengaged.

Illustration, above right, by Kagan McLeod; lower left: iStockphoto

Q: How can I support students committing a lot of time and energy to my course but who are still struggling to learn key concepts?
A: Invite them to have a conversation with you. As the educator, accept the responsibility of directing the discussion. What are the student's current tactics for learning the content? Have them describe a time when they learned difficult content in the past. What helped them then?

Ask very basic questions about the content and work your way to more nuanced questions. The student may be harboring a misconception about a foundational concept that prevents them from conceptualizing more difficult content. Ask them to draw diagrams to explain their answers.

Discuss the benefits of working through difficult concepts with study groups, rather than isolating and rereading the text. Reinforce these benefits with class discussions about how both struggling and thriving students are more likely to excel when they regularly participate in effective study groups.

Q: How do I motivate students who are completely disengaged from my course?
A: Don't take it personally. There are many reasons a student may not be engaged. Once again, communication is the key. Arrange a conversation, and approach the discussion with concern and support, avoiding accusation and blame.

One possible way to start the conversation is to ask the student how the course is going. How are they doing in their other courses? What else is going on in their life? Do they have other major commitments that might be overwhelming right now? It is possible, given the student's professional and academic goals, the grade of a C is OK or even an accomplishment and they are happy to continue as is.

Another possibility is the student is completely overwhelmed with school and other commitments, and a realistic discussion about whether this is the right time to take your course—or even be a student—may be appropriate. If you have ruled out major life concerns, it is likely the student is struggling, rather than simply disengaged. Guiding them through conversations to determine where they are struggling, working with them to find a study group and connecting content to their day-to-day life will be helpful. Often, just the conversation goes a long way.

Q: What about students who have career aspirations, such as professional school, but do not have the grades or experience necessary to be competitive in the application process?
A: Despite what you think of their abilities, walk students through a realistic path from where they are today to where they want to be. The student should next consider if this path full of logistical, financial, emotional and psychological hurdles is how they want to spend their time. (Potential hurdles could include retaking courses, earning certifications, working entry-level health care jobs, finding time to study in demanding pre-professional and professional school environments, and navigating years of heightened stress and strain.)

What type of lifestyle does the student want in 10 years? Does this path match this lifestyle? Focus the conversation on if they want to take this path rather than if they can do it. Completely avoid discussions of their abilities and intellect, as it will ruin your working relationship, crush their morale and probably just make them dig their heels in deeper. On the bright side, providing a road map, no matter how difficult, may serve as a motivating force for student success. I have seen it happen!

Got a career question you'd like to submit? Email it to education@physiology.org and we'll consider it for an upcoming Mentoring Q&A.

iStockphoto

RESEARCH FIZZ

Potential role of oral rinses targeting the viral lipid envelope in SARS-CoV-2 infection

An evidence review article finds that readily available dental mouthwashes have the potential to destroy the lipid envelope of coronaviruses, combating virus replication in the mouth and throat. The researchers conclude there is an urgent need to test the effectiveness of this approach in clinical trials.

***Function*, May 2020**

https://doi.org/10.1093/function/zqaa002

STATS & FACTS

16

The number of times the International Space Station orbits the Earth every 24 hours

NASA

STATS & FACTS

13,696

The cubic feet of the habitable portion of the International Space Station, larger than a six-bedroom house

NASA

STATS & FACTS

42

The number of assembly flights needed to transport International Space Station modules into space

NASA

RESEARCH FIZZ

What makes long-term resistance-trained individuals so strong? A comparison of skeletal muscle morphology, architecture and joint mechanics

This study suggests that larger muscle volume and differences in muscle fiber (fascicle) length in people participating in long-term resistance training contributes to increased muscle strength.

***Journal of Applied Physiology*, April 2020**

https://doi.org/10.1152/japplphysiol.00224.2019

STATS & FACTS

5,100

The meters above sea level of the highest permanently inhabited town in the world—La Rinconada, Peru

High Altitude Medicine & Biology

POLICY IQ | COVID-19 CRISIS

Pandemic Upends Postdoctoral Training

BY ERICA LITTLEJOHN, PHD

Postdoctoral training is practically a prerequisite for PhD-holding scientists who wish to be competitive for an academic tenure-track faculty position as a biomedical researcher.

However, competition is fierce, and less than 20% of postdoctoral scholars secure these coveted faculty positions in the U.S. within 10 years of completing their training. This reality is enough to stir anxiety and imposter syndrome to last a lifetime—and that was before the COVID-19 pandemic.

The current postdoc career timeline can be split into two parts: the time before COVID-19 (BC) and the aftermath dilemma (AD). This may seem melodramatic to veteran tenure-track faculty or morose to hopeful PhD candidates. However, as a current neurophysiology postdoctoral scholar, I can confirm that the COVID-19 pandemic has dramatically interrupted the lives of trainees, practically and emotionally.

Postdocs are struggling with strategies to keep their studies moving forward, meet benchmarks and publish research articles when the majority of their resources are only accessible virtually. There are no clear-cut answers as to when research will ramp back up to full speed. Even worse, the pathway to a successful career in academia is becoming increasingly unclear. Because of the financial strain of the pandemic, many academic institutions have announced hiring freezes. Essentially, during AD, even if trainees reach their personal best, the job market for highly trained biomedical scientists may be non-existent.

As an African American woman, I also must grapple with the fact that a decrease in opportunities will disproportionately affect women and minorities. Despite our efforts, the biomedical research workforce is suffering from limited representation of women and African American scientists. There are many external and internal factors influencing the nearly nonexistent representation of Black women in biomedical research tenure-track faculty positions. However, a lack of financial security is widely reported as an internal factor that can negatively influence an underrepresented minority (URM) researcher's decision to remain in academia.

Postdoctoral training is already an isolating stage of your career. For many URM trainees, this feeling is often intensified when they are the only minority in their lab or department. This isolation is no doubt compounded by necessary isolation and physical distancing required to protect yourself and others from coronavirus infection. Aspirations to be the first member of my family to earn a PhD and a position as tenure-track faculty at a premier medical school were never for the faint of heart. However, the added layer of uncertainty increases anxiety about future job security.

Erica Littlejohn, PhD, is a second-year cardiovascular-neurophysiology postdoctoral fellow at University of Texas Health Science Center in San Antonio. She was recently awarded an APS Early Career Advocacy Fellowship.

far left: iStockphoto

POLICY IQ | REMOTE ADVOCACY

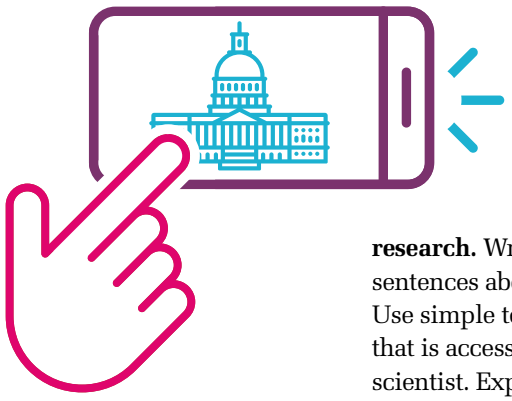
Let Lawmakers Know How the Pandemic Affects Research

During a typical Washington, DC, spring, the city is flooded with people who come to Capitol Hill seeking support from Congress. However, in 2020, physical distancing measures closed congressional offices to visitors. This has presented a huge challenge for elected officials, who rely on constituent meetings to inform them how to serve the needs of their districts.

Despite the current disruptions, members of Congress still need to know the pressing needs of their constituents.

First, find and learn about your representative online. You can identify your U.S. representative and senators and get links to their websites at **www.govtrack.us**. Their websites should also tell you how to contact them right now. Gather basic information about your member and their district/state on their websites before you contact a congressional office. The Federation of American Societies for Experimental Biology (FASEB) also has fact sheets about each state or district's federal biomedical research funding. Visit **http://bit.ly/FedResearchFundingMap**.

Constituents usually meet with congressional staff, who are often quite knowledgeable about the issues they handle. Their job is to keep the elected official informed about constituents' concerns.



Before contacting the office, prepare what you plan to say. If you call, it is important to be able to state your message succinctly. Below are talking points you can use to draft an email or initiate a phone call:

- **Introduce yourself as a constituent and member of the American Physiological Society (APS).** While you should tell them where you work, be clear that you are not contacting the office on behalf of the institution.
- **Thank them for supporting biomedical research.** Over the past several years, the budget of the National Institutes of Health (NIH) has increased significantly. Unfortunately, budgets for other agencies, such as the National Science Foundation (NSF), have stagnated. Most members of Congress support research, even though they may oppose funding bills for other reasons. Therefore, it's a good idea to start by thanking them.
- **Briefly explain your research.** Write two to three sentences about your work. Use simple terminology that is accessible to a non-scientist. Explain how answering your research question could improve the health of people, animals or the environment.
- **List federal agencies that fund your lab.** Give examples of federally funded research that have sparked innovation. Point out how research agencies support students and trainees, who will become the next generation of scientists.
- **Explain the impacts of the pandemic.** Most labs shut down abruptly, but many researchers continue to pay their research staff and trainees. List what these costs are and what it may cost to get your work restarted. Congress included some COVID-19 research funds in the first emergency aid packages, but it is crucial for legislators to understand why supplemental funding is needed to continue paying staff and to enable both researchers and students to complete their work.
- **APS supports the principle that research success requires predictable, sustainable funding increases.** APS supports the following recommendations for federal research agencies for fiscal year 2021:
  - NIH: at least $44.7 billion
  - NSF: at least $9.4 billion
  - VA Medical and Prosthetic Research: at least $860 million
  - NASA Life Sciences Research and Human Research Program: Due to the complexities of the NASA budget, APS does not specify a dollar amount. Instead, we recommend increasing life sciences research to improve the safety of human spaceflight.

More advocacy resources can be found on the APS website at **www.physiology.org/advocacy** or by emailing sciencepolicy@physiology.org.

Kirkton riding bikes with his daughters, Zoe, in the middle, and Piper.

UNDER THE MICROSCOPE

Rapid Fire Q&A

Scott D. Kirkton, PhD, shares why he became a scientist, the ironic thing he was scared of as a kid and how grasshoppers got him out of a speeding ticket.

Q: Ever had a "eureka" moment? Tell us about it ... in 10 words or less.
A: Watching insects respire inside the Argonne National Laboratory X-ray Synchrotron.

Q: What inspired you to become a scientist?
A: As a rising sophomore at Denison University in Ohio, the only upper-level biology course that I could get into was honors entomology. I signed up for it even though I was scared of insects. The class taught every aspect of biology through insects. The idea that there was so much around me that I ignored (or had been scared of for so long) made me want to learn more.

Q: How has the coronavirus pandemic changed the way you work?
A: Balancing online teaching, research and homeschooling my two young daughters has led me to try to be as productive as possible with every available moment.

Q: Favorite lab mishap story that you can share without incriminating the innocent?
A: I was in Southern Arizona collecting large Western horse lubber grasshoppers, which can weigh up to nine grams. I had numerous brown paper bags full of them—about 50 animals total—and was driving the two hours back to our lab at Arizona State University. I was pulled over for speeding by a state highway patrol officer. He walked up to the car and heard all the rustling from the moving paper bags in the backseat. I showed him the insects, and he was so freaked out by the grasshoppers that he told me to "just go."

Q: Best "MacGyver" moment in the lab?
A: To better visualize the insect tracheal system using electron microscopy, I modified an old Wigglesworth experiment and filled a grasshopper's tracheal system with electron-dense peanut oil. To do this, I used a magnet to suspend a grasshopper above a beaker of oil inside an old department lyophilizer (a piece of equipment used for freeze-drying). After the grasshopper was under vacuum and the air removed from its tracheal, I removed the magnetic field and dropped it into the oil. Then, I slowly increased pressure to fill the tracheal system.

Q: If you could do a sabbatical with any scientist (living or dead) who would it be and why?
A: Sir Vincent Wigglesworth. Well, first, he has the best scientist name ever. Second, he was arguably the greatest insect physiologist and contributed to our understanding of hormones, metamorphosis and respiration.

Q: Briefly, what do you wish the general public understood about science or research?
A: Science is not political.

Q: No. 1 guilty pleasure?
A: M&M's.

Q: Most influential scientist on your career?
A: Jon Harrison, my PhD adviser. Jon is not only the best scientist I know, but he prioritizes his family and personal relationships over his work.

Q: Favorite science-related TV show (fictional or factual)?
A: "House MD."

Q: First place you plan to visit once the pandemic-related travel restrictions are lifted?
A. My parents in Ohio.

Q: Biggest misconception about physiology/physiologists is ... in five words?
A: It is all about mice.

Q: Most valuable quality in a colleague?
A: Someone who can listen first and then tell you why you are wrong.

Q: Tell us a surprising fact about you.
A: My mom did my fifth grade bug collection because I was scared of insects.

Q: Favorite part of your job?
A: Working with students in my research lab to help them find their academic passions.

Q: Least favorite part of your job?
A: Grading.

Q: How would you describe your job to a child?
A: I am basically a car mechanic for animals. I am interested in studying what happens on their insides.

Q: Next book on your reading list?
A: "Stripped Bare: The Art of Animal Anatomy."

Q: Favorite TV show, movie series or podcast to binge-watch/listen?
A: "Parks and Recreation."

Q: Favorite musician/musical artist/band?
A: Beastie Boys.

Q: Go-to snacks to get you through long days working from home?
A: Pretzels.

Q: The question we didn't ask that we should have?
A: Who is your favorite public science figure? Sir David Attenborough.

Scott D. Kirkton, PhD, is an associate professor of biology and secretary of the Faculty Executive Committee at Union College in Schenectady, New York. He has been an APS member since 1999. He currently serves as the chair of the Comparative & Evolutionary Physiology Section and is the chair-elect of the Section Advisory Committee.

Above: Kirkton with his grasshopper colony. Left: Kirkton met his public science hero, Sir David Attenborough, in 2005.

PUBLISH WITH POLISH | CORONAVIRUS RESEARCH

APS Journal Programs Promote Hot Research Topics

With the COVID-19 pandemic dominating the news and affecting all aspects of society, dissemination and promotion of scientific research have become even more important as public services. The APS journals have long sought to highlight, promote and disseminate "hot" research topics through various means, including calls for papers, the *APSselect* program, press releases and social media. We also create special resources for areas of immediate interest—such as COVID-19 research.

Calls for papers are issued by the journal editors to highlight current, important and timely areas of research. Authors can submit papers in answer to these calls, and published call-related articles are highlighted with a special "call for papers" subject banner and are included in the online article collection for that call at time of publication. You can see the full list of current calls for papers at **https://journals.physiology.org/calls**.

APSselect focuses on promoting outstanding scientific discoveries published by APS each month. *APSselect* articles are selected from the most recent issues of the 10 APS research journals. The journal editors nominate two of their most exciting papers, and the *APSselect* editorial team makes its final selection from these nominated articles. For more about the *APSselect* program, see **https://journals.physiology.org/apsselect/about**.

Due to the extraordinary nature of the coronavirus outbreak, APS journals have taken special measures to assist with the dissemination of COVID-19–related articles in addition to APS' regular channels. Read the growing list of relevant articles on the COVID-19 collection page at **https://journals.physiology.org/covid19**.

RESEARCH FIZZ

COVID-19, ACE2 and the cardiovascular consequences

This perspective piece explores the cardiovascular benefits of angiotensin-converting enzyme 2 (ACE2) and whether blocking ACE2 may help improve symptoms of COVID-19.

***American Journal of Physiology-Heart and Circulatory Physiology*, May 2020**

https://doi.org/10.1152/ajpheart.00217.2020

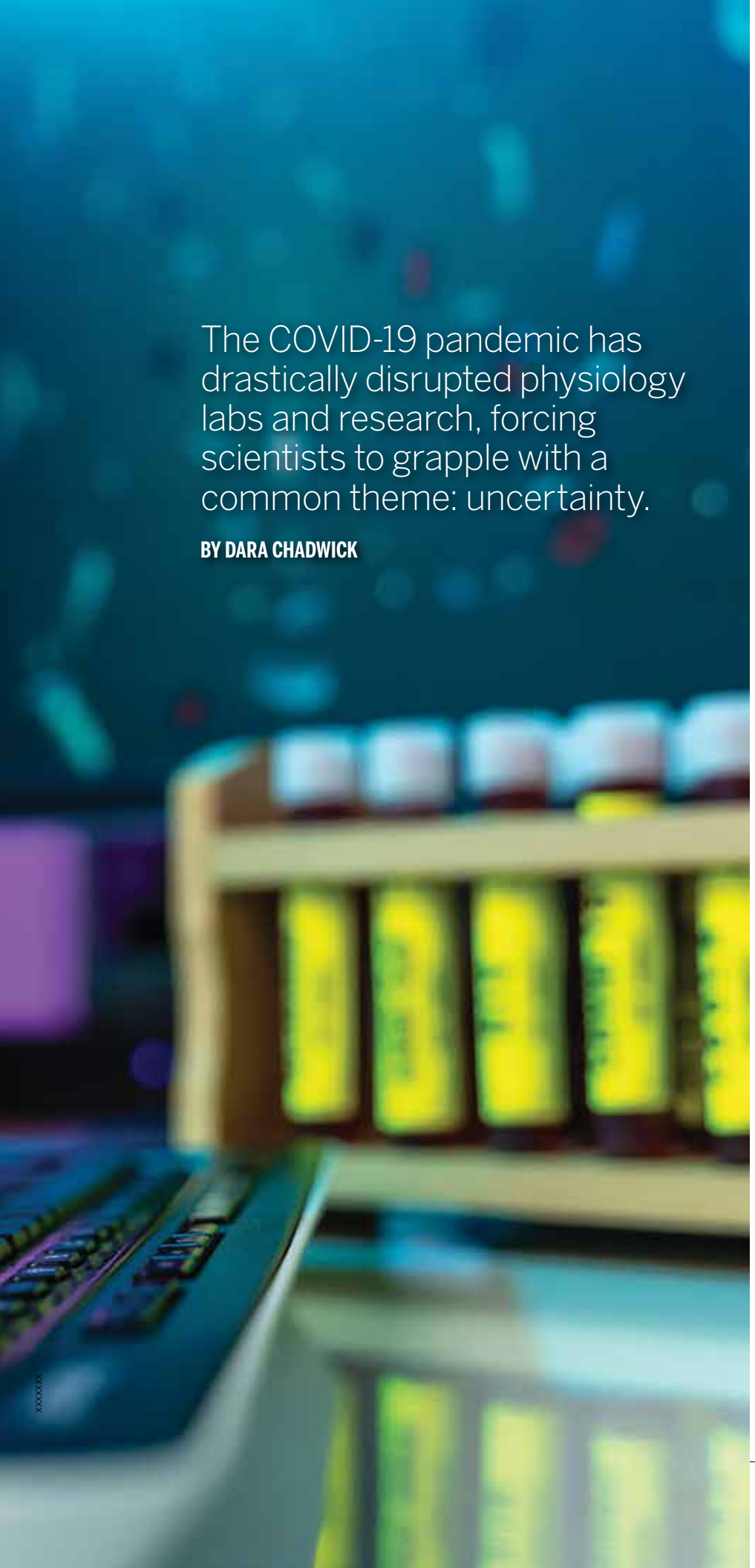
STATS & FACTS

2,992

The meters below sea level for the deepest recorded dive of any mammal, performed by a Cuvier's beaked whale

PLoS ONE


Idle
Labs



The COVID-19 pandemic has drastically disrupted physiology labs and research, forcing scientists to grapple with a common theme: uncertainty.

BY DARA CHADWICK

The unexpected comes with the territory in research science. But even those who expected COVID-19 to have some impact on life in the lab say the disruption to their research has gone far beyond what they anticipated. While most labs have plans for managing operations through natural disasters and unforeseen complications, many have made on-the-fly adjustments that include remote work, physical distancing and project pivots.

Lila Wollman, PhD, a postdoctoral research associate in the Department of Physiology at the University of Arizona in Tucson, says her lab has been able to continue some work by shifting schedules. "There are no in-person classes, but research hasn't completely closed down," she says. "We had to submit a waiver and get specific approval to not shut down our lab. We have a waiver in place, and we completely stagger our schedules so no two people are ever overlapping in the lab."

Interviews for this article were conducted in late April–early May. Some of the restrictions may have changed as you are reading this.

It's been working well, she says. While there are other labs on her floor, the lab next door is closed. Wollman comes in from 7:30 a.m. to about 12:30 p.m. three days a week. The lab's graduate student comes in after 1 p.m., and the lab technician comes in on the other two days.

"Occasionally, I'll see someone way down the hall, but when I go to work, I truly am social distancing," Wollman says. "We're committed to safety first. If I felt like I wasn't able to maintain social distancing, I'd definitely have to reevaluate what I was doing."

Wollman says she would typically be in the lab all day, every day, using a rat model to study the control of breathing and how it's affected by nicotine exposure during development. "Now, I'm working about 15 to 20 hours a week in the lab," she says, estimating that her personal productivity in experiments has been cut in half.

Adrienne Wilburn, who is pursuing a PhD in immunology at the University of Cincinnati in Ohio and is housed in the Lewkowich Research Lab at Cincinnati Children's Hospital Medical Center, says she's able to go into the lab as needed. Her work, focused on early disruption of the microbiome and its influence on asthma and lung development, uses a mouse model to monitor airway

Weathering the storm

In 2017, Bruce Wright, PhD, professor of physiology at Ross University School of Medicine headquartered in Miramar, Florida, was ready to launch his pilot study on the impacts of scuba diving on blood pressure at the university's campus in the Commonwealth of Dominica in the Caribbean.

"I had a beautiful setup 100 yards from the sea," he says. "I had 100 students in my scuba club, I was getting my research protocols ready to go, and I had my pilot studies all written up and ready for people to start testing."

Then, Hurricane Maria hit.

"The lab, the whole building, was destroyed," says Wright, who happened to be at a meeting in Chicago when the storm hit. "Everything was gone."

In the years since, Wright says he's been focusing on his first priority—educating students—and on doing educational research while he waits for the equipment he needs to begin his study again. "This was an act of nature," he says. "When you're not in control of things, you find what you can do and you make that work. I'm pretty excited about what I'm doing right now, until the day comes that I can step into a lab again."

What he can do right now, Wright says, is focus on an educational program with cross-applicability to his research. "I can get my pilot data in," he says. "I also have to dig through three years of literature to see what I've missed. The world keeps moving."

To researchers who've been disrupted by COVID-19, Wright offers this perspective: "Everybody is in the exact same boat. Nobody right now anywhere in the world has a competitive advantage over anybody else in the research business. Nobody's leapfrogging you because you can't get to your lab right now. Work from home, and do what I'm doing—writing, planning, all the things that don't involve being in the laboratory."

Keisa Mathis, PhD, principal investigator in the Mathis Laboratory at the University of North Texas Health Science Center in Fort Worth, uses a lupus mouse model to study how long-term inflammation leads to hypertension. "I've been talking to colleagues who are stressed about their labs being closed," she says. "And I've wondered, 'Why am I not feeling stressed?'"

Upon reflection, Mathis says she doesn't have the same anxiety because she knows she'll get back to work eventually. As a graduate student at Louisiana State University in New Orleans, her lab was closed after Hurricane Katrina hit in 2005. She says it was scary and progress was slow at times, but her lab was able to keep projects moving at the university's Baton Rouge campus until the team could return to New Orleans.

The experience gave her perspective, she says, adding that while the COVID-19 shutdown wasn't planned, most labs had some time to complete critical project components—unlike the immediacy of Katrina's closures.

Still, other factors, such as parents having to manage children's education while trying to work remotely, make COVID-19 a uniquely stressful experience, she says. "Everyone has their own storm going on right now. But we will get back to the lab, and the work will continue."

function and lung development in pregnant mice.

"Children's has been really great," she says. "They've left it up to the principal investigators to decide which experiments are critical and which can be ended sooner or sidelined. I'm at a part of my project where I can go in just a few times a week to check on the mice and that's sufficient. But I've been working at home mostly."

AN UNCERTAIN PATH

Other researchers have seen their work come to a halt. "Everything's on hold right now," says Sonnet Jonker, PhD, associate professor in cardiovascular medicine at the Oregon Health & Science University School of Medicine in Portland. Jonker, who studies cardiac development in the perinatal period, uses sheep to study the physiology that drives anatomical changes in the heart during fetal development.

"We're able to do surgery on pregnant ewes and place catheters, flow probes and other devices," she says. "We let them recover from surgery and then we measure physiological parameters continuously for several weeks during the period of pregnancy we're interested in. This is really quite unavailable in other animal models."

But her sheep model has proven challenging in light of COVID-19's impact, says Jonker, who serves as chair of the APS Animal Care and Experimentation Committee. "We're in a rather unique situation with large animals," she says. "To do any work with sheep, including euthanizing them, we have to have multiple people there. You can't do that work alone. Throughout the nation, policies related to animal work are really geared toward rodents because they are the overwhelming majority. Universities are having to approach large animals on a case-by-case basis."

"We're committed to safety first. If I felt like I wasn't able to maintain social distancing, I'd definitely have to reevaluate what I was doing."

—Lila Wollman, PhD

Because sheep are seasonal breeders, Jonker does most of her animal work from October through April, so that portion of her work was winding down as COVID-19 closures began. "We're also a hospital, so the university was backing off any work that used personal protective equipment (PPE) on the research side," she says. "Our comparative medicine department actually donated tens of thousands of masks to the hospital side."

Jonker was able to petition the university for an exemption for one animal in which research was ongoing and the plan couldn't be changed, she says. "We have critical function employees designated, so we had a reduced staff that went in to do that work," she says. Normally, her lab would have been doing polymerase chain reaction, cell culture and histology work by May, but none of that could be done. As of early May, "we're not really generating any new data or doing any new work."

But Jonker says the biggest issue she's facing is uncertainty. "Sheep gestation is 147 days long, and we do most of our work in the last third of gestation and a bit in the neonatal period," she says. "To start our work at the regular time in the fall, our supplier needs to start breeding the sheep in May. We have no idea where this is going. We have no idea when we're going to be able to go back to work."

"A big question is how to deal with this in the context of graduate students, especially those who were about to complete experimentation. We're trying to be as accommodating as possible, but we have to maintain standards for the program."

—Gregory Funk, PhD

Likewise, Gregory Funk, PhD, professor in the Physiology Department at the University of Alberta in Edmonton, Canada, is facing uncertainty around his animal models. Funk uses rat and mouse models to study networks in the brain stem that produce and control breathing, as well as how those networks change during development and respond to hypoxia.

"The university is open for essential services and essential research," he says, adding that he applied for and received an exemption for one of his studies. "I have one person in the lab one day a week to complete a longitudinal study with a transgenic mouse line that had already started when the closures were introduced. Aside from that, my lab is closed, and that's the case for most labs on campus. Staggering schedules was not considered a viable option. So, aside from a few exemptions like mine, the research has stopped."

That creates a challenge for future work, according to Funk. "Because we need neonates, we typically have a lot of breeding pairs run every week," he says. "That's all been scaled back to maintenance of the colonies. When we get back, we can't just start up right away because we won't have animals. They will have to go through at least one breeding cycle to get the colony back up to size. Once we get back in the lab, it's probably going to be another six to eight weeks before we're really doing experiments again."

RIPPLE EFFECTS

Funk says the uncertainty of the lab's status is taking a toll on graduate students who tend to be on a timeline, with limited resources and income. "I run our graduate program in the Physiology Department, and a big question is how to deal with this in the context of graduate students, especially those who were about to complete experimentation," he says. "We're trying to be as accommodating as possible, but we have to maintain standards for the program."

Funk praised the Canadian Institutes of Health Research (CIHR) for issuing guidance to research labs who use grant money to pay research staff. "They came out with a statement saying that supporting our research workforce is a priority and that paying these staff is an eligible expense even though most of them are not in the lab doing research right now," he says.

Funding is another issue some researchers with shuttered labs will need to address, Funk adds. CIHR runs two grant rounds each year, and the last round at the beginning of March was canceled. "People who had grants submitted can take them back and revise them or leave them in and they'll be added to the pool for the next competition," he says. "But one entire grant round was removed from the system. Some people are going to have a gap in funding if their grants didn't renew last time."

The unknowns of a still-evolving situation make planning difficult, but Jonker and her team are trying to put together contingency plans. "We're asking 'what if we can't get the PPE we need for surgeries and we order these animals, what can we do?'" she says. "If we can't gather in groups of more than three, what can we do? If we can only get two people in the lab at the same time—if that's the most they'll allow us—then how do we need to change what we do in order to make the work happen?"

FINDING THE POSITIVE

Jonker has been talking with colleagues about what can be done while the lab is closed. "Rather than dwelling at length on what we can't do or what we've lost, we're thinking about ways to move forward," she says.

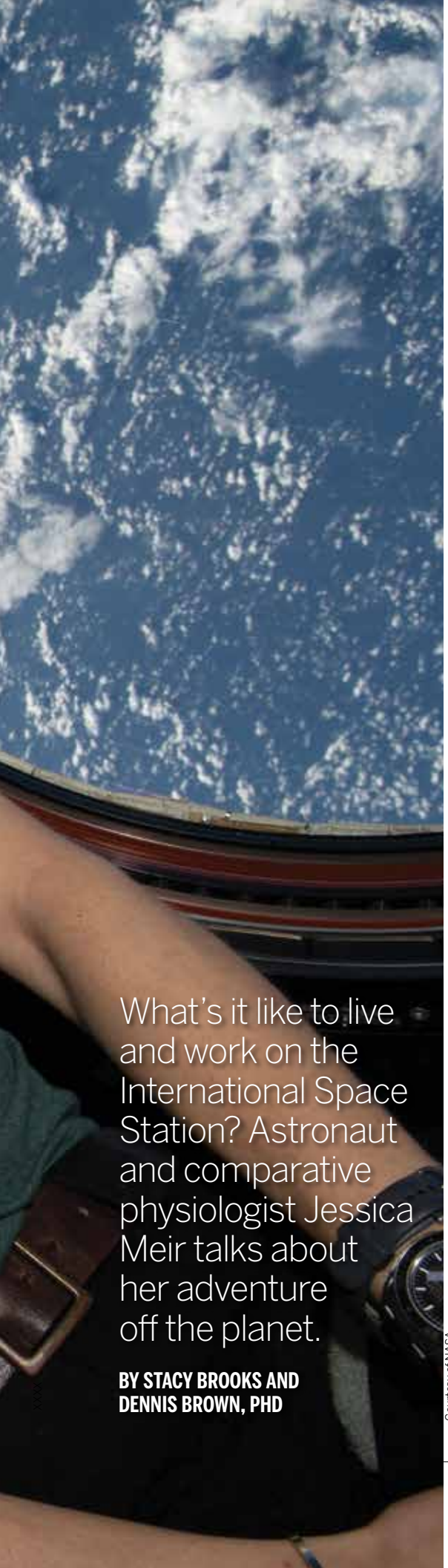
Funk, who canceled his attendance at a conference in Switzerland as COVID-19 was beginning to spread, says at that time he told everyone in his lab to start doing as many experiments as they could. "I told them we will not be here for much longer," he says. "So, people just started cranking as much as they could, knowing they could do the data analysis later. That helped."

Wollman knows how lucky she is to be able to continue her experiments. "It's great to be able to go into work, even if it's just a couple of days a week," she says. "It helps maintain some kind of normalcy and routine. I have grants I want to apply for that I've been thinking about for a while. I'm close to being at a point where I'm going to need to stop and just write. This has forced me to get started, and that's not necessarily a bad thing."

As for Wilburn, she's using this time to focus on thinking about her thesis. Although a conference she was supposed to attend was canceled, she's reading papers, organizing and collating data, and thinking about ways to do her work that will be useful down the road, she says.

Still, it can be tough to tune out the ever-present anxiety. "I know graduate students who are at a standstill and early-career faculty who are trying to get their labs established and can't make any progress on their research," Wollman says. "Who knows how long all of this is going to be going on? I think it's realistic to think it will be going on for a while and that some of the things that are going well now might be impacted later."

The World in Her Sights



Courtesy of NASA

What's it like to live and work on the International Space Station? Astronaut and comparative physiologist Jessica Meir talks about her adventure off the planet.

BY STACY BROOKS AND DENNIS BROWN, PHD

Jessica Meir, PhD, is a member of a very exclusive club. She is one of only 242 people in the world who have ever visited the International Space Station (ISS)—the large orbiting spacecraft that hosts an international mix of crewmembers, equipment and experiments, helping all of us on Earth learn and understand more about living and working in space.

In March, *The Physiologist Magazine* had the opportunity to interview Meir from the ISS as she was finishing up her almost seven-month stint. During her Skype video conversation with APS Chief Science Officer Dennis Brown, PhD, Meir shared the vital role that physiological research is playing as NASA sets goals of sending astronauts back to the moon and eventually to Mars.

PHYSIOLOGY IN SPACE

Physiology is one of the most important disciplines when discussing human space exploration, Meir says. "We need to understand the effects that the space flight environment and microgravity have on the human body. We've definitely made impressive progress over the now decades of research of human spaceflight, but there still are some pretty big unanswered questions, particularly those dealing with radiation."

Meir and the other astronauts on the ISS spend a lot of time in pursuit of these and other answers as they conduct multiple experiments sent to space by researchers from around the world. But that's far from all they do, and on the ISS today, research isn't left up to only the scientists.

"One of the nice things about our roles on the Space Station now is that all astronauts and cosmonauts are really created equal," Meir says. "It's different than things were back in the shuttle program, where the commander and the pilot really focused on being able to land the space shuttle, while others were more focused on science or spacewalks. But now, since we have these long-duration missions—typically about six months—we all have to be able to do everything."

Left: Meir inside the ISS "window to the world," or cupola, as she flies above the middle of the Pacific Ocean.

THE MAKING OF AN ASTRONAUT

Meir attended Brown University in Providence, Rhode Island, as an undergraduate before receiving a master's degree in space studies from International Space University in Strasbourg, France. She earned a PhD in marine biology from Scripps Institution of Oceanography at the University of California, San Diego, where she studied diving physiology of marine mammals and birds. Her postdoctoral work was conducted at the University of British Columbia in Vancouver, Canada.

Before her selection to the 21st NASA astronaut class in 2013, Meir accepted an assistant professor position at Harvard Medical School/Massachusetts General Hospital, working as a marine biologist and physiologist. Her research involved studying "charismatic megafauna"—large animals such as emperor penguins, elephant seals and bar-headed geese. She participated in Smithsonian Institution diving expeditions to Antarctica and Belize. She also found time to become a pilot and learn conversational

Meir conducts cardiac research in the Life Sciences Glovebox in the Japanese Kibo laboratory module. The Engineered Heart Tissues investigation could promote a better understanding of cardiac function in microgravity, which would be useful for drug development and other applications related to heart conditions on Earth.

Swedish. Later, as an astronaut, she learned Russian.

Meir continued to add to her previous accomplishments aboard the ISS, racking up an impressive list of accolades. After her 205-day mission, she ranks sixth on NASA's list of single space flight record holders. She was one of two women, along with crewmate Christina Koch, MS, to conduct the first three all-female spacewalks, logging 21 hours and 44 minutes in spacewalking time. And during her mission, Meir completed 3,280 orbits of the Earth and traveled a total distance of 86.9 million miles.

She says her diverse scientific training prepared her well for the rigors of being an astronaut. The research process, however, "is a lot different from being in academia, where we have a lot of freedom and a lot of flexibility in our schedules, our roles and in what we do.

"As astronauts, everything that we do up here on the Space Station is set out by the Administration and the NASA management, the ground team and all of the program objectives on the ground. Each space station expedition (right now it's Expedition 62) has a set of experiments, a set of hardware tasks, a set of things that have already been established of what needs to done on the Space Station in that given time period.

"We've definitely made impressive progress over the now decades of research of human spaceflight, but there still are some pretty big unanswered questions, particularly those dealing with radiation."

"On the research front, it's just the same. NASA sends out a call for proposals, just like you would have through NIH or NSF, and the science that's selected for that mission is what we end up carrying out. We as individual astronauts onboard don't really have any say in that."

Though she may not have been involved with the selection of the research experiments on the expeditions, the enthusiasm Meir holds for the work being done is clear. She described several of the experiments she and her crewmates were running, including some in which the astronauts themselves were the test subjects.

For example, the Cardiac and Vessel Structure and Function with Long-duration Space Flight and Recovery (Vascular Echo) study examines changes in blood vessels and the heart while in space and following return to Earth. "It's an interesting study building on other data sets of experiments they've already done, and they've actually seen some pretty impressive effects," Meir says. "They've shown that even in a six-month mission, if you look at the carotid artery, for example,

All photoso, pages 24 and 25, courtesy of NASA

the walls of the artery are actually getting thicker and stiffer during space flight, similar to the aging process but in a very much accelerated fashion.

"Some of these changes are equivalent to about 20 to 30 years of aging, which is of course very significant," she explains. "The question of the mechanism behind that and whether or not it persists when we return to Earth is also something we need to know more about."

In the few days leading up to *The Physiologist Magazine* interview, Meir conducted that experiment, getting ultrasounds and echocardiograms to image various blood vessels. "Today, I'm taking my blood pressure every hour, and there are some blood samples associated with that in order to try to look at that problem from many different sides."

She explained another study in which her crewmate Andrew Morgan, MD, was the subject for a "fluid shifts" experiment, which aims to understand more about the upward shift of body fluids experienced in microgravity. "Some astronauts experience vision deficits and some morphological changes to the eye and even to the retinal layer itself during and after spaceflight," Meir explains. "Some crewmembers develop folds in the choroid layer and edema of the optic disk. Luckily, so far, none of those changes have led to any long-term significant problems or pathology post-flight. But, we really need to understand the mechanism behind that to make sure that we can maintain the long-term health of astronauts."

Meir and fellow NASA Flight Engineer Andrew Morgan, left, with Expedition 62 Commander Oleg Skripochka in the weightless environment of the ISS.

Meir waves during the first all-woman spacewalk with fellow NASA astronaut Christina Koch (not pictured). They ventured into the vacuum of space for seven hours and 17 minutes to swap a failed battery charge-discharge unit (BCDU) with a spare. The BCDU regulates the charge to the batteries that collect and distribute solar power to ISS systems.

That particular experiment, Meir says, was especially packed with cool physiological research. "We were using ultrasound. We were using a lower-body negative pressure machine in the Russian segment so that we could actually return blood flow temporarily to take measurements. We were doing tonometry to measure pressure in the eye as well and OCT to image the eye. So it was a really multi-faceted approach to examine aspects of these fluid shifts."

With so much of Meir's recent work focused on how humans might fare on extended missions to space, we had to end our interview with a fun hypothetical question: Which of the diving and flying animals that she previously studied would do the best in the harsh environment of space?

"The animals that I studied were real extremophiles—the most elite divers in their classes—and high-altitude animals—animals that are exceptional in their capability, even in the animal world. Of course, though, space is the ultimate of extreme environments. Neither humans nor any of those animals would be able to survive freely in the vacuum of space since we've all evolved on planet Earth.

"But, I guess in a fun way I'd have to pick the emperor penguin. You can see how agile they are when they're diving beneath the surface, and I think that they would be able to adapt to moving around in micro-gravity quite well," Meir says.

Want to see more of our conversation with Jessica Meir? Watch the full interview at https://bit.ly/APSInterviewWithJessicaMeir.

From left to right: William Milsom, PhD; Lorna Grindlay Moore, PhD; Trevor Day, PhD

FLYING HIGH

Three physiologists share their adventures studying science at high altitudes.

BY HEATHER BOERNER

Physiology is a science that is often conducted within the confines of a lab. But the discipline also takes some researchers to great heights—including above the Himalayas and to the Andes Mountains. Three physiologists tell us how they reached physical and scientific heights.

The Animal Guy

As a kid, you could find William Milsom, PhD, tromping through the woods around whatever Army base his dad was stationed at, turning over logs and making pets of the salamanders, newts and turtles he found there.

Those would join a shed of parakeets and aquaria of tropical fish in the family menagerie. But it didn't occur to Milsom until college that this love of animals could become his career.

Milsom, professor emeritus and former head of zoology at the University of British Columbia in Vancouver, Canada, has been tromping around in the wilderness professionally ever since. He originally thought he'd focus on marine animals, but an expedition to Antarctica in the early 1970s changed all that.

"Studying penguins and giant petrels set everything off," he says. Since then, he's studied animal adaptations to extreme environments.

Today, Milsom is studying two different sets of resident high-altitude birds; one group has been at altitude only for thousands of years. The other, for millions of years.

But he's perhaps best known for his work with bar-headed geese, a unique breed. Bar-headed goose migration takes them from India's humid lowlands to Mongolian grasslands. In between, the birds climb 15,000 feet in the span of 12 hours—and then higher still—to surmount Himalayan passes.

Milsom has found himself in interesting environments—like running wild geese on a treadmill powered by a portable generator in "a tent in the middle of nowhere Mongolia."

"The question had always been, 'What can the birds do? And what do the birds do?" Milsom says. Until the 2000s, scientists didn't have the technology to answer those questions. But then came the advent of 3D accelerometers, GPS tracking by satellite and logging devices. The geese's time had come.

Now they could ascertain whether the birds glided like albatross on trade winds or if they flapped their wings for the entirety of the 3,000-mile journey.

The verdict? "They're not albatross," Milsom quips. "They don't glide."

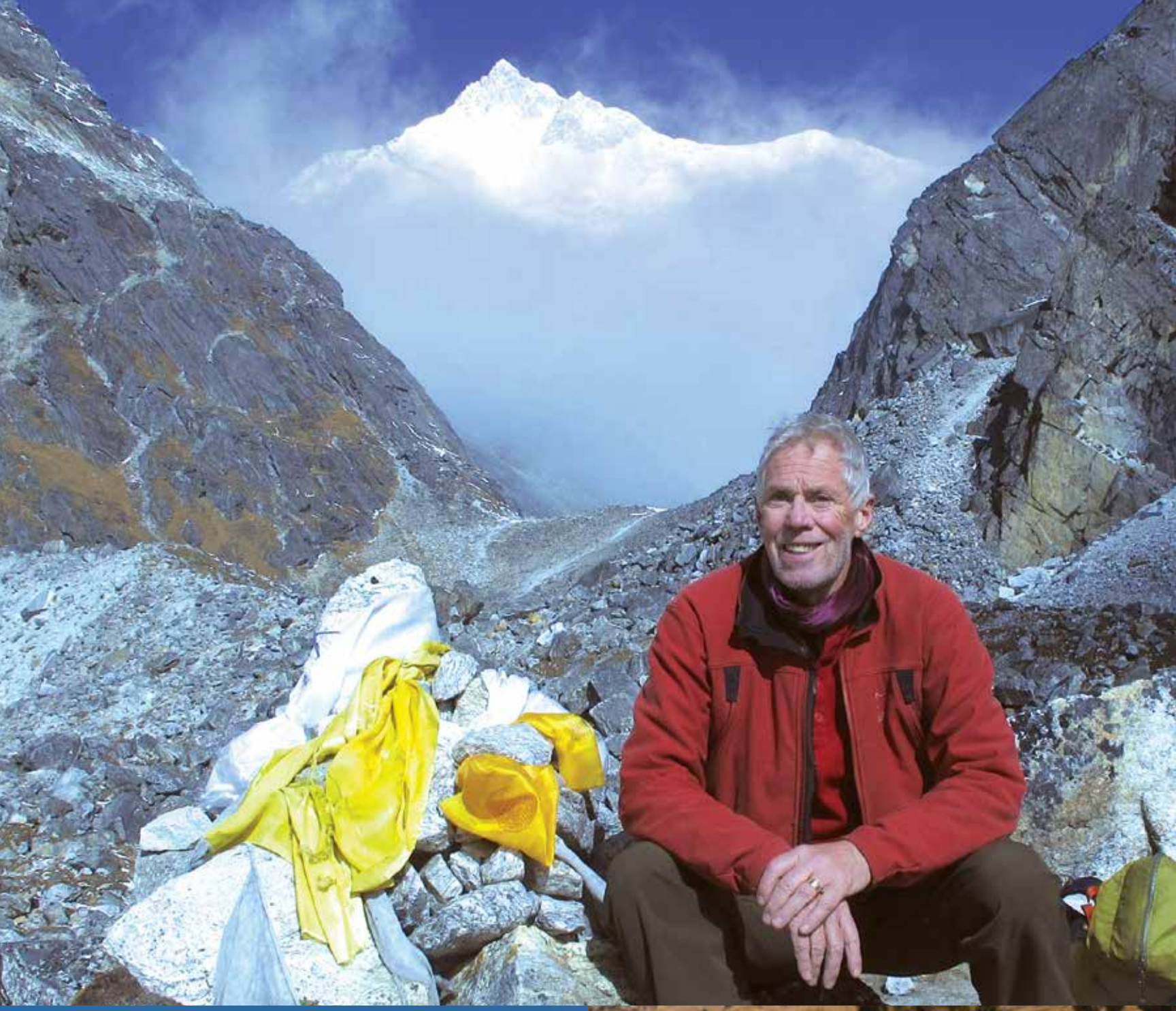
In a series of papers published in *Physiology*, *Science* and elsewhere, Milsom and a team of researchers found that the birds flap their wings almost constantly, hugging the terrain of the Himalayas, and breathing faster to get enough oxygen from the thin air. Then the team looked at how the geese moved that oxygen from the lungs to the blood, from the blood to muscle, and from muscle to cells and mitochondria.

In the process, Milsom has found himself in interesting environments—like running wild geese on a treadmill powered by a portable generator in "a tent in the middle of nowhere Mongolia." The idea was to test pulmonary function through exercise and to lower the oxygen level in the tent to see how they did. "You put them on this treadmill and turn it on. They'll start to walk," he says. "It just takes a little training."

Because the birds were suspected of carrying avian flu, the researchers wore personal protective equipment. "It would be so hot in there that you'd be sweating like mad," he says. "Your goggles would slowly fill up with perspiration. You'd have to continually drain them."

Milsom said his research is more than an academic question. In parts of the world, birds are already suffering from climate changes. Ascertaining how quickly and to what extent a bird might adapt as climate change drives them to seek cooler environments, such as at altitude, he said, might help identify which species have the best chance of survival.

At left, Milsom and a graduate student set traps for mole rats in South Africa. At right, top, Milsom along the border of India and Nepal with Kangchenjunga, the third highest mountain in the world, behind him. Bottom, left to right, Milsom in Mongolia, where "gers," or yurts, were used as both living quarters and the research facility. Milsom, a graduate student and a clinical veterinarian working at Lake Titicaca in Peru.




PIKES PEAK
SUMMIT
AUGUST 1956

The Pregnancy Pioneer

Lorna Grindlay Moore, PhD, professor of obstetrics and gynecology at University of Colorado's School of Medicine, climbed to her first summit at age four. Moore was in her backyard in Rochester, Minnesota. She was going to hang from the very top of her swingset, and no one was going to stop her.

As the family story goes, Moore scaled the rickety metal ladder that swung with each step. She reached the top, scooted over to the trapeze and locked her knees onto the metal piping.

As she flipped upside down, her hair streamed toward the earth and she hung, suspended by her knees, satisfyingly weightless.

When she was done, she fell to the ground, dusted herself off and said, "There. I can do anything."

That's the determination, Moore says, that keeps her pursuing the physiology of pregnancy in high places despite the occasional lack of grant funding and skepticism from some colleagues who don't see the value in studying pregnancy. As a result, Moore has pioneered research into not just pregnancy at altitude but also how humans evolved to have healthy babies in extreme conditions. That research may now help lowlanders have healthy pregnancies, too.

Originally trained as an biological anthropologist, Moore wanted to study not just the evidence of evolution in the fossil record but primarily the process of evolution itself. That led her to pregnancy. "And that," she says, "took me to high altitude."

Moore has pioneered research into not just pregnancy at altitude but also how humans evolved to have healthy babies in extreme conditions.

When her second child was a baby, Moore traveled to Peru with her children and husband in tow. She had already ascertained that women with higher blood oxygen levels during pregnancy at high altitudes had normal-weight babies, something that is unusual at altitude since most people's blood oxygen drops as they ascend.

In later studies in Tibet and then Bolivia, she determined that when lowland women became pregnant at altitude, their placental blood flow didn't increase as much as it would have had they been on their home soil. Native highlanders, meanwhile, have the kind of blood flow of women at much lower altitude. (This is important because fetuses already exist in a low-oxygen environment during gestation, and at altitude that oxygen can be decreased.) Those native highlanders, it turned out, had genetic adaptations that enabled them to deliver normal levels of oxygen to the placenta while pregnant at altitude.

As a result, the highlanders—whether from Tibet or the Andes—gave birth to babies who weighed more than the babies born to lowland women residing at high altitude.

The difference in birth weights between lowland women and highland women were so consistent and pronounced across income levels and elevations from 7,000 feet to 16,000 feet that they "practically knocked your socks off," Moore says.

In Bolivia, her research identified among highlander women a mutation to AMPK, a metabolic signaling enzyme. It was an alteration associated with preservation of normal infant birth weight and uterine blood flow during pregnancy at altitude.

Now Moore is studying whether that discovery might help identify novel targets for drug therapies for women without genetic adaptations. The goal is to see if they might help women whose placental blood flow is compromised by pregnancy complications of fetal growth restriction or preeclampsia. So far, what she's learned is that AMPK operates in ways she couldn't have imagined.

"It looks as though AMPK has quite different effects on the maternal versus the fetal side of the placenta," she says. And she doesn't yet know why. But she's going to keep looking because, to Moore, high altitudes are a great natural laboratory for studying pregnancy and other hypoxic complications.

"It's now well-documented that the maternal responses to pregnancy and the fetus' intrauterine development not only affect maternal and newborn mortality but are also among the strongest determinants of susceptibility to cardiovascular and other diseases during adult life," Moore says. "High altitudes therefore constitute a natural environment for understanding fundamental questions of life itself."

At left, clockwise from the top, La Paz, Bolivia, where Moore has done a lot of her research. Moore holding one of the participant's babies during an Andean postpartum ventilation study. Moore, front row center, with the Bolivian study team at the Bolivian Institute of High-Altitude Biology in about 2000. Moore, age 10, at the top of Pikes Peak, the highest summit of the southern front range of the Rocky Mountains.

"So much of science is just getting into the lab or in the field and doing the work and then weird stuff happens. If you're paying attention, you might learn something new. So much of science is serendipity!"

The Accidental Physiologist

As a teenager, Trevor Day, PhD, was more interested in working as a lifeguard at sea level than investigating complicated biological interactions in thin air. He says now that if his teenage self had known how creative biology could be, he might have done better in high school biology.

But even back then, the physiology of breathing was "already in the air for me." Managing breathing was key to being a good swimmer. And when he graduated high school and trained to be an emergency medical technician, there was breathing again. He learned after watching one too many asthma attacks that "if you don't have an airway, you've got nothing."

"Respiratory and cardiovascular physiology were some of the most important things in terms of intervening in crisis," says Day, professor of physiology at Mount Royal University in Canada. Now he realizes, "I was dabbling in applied physiology early on."

It was Day's curiosity that landed him in an undergraduate environmental physiology course years later. That's where he was introduced to mountain physiology and where he read the book "Into Thin Air" about a 1996 disaster on Mount Everest.

"[Mountain physiology] kind of had everything: an environmental stressor, respiratory physiology, plus adventure," he says. "We read the book, and I never dreamed that 15 years later, I'd be looking at Everest with my own eyes on a trek to base camp in 2012."

Since then, he's returned to the mountain multiple times, studying the stressor of thin air on human systems. His work started in respiration. But quickly, it became clear that to study the effect of low oxygen on humans, he had to look beyond the dispersal of oxygen. Sure, everyone increases their breathing as they climb the mountain, he says. But it's more than that.

"Every organ system has to respond in some way to compensate for low oxygen," he says. "As one organ system compensates, another organ system has to compensate for that compensation. They're all talking to each other."

Take, for instance, kidney function in native lowlanders. As soon as you breathe more to replace that missing oxygen, your pH levels shift. Day and his team came up with an index of renal activity during ascent to high altitude.

But Day may be best known for a single case report, published in the *Journal of Applied Physiology* in 2018, which added to what Moore had already learned about pregnancy in high places. And it came entirely by accident.

"As we were ascending in the Everest region, our lead guide was telling us about his wife, who was pregnant," Day says. "I asked if we were going to meet her, and he said, 'Yeah, I think she's going to come along.'"

"OK, what?!" Day said at the time. "She's seven months pregnant!"

But she climbed. And the case report received write-ups in the *New York Times* and elsewhere. To Day, it wasn't proof that all women could exercise more during pregnancy. It was proof of the wonders of what some humans could do.

"It's a nice reminder that so much of science is just getting into the lab or in the field and doing the work and then weird stuff happens," he says. "If you're paying attention, you might learn something new. So much of science is serendipity!"

Today, Day has his eyes on the stratosphere. He's submitted a grant to the Canadian Space Agency to study physiology on the International Space Station, with an eye to the upcoming high-orbit lunar gateway platform.

"Our exploration of space is coming back again," he says. "We can be excited about the moon again."

At right, top, Day and his team at Everest base camp in 2017. Bottom right, Day at Everest in 2016. Bottom left, Day in the village of Tengboche, Nepal, with the Himalayan peak of Ama Dablam behind him. As people trek to Mount Everest base camp, Ama Dablam dominates the eastern sky.

Top right: Courtesy of Ken Imrie of Glass Beach Photography in Calgary


OR

GI SUCCESS

Meet Linda Samuelson: physiologist, teacher, opera fan, cyclist and 93rd president of APS.

BY MELANIE PADGETT POWERS

In April 2020, Linda C. Samuelson, PhD, FAPS, FAAAS, became the 93rd president of the American Physiological Society. Samuelson is the John A. Williams Collegiate Professor of Gastrointestinal Physiology at the University of Michigan in Ann Arbor. She's also a professor of molecular and integrative physiology, a professor of internal medicine in the Division of Gastroenterology and director of the Center for Cell Plasticity and Organ Design at the university.

The Physiologist Magazine interviewed Samuelson about her science, how the pandemic is affecting her work and what she does for stress relief.

Photo, facing page, by Chuck Fazio

"APS has been a great home. I've always been the kind of person who volunteers their time to make any community that I'm involved with better."

Clockwise from top, Sameulson hiking with her husband, Joel, and their oldest son, Jon Howell, and his wife, Rhianna. Samuelson and her husband and younger son, Ben, biking on Martha's Vineyard. Biking with her husband in Croatia.

How did you become interested in science?

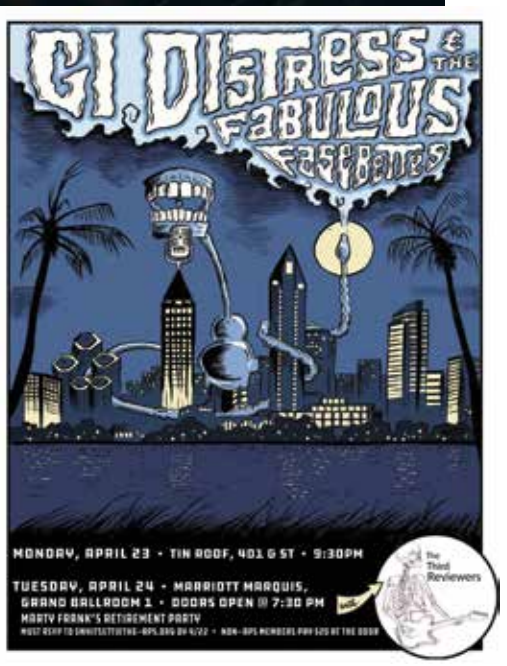
Even as a young kid I was always interested in science. I was drawn to nature and biological sciences, but I really liked all math and science. In high school, I was chosen to help the chemistry instructor set up labs. So, I think my teachers recognized that I had an interest in science from a pretty young age. Then in college I majored in biochemistry. I knew that I wanted to go to graduate school and continue my science post-college. I never was very interested in medical school. A lot of my friends from college were doing that, but I really wanted to get into the details of how things worked and learn more about how the pieces fit together to support life.

Why did you choose physiology as a career?

To be honest, I think physiology chose me. I originally studied molecular genetics, but I was unsatisfied with the lack of appreciation of the functional implications of the genes and the gene families that I was studying. And I was drawn to understanding fundamental processes and how they inform our understanding of organismal function, as well as how they inform our understanding of mechanisms of human disease. So when I set up my own individual research program as an assistant professor of physiology, I turned to research that relied on the newly emerging gene targeting technology to create mouse mutants so that I could study the function of genes or gene families in living animals to try to understand physiologic function.

What area of physiology are you working in today?

I was particularly drawn to the gastrointestinal (GI) tract and how



Samuelson and the band GI Distress at the closing party at EB 2018, along with one of their event posters.

that was regulated. My work has evolved over time, but for some time I've been doing research in the field of stem cell biology. I'm fascinated by stem cells and how they renew adult tissues in health and contribute to disease. In particular, my work focuses on GI stem cells. These cells maintain the lining of the GI tract by continuously generating new cells. It's an astounding process. It's been estimated that there are 10 billion new cells made every single day in the human intestine, which is mind boggling, right?

My interest is in trying to understand the fundamental mechanisms of how a stem cell knows what it is and what it should be doing and how those mechanisms might be dysregulated to lead to proliferative diseases like cancer.

How has the coronavirus pandemic affected you and your work?
At the University of Michigan and in the state of Michigan we currently have a stay-at-home order [in mid-May]. We're only allowed essential activities in the laboratory. We can't start new experiments unless it's somehow related to COVID-19. So most everyone in my research group is working from home. I had to teach my class by video lecture, which was an interesting experience. I teach a section on GI physiology.

As for my lab, I have one lab member coming in two to three times a week to take care of our mouse colony. She manages the breeding colony and the genotyping of the new mice that we're generating. We shrunk the colony way down at the beginning, and we're now building up animals to do experiments, hoping that we'll be able to get back in the lab in June.

The other thing that's happening is that we're shifting to things we can do from home—analyzing previously generated data, writing manuscripts and fellowship applications, planning new experiments so that we'll be ready when we can get back. Our research meetings are remote video meetings.

It's not that things aren't happening; it's just that it's very different than it was. In many ways, I feel lucky because I have a well-equipped home office with good internet so I can work at home pretty effectively.

What advice do you have for graduate students during the pandemic?
Stay engaged as much as possible and identify things that are going to move your work forward. Some of the people in my group are taking online classes to gain skills, to broaden their knowledge. For example, I have one person who's taking an online class on big data analysis because she's going to be doing an RNA sequencing experiment when she's back in the lab. A PhD student in the lab is taking a programming class to learn how to write code in a specific computer language.

The other part that I think most people are doing is to take on a writing project. It's really a fantastic time to read the literature and understand the foundational work and recent discoveries and maybe translate that understanding into a review article. And I know the *American Journal of Physiology* journals are interested in getting review articles from trainees at this time. I think reading, writing and investing in continued learning are things that students can do, even though they're not in the lab right now.

My more general advice for graduate students is to follow your passion. Doing science requires discipline and hard work, and unless you have passion for what you're doing to keep you engaged, to make it fun when the science gets challenging, it's hard to sustain.

"It's really a fantastic time to read the literature and understand the foundational work and recent discoveries and maybe translate that understanding into a review article."

Tell us how you got involved with APS and what it has meant to you.
I joined the Society around 1995 when I was an assistant professor. I had just joined this Department of Physiology, and I joined APS largely because my department chair advised me to. His name is John Williams, and he was very active in APS and is a past president. John was a huge mentor for me, and I'm currently the John Williams Collegiate Professor of Gastrointestinal Physiology, which reflects his important role for me in advancing my career.

Samuelson becomes APS president—complete with a gavel APS staff mailed her—during the virtual Annual Membership Meeting in April.

APS has been a great home. I've always been the kind of person who volunteers their time to make any community that I'm involved with better. So I got involved with the Gastrointestinal & Liver Section, served on a variety of section committees and then started to get involved in the Society-wide committees.

Who have been other important role models in your career?
Miriam Meisler, who was my postdoctoral mentor. I think about her passion and commitment, but also her approach to the people she works with—to value them and value their life outside the lab. For example, I remember her love for new babies, and when I had my children, I felt like she was as excited about me having children as she was if I made some kind of scientific discovery. She taught me that as a scientist, you integrate this life passion you have for your research with a fulfilling personal life.

How have you maximized collaboration in moving your research forward?
I really enjoy and value my colleagues, and so I'm always looking for ways to interact. When I started as an assistant professor, there were two other faculty members that started around the same time, Juanita Merchant and Deb Gumucio. We were in three different

departments. I was in physiology, Deb was in cell and developmental biology, and Juanita was in the Department of Medicine. We were all GI scientists interested in different aspects of GI science, and we started having group meetings together because we thought that through our interactions we would amplify our own ability to do research. So, over the years, we had many collaborations, shared projects, shared grants. For quite a number of years, we had a big, open, shared laboratory space.

As APS president, how do you want to advance and expand the APS community?

This is going to be a tough time, right? We don't even fully know what the impact of the pandemic is going to be. However, we are already planning for major financial challenges with the transition to open access publishing, which really changes the funding model for the Society.

The biggest thing I am thinking about is how to make an impact with the planning of our annual meeting. The new APS Annual Meeting will launch in 2023, when we're going to pull out of Experimental Biology (EB). I feel like we have a unique opportunity as a Society to program high-level, cross-sectional talks that bring in the top physiological science to our meeting, and I really want to work to make that happen.

When life gets hectic, how do you step away and have a little fun?

My husband, Joel, and I have two passions: opera and bicycle riding. We love classical music; the music school here at the University of Michigan is terrific, so we are very involved there. We also travel to see performances, and we have season tickets for Lyric Opera in Chicago. Then, the other part, which is fun but different, is bike riding. Biking's been a consistent part of our lives for a long time. It's a great way to get out, escape the pressures and problems, clear your head and reset. In order to bike, you have to stay present; you have to pay attention to what you're doing. So you quickly get out of your head, and you're experiencing the outside and enjoying the ride. In addition to riding around Ann Arbor, we take bike-touring vacations. I think we've had more than 15 at this point, going to Italy, France, Spain, England and many others.

You're in a band called GI Distress that has been known to sing on stage at the APS annual meeting at Experimental Biology. Tell us about that.

First, I have to say science and rock and roll—what could be better, right? It's been fantastic. We are mostly a cover band performing rock music. I'm part of the backup singers—we're called the FASEBettes. There's a lot of talent in the broader GI community, and the band is from all over the world. Our lead singer's in Dublin, Ireland; our keyboard player is in Los Angeles; our lead guitarist is in Virginia; our drummer is in the Boston area; the bass player is in Georgia. The only time we get together is at scientific conferences. We used to say that we performed more than we practiced!

FASTFACTS

Legacy of APS Service & Physiology Leadership

- APS member since 1995
- Fellow of APS since 2015
- Fellow of the American Association for the Advancement of Science since 2019
- APS Takeda Distinguished Research Award
- Horace W. Davenport Distinguished Lectureship
- American Gastroenterological Association's Grossman and Funderburg awards
- Excellence in Mentorship Award, Program in Biomedical Sciences, University of Michigan
- Lyman Briggs College Distinguished Alumni Award, Michigan State University
- *American Journal of Physiology-Gastrointestinal and Liver Physiology* editorial board, current member
- APS*select*, APS' monthly collection of the "best of the best" research articles, editor-in-chief
- APS Council, former member
- Gastrointestinal & Liver Section Steering Committee, former member
- Committee on Committees, past chair
- Publications Committee, former member
- Finance Committee, former member
- *Physiological Genomics*, past associate editor

Education

- PhD, Microbiology, University of Chicago
- BS, Biochemistry, Michigan State University

Bucket List

- "Seeing more parts of the world, while sharing my science."
- "Exploring more places by bike. Our next trip was going to be to the Basque region of France and Spain this fall."
- "I'm expecting my first grandchild in July! I expect that my bucket list will be changed by this major life event."

Bagchi Receives Outstanding Graduate Student Instructor Award

Devika Bagchi, an MD/PhD student in the University of Michigan (UM) Department of Molecular and Integrative Physiology, is a 2020 recipient of the UM Rackman Graduate School's Outstanding Graduate Student Instructor Award. Winners of the award are recognized for exemplary teaching, mentoring and advising skills; creativity; and commitment. Bagchi is also the founder of Science Education & Engagement for Kids, an organization that brings hands-on science lessons to local classrooms.

Nemeth Named Goldwater Scholar

Erika Nemeth, an undergraduate biochemistry student at Stony Brook University in New York, has been named a Goldwater Scholar for 2020. Named after the late U.S. Sen. Barry Goldwater, the prestigious award "recognizes promising research leaders in the fields of science, mathematics and engineering." Nemeth's studies include investigating ways to visualize subcellular localization of bioactive lipids that play a role in cancer signaling and developing a platform to visualize cancer gene expression.

DiCello Awarded Mollie Holman Medal

Jesse DiCello, PhD, from Monash University in Australia, has received the prestigious Mollie Holman Medal. As one of the university's highest honors, the 2020 award—named after late pioneering physiologist Emeritus Professor Mollie Holman AO—recognizes up to 10 doctoral students who were nominated by faculty for presenting one of the best theses of 2019. DiCello—who recently earned his doctorate from the Monash Institute of Pharmaceutical Sciences in the Department of Drug Discovery Biology—researches the novel pharmacology of opioid receptors in the gastrointestinal tract and how opioids affect gut motility at the cell level.

Severin Receives Physical Therapy Association Awards

Richard Severin, PT, DPT, is a 2020 recipient of the American Physical Therapy Association's (APTA) Dorothy Briggs Memorial Scientific Inquiry Award. The award recognizes authors published in APTA's journal *Physical Therapy* "whose research and discussion has made a measurable contribution to the knowledge base of physical therapy." He is also a 2020 recipient of the Illinois Physical Therapy Association's Emerging Leader Award, which recognizes "the efforts of clinicians, educators and leaders toward the advancement of the physical therapy profession."

Severin, a visiting clinical instructor in the Department of Physical Therapy at the University of Illinois at Chicago (UIC) and part-time clinical assistant professor in the doctor of physical therapy program at Baylor University in Waco, Texas, is pursuing a PhD in rehabilitation science at UIC.

Mantica Selected as AAAS Mass Media Fellow

Gina Mantica, a biology doctoral student at Tufts University in Medford, Massachusetts, has been selected as the 2020 APS-sponsored American Association for the Advancement of Science (AAAS) Mass Media Science & Engineering Fellow. This annual summer program—sponsored by scientific societies, universities and private philanthropy organizations—sends young scientists to newsrooms across the country to hone their writing, editing and interviewing skills. Mantica regularly contributes to the *Journal of Experimental Biology's* "Outside JEB" section and to Tufts University's online news site, TuftsNow. She is also a contributor to APS' I Spy Physiology blog. During her fellowship, Mantica will cover science news for the *Dallas Morning News*.

OPPORTUNITY KNOCKS

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

PHYSIOLOGY FACULTY POSITION • CAMPBELL UNIVERSITY

The Campbell University Jerry M. Wallace School of Osteopathic Medicine in Buies Creek, North Carolina, invites applications for the tenure-track position of physiology faculty at the academic rank of assistant or associate professor.

Read more at www.physiology.org/campbell.

FACULTY, MEDICAL EDUCATOR • MERCER UNIVERSITY

The Mercer University School of Medicine is seeking highly qualified educators with broad training capable of teaching in an integrated medical school curriculum. Multiple, non-tenure track, 10-month appointments are available on the Columbus, Georgia, campus.

Read more at www.physiology.org/mercer.

ASSISTANT/ASSOCIATE PROFESSOR POSITION • AUGUSTA UNIVERSITY (AU)

The Department of Physiology at the Medical College of Georgia at AU invites applications for a tenure-track position as an assistant/associate professor. Successful candidates are expected to establish vigorous independent programs of extramurally funded research to complement the research strengths and goals of the department and the university.

Read more at www.physiology.org/augusta.

TRAINEE POSITION • UNIVERSITY OF CALGARY

Professors Marc Poulin and Richard Wilson from the University of Calgary in Alberta, Canada, are pleased to announce new cutting-edge training opportunities with full scholarships for MSc and PhD students and postdoctoral fellows.

Read more at www.physiology.org/calgary.

DATES & DEADLINES

CALLS FOR PAPERS

Journal of Applied Physiology (July 1, 2020)

- Highlighted Topic: Physiology of Thermal Therapy

American Journal of Physiology-Cell Physiology (July 31, 2020)

- Cellular Processes in Tumor Metastasis: Basic Research to Translation

American Journal of Physiology-Cell Physiology (August 31, 2020)

- Inflammation: From Cellular Mechanisms to Immune Cell Education

American Journal of Physiology-Heart and Circulatory Physiology (August 31, 2020)

- Environmental Inhalants and Cardiovascular Disease
- Exercise and Cardiac Remodeling in Normal and Athletic States
- Exosomes and Extracellular Vesicles in Cardiovascular Physiology

Physiological Genomics (August 31, 2020)

- Extracellular Vesicles: Role in Physiology and Pathophysiology
- Precision Medicine and Complex Disease

More details: www.physiology.org/calls

PHYSIOLOGY IN FOCUS WEBINAR SERIES

FUNCTION-SPONSORED WEBINAR

Endocytosis and endosome trafficking: roles in coronavirus uptake and cell signaling

July 8, 2020

- Speakers: Ole Petersen, CBE, FRS; Roop Mallik, PhD; Erwin Neher, FRS

More details: www.physiology.org/functionwebinar

OBESITY WEBINAR

Heterogeneity and crosstalk of human brown adipose tissue

July 22, 2020

- Speakers: Camilla Scheele, PhD; Christian Wolfrum, PhD

More details: www.physiology.org/obesity

MEET THE EDITOR

Heddwen Brooks, PhD

American Journal of Physiology-Renal Physiology

Heddwen Brooks, PhD, will begin her term as editor-in-chief of the *American Journal of Physiology-Renal Physiology* (*AJP-Renal*) on July 1, 2020.

"I have been involved with *AJP-Renal* since being invited to join the editorial board by Dr. Jeff Sands in 2001. I recently served for six years as associate editor for *AJP-Regulatory, Integrative and Comparative Physiology*. I started my first renal foray working on aquaporin inhibitors and ion channel function with Andrea Yool at the University of Arizona (1997–1999) before moving to train in renal physiology with Mark Knepper at the Laboratory of Kidney and Electrolyte Metabolism at the National Institutes of Health's National Heart, Lung and Blood Institute (1999–2001). I also had the privilege to receive additional mentoring during my time there from Drs. Moe Burg, Ken Spring, Josie Briggs, Jurgen Schnermann and Robert Star. My own laboratory has worked on aquaporin regulation/renal concentrating mechanism, lithium-induced nephrogenic diabetes insipidus and sex differences in diabetic kidney disease. Now we focus mostly on sex differences in hypertension, coming full circle back to the role of the immune system in disease. (My PhD involved cloning immunogenic antigens from parasitic nematodes at Imperial College of London.)

I have assembled an international team of outstanding associate editors. Our goal is to increase the impact of *AJP-Renal* in our field. As chair of the APS Renal Section, I worked hard to increase the section's diversity, and this will also be a goal as editor-in-chief. Professional development is critical, and we will implement some new programs in the first year that will help train the next generation of associate editors and junior reviewers. We will continue the outstanding work of past editorial teams and run several calls for papers in key areas of renal physiology. We will invite guest editors to work with an associate editor to coordinate these calls, and we will also collaborate extensively with our sister APS journals. The first of these collaborations is one Dr. Darwin Bell and I have committed to, which will be a call for papers across most APS journals: "Deconstructing Organs: Single Cell Analyses, Decellularized Organs, Organoids and Organ-on-a-chip Models."

I look forward to working with all of you, and I highly encourage junior faculty and postdoctoral fellows to contact me (hlbrooks@physiology.org) if they have an interest in being involved in the future of *AJP-Renal*."

SECTION AND CHAPTER NEWS

New Section Advisory Committee Chair Elected

The Section Advisory Committee (SAC) recently elected Scott D. Kirton, PhD, of Union College in Schenectady, New York, as the incoming chair of SAC. His three-year term will begin January 1, 2021. The Comparative & Evolutionary Physiology Section will hold an election for a new chair.

APS sincerely thanks Sean Stocker, PhD, FAPS, for his service and contributions to the Society and the sections. Stocker served as SAC chair from 2018 to 2020.

New Section Leaders Elected

APS would like to extend our thanks and gratitude to the following outgoing chairs and welcome the new chairs of the following sections.

SECTION	OUTGOING CHAIR	INCOMING CHAIR
Central Nervous System	Kirsteen Browning, PhD Pennsylvania State College of Medicine *Interim Chair* J. Mike Wyss, PhD, FAPS University Alabama, Birmingham	Janice H. Urban, PhD Rosalind Franklin University of Medicine and Science, Chicago
Endocrinology & Metabolism	Gina L.C. Yosten, PhD Saint Louis University, Missouri	Damian G. Romero, PhD University of Mississippi Medical Center
Renal	John D. Imig, PhD, FAPS Medical College of Wisconsin	Kathleen S. Hering-Smith, PhD, Tulane University New Orleans Health Science Center
Respiration	Gregory D. Funk, PhD University of Alberta, Edmonton	Melissa Bates, PhD University of Iowa
Teaching	Lynelle Golden, PhD Bastyr University, Kenmore, Washington	Patricia Halpin, PhD University of New Hampshire

Michigan Physiological Society Creates Virtual Poster Session

Due to the COVID-19 pandemic, the eighth annual meeting of the Michigan Physiological Society (MPS)—scheduled for June 25–26 at Ferris State University—was, unfortunately, canceled. However, MPS provided its trainee members an opportunity to disseminate their research in a public forum through a virtual poster session in June. To see a recap of the poster session and to learn more about MPS, visit **www.apsmichigan.org**.

american physiological society®

Deadlines

The American Physiological Society (APS) Publications Committee plans to interview candidates in the fall of 2020.

Nominations due:
August 1, 2020

Applications due:
August 15, 2020

How to Nominate

Nominations, accompanied by a curriculum vitae, should be sent to David Gutterman, MD, FAPS, chair of the APS Publications Committee, via email, care of the APS Publications Department Administrative Assistant, Charmon Kight, at ckight@physiology.org.

CALL FOR NOMINATIONS

EDITOR-IN-CHIEF

American Journal of Physiology-Cell Physiology®

Nominations are invited for the position of editor-in-chief of *American Journal of Physiology-Cell Physiology* (journals.physiology.org/journal/ajpcell) to succeed Josephine C. Adams, PhD, who will complete her term as editor on June 30, 2021.

American Journal of Physiology-Gastrointestinal and Liver Physiology®

Nominations are invited for the position of editor-in-chief of *American Journal of Physiology-Gastrointestinal and Liver Physiology* (journals.physiology.org/journal/ajpgi) to succeed Nigel Bunnett, PhD, who will complete his term as editor on June 30, 2021.

Physiological Genomics®

Nominations are invited for the position of editor-in-chief of *Physiological Genomics* (journals.physiology.org/physiolgenomics) to succeed Bina Joe, PhD, who will complete her term as editor on June 30, 2021.

Physiology®

Nominations are invited for the position of editor-in-chief of *Physiology* (journals.physiology.org/journal/physiologyonline) to succeed Gary Sieck, PhD, FAPS, who will complete his term as editor on June 30, 2021.

COMMITTEE CHAIR

APS Book Committee

Nominations are invited for the chair of the APS Book Committee (physiology.org/publications/news/books) to succeed Dee Silverthorn, PhD, FAPS, who will complete her term as chair on June 30, 2021.

Resilience: A Route to Restart Science

BY CAROLINE APPLEYARD, PHD, FAPS

Lately, it seems like the whole world has been turned upside down. Across the globe, physiologists are coping with changes to how they teach and carry out research, while attempting to balance work with home life during the COVID-19 pandemic.

In Puerto Rico, we were still recovering from the devastating category 5 Hurricane Maria that struck in 2017 when residents in the southern part of Puerto Rico (where the Ponce Health Sciences University-Ponce Research Institute is located) were shaken by a 6.4 magnitude earthquake in early January 2020. Almost constant seismic activity continues to date. Then, just a few short months later, the COVID-19 pandemic struck.

How can we carry on after such disasters? While this is a unique circumstance, our responses can be guided by how we, as a research community, have addressed previous challenges to our academic, scientific and personal progress.

Resilience is key. Based on our prior challenges, and through conversations with students, faculty and staff, I offer these thoughts and lessons learned for starting up again:

Establish an emergency communication plan. Hurricanes and earthquakes cause physical building damage, loss of equipment and power, and lack of communication. These forced us to implement emergency phone trees and detailed contingency plans that could be built upon quickly when the pandemic hit.

Prepare for your "new normal" after an unexpected disaster. Recognizing that things will be different and exercising flexibility to pivot quickly and adapt to the prevailing conditions allows for resumption of activities, albeit it in a new format or with an altered goal. Our institution focused on helping the larger community within the southern part of the island. This created a sense of purpose and accomplishment in students and faculty and provided a productive outlet to counter feelings of helplessness.

Closing down is tough—but starting back up successfully under new rules is tougher. Constant communication and assessment of needs, through surveys and virtual gatherings, are vital to direct resources. Just as natural physical disasters can have widely divergent impacts on different people, the pandemic brings about its own unique set of challenges depending upon each individual's physical location and family and financial circumstances. "Checking in" is vital to ensure that trainees and staff do not fall through the cracks and to guarantee that support (shelter, food, mental health) is there when needed.

Be realistic and flexible with goals and expectations. Find ways to leverage the altered circumstances so that this "barrier" to the next class, exam, fellowship, manuscript or grant can be navigated and perhaps even provide new opportunities and directions for growth.

Acknowledge loss. Facing adversity is tough—build resilience and coping skills through focusing on what can be controlled. When possible, prioritize wellness practices (nutrition, exercise, sleep, work boundaries), and reach out and connect when struggling. Demonstrate work kindness and compassion to others during these difficult times.

A scientific career by necessity demands resilience. With flexibility, adaptation and perseverance, our capacities to deal effectively with future adversity will also increase.

Caroline Appleyard, PhD, FAPS, is a professor at Ponce Health Sciences University in Puerto Rico.

Illustration by Brett Affrunti

american physiological society®

Open Access: What Researchers Need to Know Now

Researchers, including published authors and APS members, understand that rapid and widespread dissemination of physiological research can advance the field. Open access (OA) publishing is frequently mentioned as a path toward this future, but what does this mean for researchers? Listen to this APS webinar on-demand to learn more on this emerging publishing model.

Agenda

Intro to OA for Researchers

- **OA Typology**–Gold, green, bronze, hybrid and others.
- **OA Benefits for Authors**–Readership, copyright and reuse.

Who Covers the Cost of OA Publishing: Author? Funder? Institution?

- **Types of Publishing Costs**–Submission fees, color and page fees, publication fees, open access article processing charges.
- **What Are Transformative Agreements**–From "Read & Publish," "Publish & Read," "Subscribe to Open" and "Read, Publish & Join,": What are librarians talking about?

A Researcher Perspective: Paying for OA from Your Grant and Budget

- **Scenarios for Paying for OA**–Case examples from your colleagues about how they use their budgets and grants to pay for publishing research.

Speakers

Lisa Janicke Hinchliffe, MS
Professor for Information Literacy Services and Instruction, University of Illinois at Urbana-Champaign.

Dennis Brown, PhD, FAPS
APS Chief Science Officer, Professor of Medicine at Harvard Medical School in Boston, Director of the Massachusetts General Hospital (MGH) Program in Membrane Biology.

PHYSIOLOGY IN FOCUS:

Our New Learning Series

american physiological society

Explore our conferences and webinars at physiology.org/meetings.

Cardiac PV Loop Data Analysis: Tips & Tricks

Available on-demand
Online Webinar
physiology.org/webinars

Obesity Webinar Series 2020

Available on-demand
Online Webinar
physiology.org/webinars

Integrative Physiology of Exercise

November 11–13, 2020
Austin
physiology.org/IPE2020

More dates and topics coming soon!