THE Physiologist MAGAZINE

JULY 2021

A RUNNER'S QUEST

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Cover photo by Matthew LaVere

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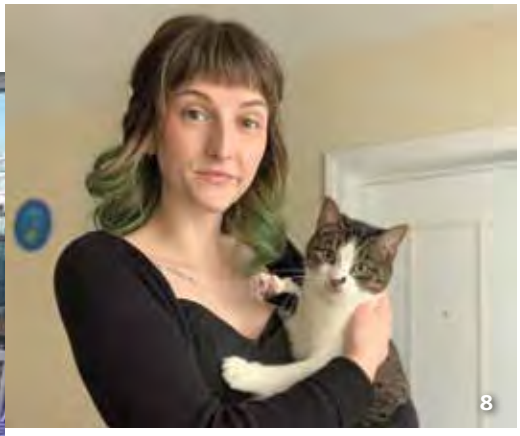

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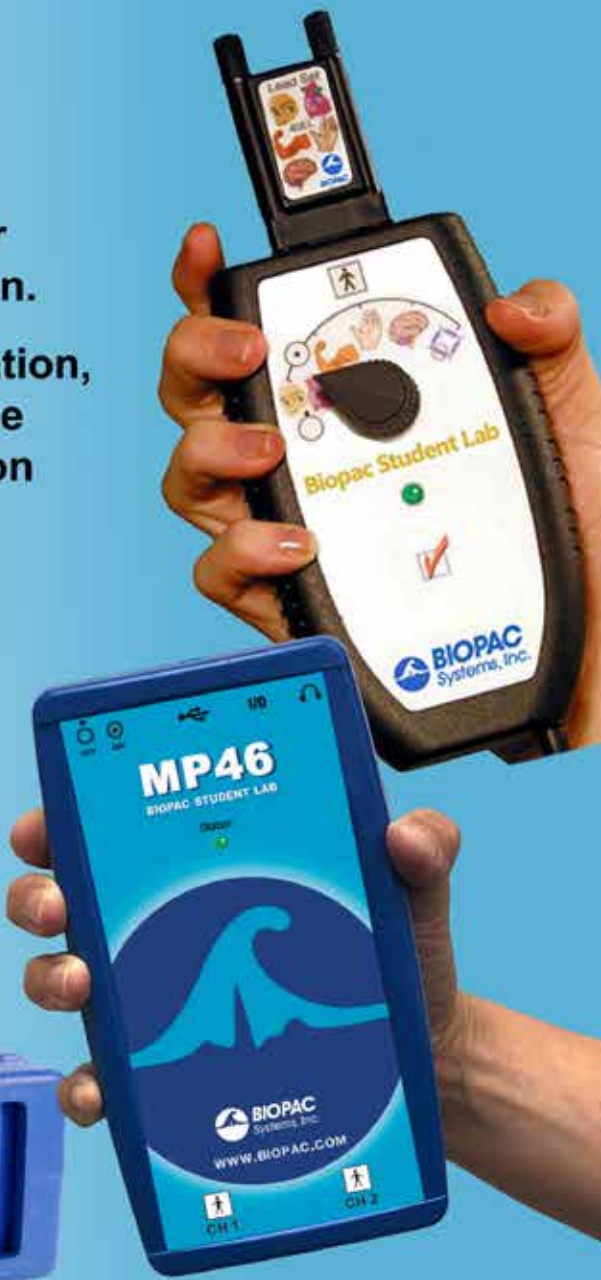

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Community & Learning: Central Pillars of Our Mission

BY MEEGHAN DE CAGNA, MSC, CAE

We at APS have recently been discussing the important role that community plays in our personal and professional lives. Throughout the past 16 months of the pandemic, the human need to feel connected with others became very real for all of us. Whether through shared interest or inspiration, learning or laughter, the experience of belonging to a community has sustained us—like so many others around the country and world—through many dark days.

As APS staff members, we maintain a consistent focus on a fundamental question: How can we better serve our members and advance both the Society's mission and the discipline of physiology? However, our recent conversations about community are challenging us to think more broadly and open ourselves to fresh questions, including:

- Who considers themselves to be part of the APS community?
- What is our community's purpose?
- How can we work together to nurture our community?
- What is this community capable of achieving when its full potential is recognized?
- How can we center our community around a vibrant commitment to learning?

We know our APS community is rooted in a deep love of science, driven by an insatiable curiosity to understand life and solve some of its biggest questions, and committed to the overarching aspiration to improve health for all. The full breadth of the APS community is broad and includes students and trainees, researchers and educators, funders, authors, librarians, sponsors, partnering organizations, and the 80-person APS staff who have the privilege to collaborate with members and leaders to accomplish our shared goals.

APS is also a part of the larger scientific community, which—at this very moment—is providing invaluable benefit to humanity through unprecedented cooperation and collaboration that has yielded multiple COVID-19 vaccines. We are so proud of the role we play in connecting the physiology community and supporting discovery through our portfolio of journals and scientific meetings and conferences.

We also understand that learning from your colleagues in the larger biomedical research community, having the opportunity to share your research and expertise, and acquiring new skills are central to your professional growth. So, we've partnered with organizations such as The Obesity Society, Alliance for Aging Research and the American Autoimmune Related Diseases Association to bring world-class content from highly respected scientists to a global audience through our scientific webinar series.

> **"Whether through shared interest or inspiration, learning or laughter, the experience of belonging to a community has sustained us—like so many others around the country and world—through many dark days."**

As we prepare to launch our new annual meeting in 2023, the Career Gateway and the Center for Physiology Education, we will continue to pursue excellence in education, cross-collaboration and community in support of compelling learning. We also continue to evaluate, challenge and tweak our offerings and staff structures to provide the most efficient, frictionless service possible.

Community is both an endeavor and an outcome. We see a future where the APS community continues to thrive and grow in our commitment to innovation; transformation; discovery; diversity, equity and inclusion; and progress. We invite you to work with us as we pursue this endeavor and to become a unique contributor in achieving these most meaningful outcomes.

Meeghan De Cagna, MSc, CAE, is the chief community and learning officer at APS and serves as associate publisher of *The Physiologist Magazine*. You can reach her at meg@physiology.org.

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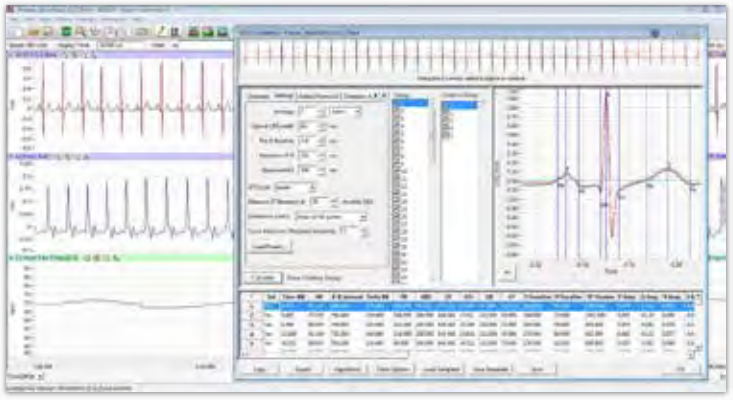

See how at iworx.com/aps

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Featured Careers at Novartis

The American Physiological Society (APS) and Novartis Institutes for Biomedical Research (NIBR) have partnered for a campaign promoting industry career development. APS members will have the opportunity to explore career opportunities for physiologists in the biopharmaceutical industry. Check out highlighted open positions at NIBR through the Featured Careers at Novartis section on the APS Jobs Board.

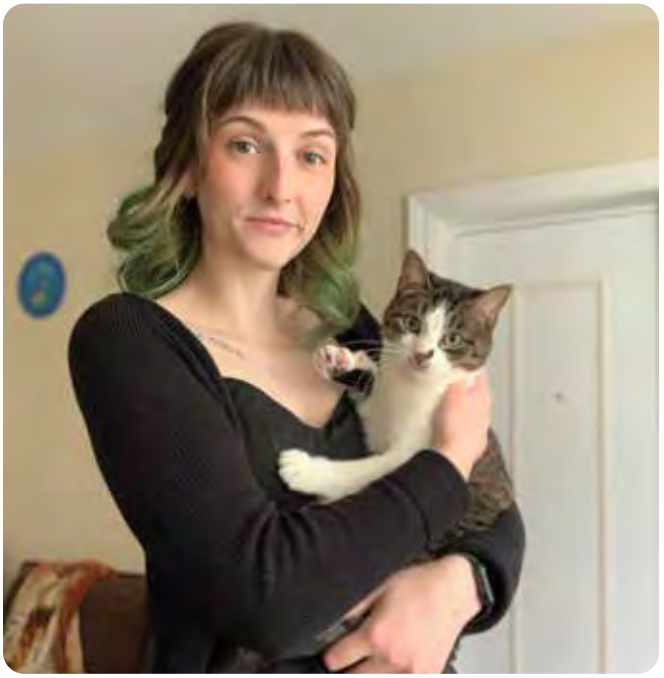
NOVARTIS | Reimagining Medicine

With more than 560 oral sessions, 3,000 posters and 7,300 registrants, the virtual APS annual meeting at Experimental Biology in April was a success! And while attendees missed seeing each other in person, they networked, enjoyed the high-quality programming and took advantage of the perks of participating from the comfort of home.

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.

Bianca N Quade
@BiancaQuade

Happy first day of virtual EB 2021! Gretel is looking forward to hearing some talks! #ExpBio #IllBeThere



9:41 AM · Apr 27, 2021

ThorstenGnad
@scheibendoc

what a great honor to share my work at @APSPhysiology @expbio! great sessions today!

11:41 AM · Apr 28, 2021

Everett C. Minchew
@everettminchew

Gearing up for the #ExpBio conference w/ @APSPhysiology, the first of my PhD !! Excited for this opportunity to #network and learn about the latest in muscle biology research 💪 #MyoTwitter

8:42 AM · Apr 29, 2021

Daisy Shu (she/her/hers)
@EyeDaisyShu

Loving the mock study section right now in the Trainee Funding #3: Don't Take It For Granted Symposium Series - What to Expect When You're Expecting (Your Grant Score) @expbio #expbio @APSPhysiology

4:29 PM · Apr 28, 2021

Faria Sanjana
@faria_sanjana

Attended an excellent session on stress resistance and resilience during a global pandemic at #EB2021 with fantastic speakers, co-chaired by my mentor Dr. Chris Martens (@snetram) and Dr. Jody Greaney (@JodyGreaney) @expbio @APSPhysiology

11:48 AM · Apr 28, 2021

Alexandria Marciante
@AlexMJ_PhD

Although it wasn't in-person, this was maybe one of the most personally rewarding @expbio conferences with @APSPhysiology ... proud to have had a Hot Topic with Control of Breathing in the Respiration Section for work under @GManBreathe in collaboration with @MiaNKelly #breather

11:19 PM · Apr 29, 2021

Amanda LeBlanc, Ph.D.
@hoosierderby

Missing in-person conferences, but I do get to sip coffee in a more comfortable chair without a mask on. #ExpBio #IAmAJPHeartCirc @APSPhysiology

10:47 AM · Apr 27, 2021

Ashley Griffin
@ashley_dom_18

This week has been hectic but a blessing. Tomorrow I will give a 3 minute oral presentation about my work for the award I received at the Joseph Erlanger Distinguished Lectureship of the @APSPhysiology CNS Section #APSCNSSection Also stop by my two posters ❤️

1:20 PM · Apr 27, 2021

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LAB NOTES

STATS & FACTS

3.46 liters

The average amount of water consumed daily by men in the U.S.

U.S. Centers for Disease Control and Prevention

RESEARCH FIZZ

Blood flow restriction training and the high-performance athlete: science to application

This review explores recent advances in understanding how blood flow restriction influences physiological adaptations to exercise training and how using this information can improve athletic performance.

***Journal of Applied Physiology*, April 2021**

https://doi.org/10.1152/japplphysiol.00982.2020

STATS & FACTS

2.75 liters

The average amount of water consumed daily by women in the U.S.

U.S. Centers for Disease Control and Prevention

Illustrations by Kagan McLeod

MENTORING Q&A | SETTING PRIORITIES

What Do We Value?

Establishing your priorities in physiology.

Each issue, we ask a trainee to pose their career questions to an established investigator and mentor. Here, Jonathan Herrera, an MD/PhD student at the University of Michigan and an APS 2020–2021 Porter Fellow, asks Tracy Baynard, PhD, associate professor and director of the Integrative Physiology Laboratory at the University of Illinois at Chicago, questions related to two of his interests: exercise physiology and diversity, equity and inclusion efforts.

Q: How valuable is exercise research in the context of health and disease?

A: As a clinical exercise physiologist, I am biased here, but researching the effects of exercise and physical activity on health and disease is extremely valuable to the biomedical community and society in general.

Acute exercise involves an integrated response that is not usually possible to assess during rest, such as might happen during a physical exam. For instance, we can assess cardiac, pulmonary and metabolic outcomes using indirect calorimetry from one exercise test using your modality of choice, such as a treadmill or cycle ergometer.

By assessing an integrated response with exercise, we can often uncover abnormalities that would not be seen otherwise. Furthermore, if we look at the bigger picture of how exercise is related to risk of disease, lower aerobic fitness is considered one of the most potent predictors of all-cause mortality. There is not one comorbidity that I can think of whereby aerobic fitness is not strongly associated with disease outcomes. In contrast, moving more or being more fit has repeatedly been found to be protective and is associated with longer life expectancy, with reduced health care costs, and greater quality of life over a longer duration of the lifespan.

I have often been at the table when others say, "We know exercise works. There's no need to do this study." Like many other physiological processes, there is so much we do not know. We are continuously adding to our understanding of mechanisms of exercise, what the correct dose of exercise is and, importantly, who benefits from what type of exercise and who may not. For example, studies examining sex, race/ethnicity and aging are all gaining more prominence.

These interactions are complex in a human system and critical to understand how we can mitigate risk with exercise, especially understanding how exercise, or rather lack of exercise in some cases, interacts with other lifestyle choices or interventions.

"First, as a research community, we all need to affirm [DEI] is a priority ... and not just give it lip service."

Q: How do we make more diverse, equitable and inclusive research environments a priority?
A: Timely question here and one that needs serious consideration across all aspects of research. First, as a research community, we all need to affirm this is a priority—this entails not only the individual scientists and their laboratories, but their department heads, their deans, their chancellors and presidents (if in industry, then the equivalent ranks)—and not just give it lip service.

But I also believe this extends much, much further than higher education and the research industry. As a society, value must be placed here, coupled with resources, starting in primary and secondary education that increases STEM awareness, confidence and aptitude. While progress is being made on this front, there is still a good bit to go. Further, role models must be elevated in order to have younger individuals, as well as their peers, identify with what is possible.

To increase diversity, equity and inclusivity, resources will need to be earmarked for existing and/or new initiatives. I am proud to see how the scientific community has recognized the importance of these areas over the years and how swiftly reflection on that progress took place recently to be more responsive to the needs of our various stakeholders. The scientific community has taken important steps already, but I believe this is only the beginning to help bring meaningful and needed change. To make it a priority we must all demand it be a priority.

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

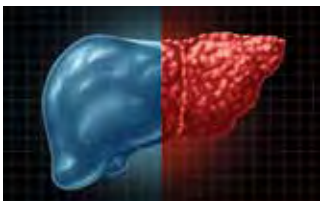
STATS & FACTS

1993

The year the National Institutes of Health began mandating inclusion of women and minority groups in all NIH-funded clinical research.

National Institutes of Health

RESEARCH FIZZ



Noninvasive stratification of nonalcoholic fatty liver disease by whole transcriptome cell-free mRNA characterization

Researchers developed a noninvasive, cell-free mRNA-based RNA sequencing platform as a potential new diagnostic tool for non-alcoholic fatty liver disease.

***American Journal of Physiology-Gastrointestinal and Liver Physiology*, April 2021**

https://doi.org/10.1152/ajpgi.00397.2020

STATS & FACTS

3.1 million

The lives of children under five saved every year thanks to oral rehydration therapy.

World Health Organization

Right: iStockphoto

RESEARCH FIZZ

MOTS-c reduces myostatin and muscle atrophy signaling

The mitochondrial-derived peptide MOTS-c reduces high-fat diet-related muscle atrophy by decreasing expression of the protein myostatin.

American Journal of Physiology-Endocrinology and Metabolism, April 2021

https://doi.org/10.1152/ajpendo.00275.2020

STATS & FACTS

40%

The portion of athletes in the U.S. who are women.

Tucker Center for Research on Girls & Women in Sport

RESEARCH FIZZ

E-cigarettes and health risks: more to the flavor than just the name

Research shows e-cigarette flavors, particularly chocolate, are harmful to the lungs and result in cell death in some instances.

American Journal of Physiology-Lung Cellular and Molecular Physiology, April 2021

https://doi.org/10.1152/ajplung.00370.2020

POLICY IQ | FOCUS ON THE FUTURE

APS Advocates for Funding during Virtual Capitol Hill Visits

On May 18 and 20, 2021, APS Early Career Advocacy Fellows and members of the Science Policy Committee (SPC) held virtual meetings with congressional staff. Working in teams of two to three, they "visited" a total of 24 offices. Some staff are back on Capitol Hill, while others continue to work from home. All continue to meet with constituents virtually.

The challenges for researchers caused by the COVID-19 pandemic are widely recognized. While laboratory scientists have returned to work, it has been difficult to pick up where they left off. When facilities closed abruptly, long-term experiments were disrupted, research with both animals and humans was interrupted and trainees lost valuable time. Principal investigators now trying to get their programs back on track face looming deadlines for funding renewals, with little certainty about whether the progress they can show will be considered enough. The effects of these disruptions fell on younger researchers just starting out in their careers and on parents, often women, who had to take on additional responsibilities when schools and child care facilities were closed.

APS members who met with congressional staff shared their personal stories to illustrate the need for additional funding for researchers whose work was disrupted by pandemic-related closures. Specifically, members of Congress were asked to support the Research Investment to Spark the Economy (RISE) Act. This bill, which has been introduced in both the House of Representatives and the Senate with bipartisan sponsorship, would provide funding specifically for research relief at agencies, including the National

Pages 12-13, iStockphoto

Institutes of Health (NIH) and the National Science Foundation (NSF). These funds would go toward helping agencies restore grantees' lost resources.

FISCAL YEAR 2022 FUNDING

In addition to asking for research relief, APS advocates urged Congress to provide robust annual funding allocations for biomedical research in fiscal year (FY) 2022. These were the agency-specific requests:

- NIH: $46.1 billion (currently $42.9 billion)
- NSF: $10 billion (currently $8.5 billion)
- VA Medical and Prosthetic Research: $902 million (currently $815 million)
- NASA: Increased funding for life sciences research and the Human Research Program

DIVERSITY AND INCLUSION

APS members also spoke to the need for continued efforts to diversify the biomedical research workforce. On May 19, 2021—in the midst of the APS Capitol Hill meetings—the House approved several bills intended to advance diversity, equity and inclusion in the sciences. APS members thanked House representatives for their support and urged Senate offices to advance the legislation.

POLICY IQ | SUPPORTING DEI

APS Suggests Ways NIH Can Address Structural Racism

On March 1, 2021, the National Institutes of Health (NIH) launched the UNITE initiative to research and address structural racism within the agency and the wider biomedical research community. The following five committees within the agency will work in coordination to shift the culture of research toward one that is more diverse and inclusive:

1. **Committee U (Understanding)** will work toward understanding the experiences of all stakeholders within the biomedical research community and identify elements that contribute to structural racism.
2. **Committee N (New research)** will review NIH-funded research related to minority health disparities and equity with the goal of increasing transparency, accountability and sustainability.
3. **Committee I (Inclusion)** is charged with improving the NIH culture and structure to promote diversity, equity and inclusion in the workforce.
4. **Committee T (Transparency)** will communicate the findings of the other UNITE committees to stakeholders both within and outside NIH and will ensure transparency and accountability throughout the process.
5. **Committee E (Extramural)** will look broadly at the extramural research community to identify potential changes to policy, culture and structure that can promote diversity within the workforce.

As part of this effort, NIH also issued a request for information. APS submitted comments that were prepared with input from three Society committees: Diversity, Equity and Inclusion; Women in Physiology; and Science Policy. The comments applauded NIH for recognizing the persistent problems of racial and gender inequities in the research workforce and called on the agency to seek innovative ways to incentivize change within the scientific community. The APS comments also included specific recommendations that focused on ways to promote diversity and inclusion by supporting researchers throughout their education, training and careers.

To read the text of the APS comments, visit **http://bit.ly/APSOnStructuralRacism**.

For more information on UNITE, visit **www.nih.gov/ending-structural-racism/unite**.

RESEARCH FIZZ

Human skeletal muscle fiber type-specific responses to sprint interval and moderate-intensity continuous exercise: acute and training-induced changes

Researchers explored responses of different muscle fibers to moderate-intensity continuous and sprint interval training.

***Journal of Applied Physiology*, April 2021**

https://doi.org/10.1152/japplphysiol.00862.2020

RESEARCH FIZZ

100th anniversary of the discovery of insulin perspective: insulin and adipose tissue fatty acid metabolism

This review commemorates the 100th anniversary of the discovery of insulin with a look at the regulation of adipose tissue fatty acid metabolism by insulin and the significance of the current definition of adipose tissue insulin resistance.

***American Journal of Physiology-Endocrinology and Metabolism*, April 2021**

https://doi.org/10.1152/ajpendo.00620.2020

RESEARCH FIZZ

Baroreflex dysfunction in Parkinson's disease: integration of central and peripheral mechanisms

This review summarizes potential changes in central and peripheral mechanisms of the autonomic nervous system that affect baroreflex function in people with Parkinson's disease.

***Journal of Neurophysiology*, April 2021**

https://doi.org/10.1152/jn.00548.2020

STATS & FACTS

4%

The portion of women's sports in all sports media coverage in the U.S.

Tucker Center for Research on Girls & Women in Sport

RESEARCH FIZZ

Behavioral and neurobiological mechanisms of Pavlovian and instrumental extinction learning

This review explores the behavioral and neural processes involved in extinction, a decrease in responding in certain types of learning, such as the Pavlovian response.

***Physiological Reviews*, April 2021**

https://doi.org/10.1152/physrev.00016.2020

UNDER THE MICROSCOPE

Rapid Fire Q&A

Helle A. Praetorius, MD, PhD, shares why she first became a doctor, the places she misses and her least favorite part of her job.

Q: Favorite nickname?
A: Helle on wheels.

Q: What inspired you to become a scientist?
A: I know why I became an MD—my best friend in first grade broke her leg while biking during the winter, and her dad, who was the GP, repositioned her leg and put it in a cast. I thought that was so cool. I fear that the science bit came along during med school because I realized that I loved the Sherlock Holmes part of it—getting to the core and realizing the system.

Q: How has the pandemic changed the way you work?
A: It has taken the joy out of science and out of teaching. To me, magic happens when you are working together, brainstorming while doing, learning from and inspiring each other. I heard the term "Zoombie"—and I think that wraps up "home office" in one word.

Q: "Old school" technique you're most proud of mastering?
A: The Ussing chamber—definitely the Ussing chamber—old school and Danish, just like me.

Q: Best "MacGyver" moment in the lab?
A: Actually, that is my middle name. I fix anything with paper clips, rubber bands and duct tape, but microscopes are my specialty, even though I am quite fond of the idea of using an eraser as support for a mouse ear to assess micro-perfusion.

Q: If you could meet any scientist (living or dead) who would it be and why?
A: I would really have loved to have a good old discussion with Dr. Ernest Starling regarding both the law of the heart and the Starling-Landis equation.

Q: What do you wish the general public understood about science or research?
A: I actually think that the general public understands and appreciates science quite well. But I would really like politicians to realize that free science is the foundation of a civilized society and supporting free science guarantees that we can handle the problem to come, whatever that may be.

Q: If you were a model organism, which model organism would you be?
A: I think that would be a sea urchin—small, round and really annoying to step on.

Q: Favorite science-related TV show (fictional or factual)?
A: "Doctor Who" from the BBC—is that science related?

Q: The scientific discovery or invention (made by someone else) that you wish you had made?
A: The microscope. It is my No. 1 solution to everything. Having been smart enough to figure out to use optics to see things that were not visible to the naked eye—wow, that discovery has changed the world.

Praetorius on her terrace in Aarhus, Denmark.

Photos courtesy of Helle A. Praetorius, MD, PhD

Praetorius skiing in Tehran, Iran, while her oldest son snowboards.

Q: No. 1 guilty pleasure? A: "RuPaul's Drag Race" and a glass of Riesling.

Q: Favorite way to spend a free hour in quarantine?
A: Knitting and listening to podcasts.

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

Q: If you could do a sabbatical with any scientist (living or dead) who would it be and why?
A: I would choose Dr. Ken Spring. My time at the National Institutes of Health was way too short, and Ken retired way too early.

Q: Tell us a surprising fact about you.
A: I am dyslexic and spend three times as long composing any written text—even emails—as others, and still the result is swamped with mistakes. There are so many scientists who have dyslexia, but it is important to acknowledge for others with this problem that dyslexia is a handicap, not a hindrance, to what you want to do.

Praetorius digging in the sand at age two in Copenhagen.

Q: Least favorite part of your job?
A: Everyone answers "writing grant applications" on this, right?

Q: Title you'd use on your autobiography?
A: I would never make an autobiography—my children have suffered enough as it is.

Q: First place you want to visit once the pandemic-related travel restrictions are lifted?
A: Marrakesh—the orange juice one can get on the Djema el-Fna (main square and market)!

Q: Crunchy or creamy?
A: Crunchy—my lunch is usually Swedish flatbread, and the crumbs get stuck in my keyboard.

Q: City, suburb, country?
A: Well, I am at the age where nostalgia kicks in, so Washington, D.C., and the D.C. area. Just a little too far from my "little boys," but I visit whenever I get the chance.

Q: The question we didn't ask that we should have?
A: How do you keep balanced on those shoes?

Helle A. Praetorius, MD, PhD, is professor of medical physiology at Aarhus University in Denmark. Her focus is renal epithelial transport and local paracrine signalling. Praetorius is the 2021 recipient of the Hugh Davson Distinguished Lectureship of the APS Cell & Molecular Physiology Section.

PUBLISH WITH POLISH | ART EXHIBIT

'Spotlight Cover' Showcases Author Artwork

Boosting the visibility and profile of an article can have a huge impact on the number of eyes finding your article (not to mention enhancing the number of downloads and citations). APS now offers the APS Spotlight Cover Program to assist authors in just such a way.

Authors are invited to submit artwork for an APS Spotlight Cover when uploading a revised manuscript. Approved artwork will be rendered into a branded issue cover to be featured on the journal's website and shared via the Society's social media channels.

APS will also provide authors with high-resolution digital files to facilitate sharing with institutional press offices, posting on social media sites, using in presentations and as Zoom backgrounds, and sharing with peers and social networks. In addition, each corresponding author will receive an 18"x24" poster print of the cover.

For consideration, image and caption files for APS Spotlight Covers should be submitted with revised manuscripts.

The inaugural APS Spotlight Covers can be viewed at **https://bit.ly/AJPHeartSpotlightCover** and **https://bit.ly/AJPReguSpotlightCover**. More information can be found at the journal websites at **https://journals.physiology.org/spotlightcovers**.

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

A RUNNER'S QUEST

Photo by Matthew LaVere

Tamara Hew-Butler, DPM, PhD, is fascinated by athlete physiology and the human messiness of applied science.

BY CHRISTINA HERNANDEZ SHERWOOD

Tamara Hew-Butler, DPM, PhD, was a Texas-based podiatrist specializing in runners in January 1999 when she volunteered as assistant medical director of the Houston Marathon. A marathoner herself, Hew-Butler watched a surge of inexperienced athletes thunder past the medical tent that mild morning, some downing dozens of cups of water during the 26.2-mile race. When ailing runners came to the medical tent, they were treated with intravenous fluids. "We assumed everyone was dehydrated," Hew-Butler says.

Hew-Butler loves working with professional athletes, including 7'4" Boban Marjanovic, who plays center for the NBA's Dallas Mavericks.

But by the end of the day, four runners had had seizures and were transferred to the hospital in weeklong comas. The diagnosis: critical hyponatremia, a dangerous condition characterized by low blood sodium. The Houston marathoners all recovered, but three years later Hew-Butler saw hyponatremia in the headlines. In 2002, the condition killed two young athletes, a 28-year-old woman running the Boston Marathon and a 35-year-old woman competing in the Marine Corps Marathon in Washington, D.C.

"That set me off on this quest," Hew-Butler says. "I needed to know why these runners were dying, whether this was because they were drinking too much water or they didn't replace their salt."

So, in a gamble that paid off big, Hew-Butler quit her job of nearly a decade and moved to South Africa to study with Timothy Noakes, MBChB, MD, DSc, the renowned sports scientist who first reported on hyponatremia in the 1980s. As she earned her PhD in physiology, Hew-Butler learned that the condition, while uncommon, is completely preventable. "All of our research pointed toward people just drinking way too much water," she says. "That's how I got into overhydration."

A decade and a half later, overhydration is still Hew-Butler's first physiological love (her Twitter handle is @hyponaqueen). In May 2021, she published an article in *The Washington Post* warning that the conventional wisdom of eight glasses of water a day isn't right for everyone. "Not to burst anyone's water bottle," she wrote, "but healthy people can actually die from drinking too much water." (See "The Science of Hydration" on page 24.)

Hew-Butler's research interests have expanded since she joined

Photos, pages 18-22, courtesy Tamara Hew-Butler, DPM, PhD

Wayne State University in Detroit, where she's now an associate professor of exercise and sport science. "The PhD in physiology gives you an understanding of how the body works and how to investigate the problems that come up," she says. "That's really the take-home. Now my research has spun out in a lot of different directions because that's where I landed."

Growing up in Los Angeles as the second daughter (or "the son that my dad never had"), Hew-Butler was a wannabe gymnast who cheered for her home teams, especially the NBA's Lakers and the NFL's Rams. She took up running at the University of California, Los Angeles, in her undergraduate years—during that tricky transition into adulthood when people are at risk of developing a sedentary lifestyle. She eventually settled into a routine of running three miles a day. "That's the one constant that's been through my life," she says. "When I don't run, my body is not used to that. Everything hurts."

Hew-Butler is fascinated by athletes. She screens student-athletes, noting their body composition, mental health and other markers, then tracks changes to learn how training and competing affects them. Her latest fixation is the fine line between peak athletic performance and overtraining. She also tracks professional athletes to learn more about what happens when that elusive line is crossed.

Hew-Butler performs a DXA scan on Kendrick Nunn, rookie point guard for the NBA's Miami Heat.

"When people overtrain their performance gets worse. They become extremely fatigued. They get sick all the time. They have headaches and brain fog, and their body is not functional anymore," Hew-Butler says. "Once you get there, it's years before you get better, if you get better at all." In that way, she adds, overtraining is a mysterious illness like chronic fatigue syndrome or long COVID-19.

As the pandemic shut down Wayne State last year, Hew-Butler went to work studying the impact of the lockdown on the performance of college athletes. Her preliminary work with the university swim team found that while the athletes spent about half the normal time training in the pool, sprinters actually performed better post-quarantine. The distance swimmers, however, didn't fare as well.

Hew-Butler, who considers herself "a weird outsider" in the world of physiology, relishes the human messiness of applied science.

"We learn stuff every day and we talk about it. To me, that's what education is. Experimentation is part of your life. Whatever field you go into, you have to learn how to experiment."

Hew-Butler wants to expand her research beyond the lab, helping to create exercise programs throughout Detroit.

One of her favorite studies, on sodium balance in runners participating in a 100-mile race, involved tracking their food and drink intake, then collecting their labeled bags of urine from along the course to study in the lab. "That's the physiology that's more real life," she says. "We can't control it."

When she's not studying athletes, Hew-Butler tries to create more of them. Part of her mission, she says, is to "inspire the joys and benefits of regular, lifelong exercise." In one example, her research team ran a three-month trial in which obese college students were trained to run a 5K Turkey Trot. "They had more energy, and it inspired them to keep going," Hew-Butler says. "Anything that we can do from a preventive health standpoint is important. It's important for the health of society, but I think there are a lot of benefits that people don't realize."

One of her favorite studies, on sodium balance in runners participating in a 100-mile race, involved tracking their food and drink intake, then collecting their labeled bags of urine from along the course to study in the lab.

Once it's safe to go back into the field, Hew-Butler wants to expand her lab's reach off campus. She's writing grants to fund a project in which students would establish fitness centers (think CrossFit "boxes") to provide workout equipment, classes and training plans throughout Detroit, where more than two-thirds of the population is overweight or obese.

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Top: A marathoner, Hew-Butler says running three miles every day has been a constant in her adult life. Bottom: Hew-Butler grew up in Los Angeles but now lives on a 10-acre hobby farm with her husband 60 miles north of Detroit, where she loves kayaking on their small pond.

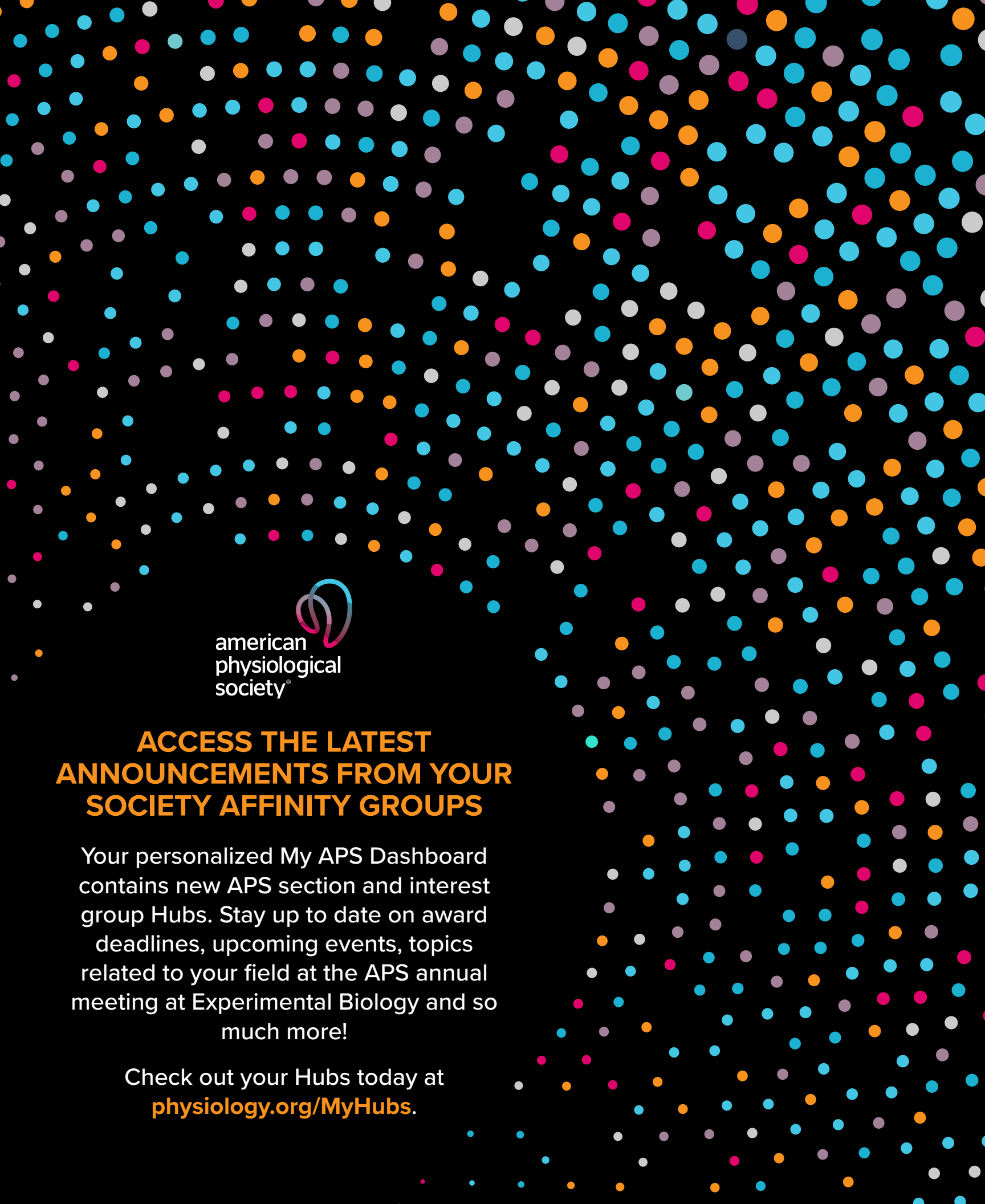
The idea is to make it as easy as possible for residents to work out, Hew-Butler says. The goal is a host of self-sustaining gyms across the city. "We need that here in Detroit," she says.

Like much of the rest of the world, Hew-Butler's work life has largely been confined to her home since March 2020. But her home happens to be a 10-acre hobby farm 60 miles north of Detroit that she shares with her husband, Bill, and their two domesticated ducks.

"Growing up in LA, we never had space," Hew-Butler says. "Here, there's space everywhere. It's like living in a park." She goes for runs through the property and watches the ducks on the pond, while Bill tends to the garden and the apple, cherry and peach orchard. In summer they eat fresh tomatoes, and in winter they shovel fresh snow.

Still, Hew-Butler is eager to return to the lab—the pandemic shuttered it for a full year—and the classroom. "The students that I have, they're hungry, and they work really, really hard," she says. "It's just so vibrant and happy and exciting. We learn stuff every day and we talk about it. To me, that's what education is. Experimentation is part of your life. Whatever field you go into, you have to learn how to experiment."

Her ongoing work includes a dehydration study that uses sensors, such as the Apple Watch, to monitor for subtle heart rate changes. Otherwise, Hew-Butler is waiting for the next big question that will guide her research. "At this point it's like, what falls in my lap?" she says. "When the swimmers end up in the hospital, why did they get there? When the basketball players all get fractures, why did that happen? We see a problem and try to find a solution."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The Science of Hydration

Uncovering the myth of the 8x8 rule.

BY MARIJKE VROOMEN DURNING, RN

The idea that humans should drink a minimum amount of water for optimal health goes back centuries. Hydropathy, a discipline touted by alternative practitioners in the 19th century, claimed that water was a cure-all for much of what ailed humans. Vincent Priessnitz, a farmer in Austria, promoted this notion and opened an institute in 1829 to support the practice. Despite Priessnitz's lack of formal education, his idea became popular, and he was deemed the "father of hydrotherapy."

In 1945, the U.S. Food and Nutrition Board issued guidelines indicating that people should drink two and a half liters of fluid per day. However, there was an added bit of information associated with the recommendation that seems to have been lost over the years, as if people stopped reading before they got to the end: "Most of this quantity is contained in prepared foods."

Illustration by Joey Guidone

This resulted in people, including renowned U.S. nutritionist Fredrick J. Stare, PhD, to recommend consuming a minimum of six glasses of water per day. Interestingly, Stare did not offer any support for his recommendation, admitting that the reasoning was not fully understood, according to a 2012 editorial published in the *Australian and New Zealand Journal of Public Health*.

In more recent years, we've all heard recommendations regarding how much water healthy adults should drink. It's eight glasses of eight ounces of water each day, right?

Although 64 ounces a day, which is just shy of two liters, won't hurt a healthy adult, Heinz Valtin, MD, disputed the idea that it was medically necessary in a 2002 article in the APS journal *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology*. Valtin, who died in 2019, challenged the evidence: "No scientific studies were found in support of 8x8. Rather, surveys of food and fluid intake on thousands of adults of both genders, analyses of which have been published in peer-reviewed journals, strongly suggest that such large amounts are not needed because the surveyed persons were presumably healthy and certainly not overtly ill."

HOW TO HYDRATE

Most of us have done it: We're out in hot weather and realize we're thirsty. We grab a bottle of water and guzzle it down, often in one go, to satisfy that thirst. But that's not really the best way to hydrate, says Lindsay Baker, PhD, a senior principal scientist at the Gatorade Sports Science Institute.

"In general, it's best to sip a little bit throughout the day," Baker says. "Most people take in larger amounts when they're eating meals and snacks, which helps the body retain the fluid." But sudden ingestion of large amounts of plain water by itself generally just ends up being eliminated in the urine pretty quickly.

"In general, it's best to sip a little bit [of water] throughout the day. Most people take in larger amounts when they're eating meals and snacks, which helps the body retain the fluid."

—Lindsay Baker, PhD

Chugging a glass of water initiates a bolus response, says Evan C. Johnson, PhD, an associate professor of exercise physiology at the University of Wyoming. A bolus response is the body's protective mechanism against hyponatremia after consumption of a large amount of fluid. It causes the body to excrete a larger proportion of that suddenly introduced fluid.

Sensors in the mouth and throat trigger the oropharyngeal response—which perceives a large, potentially dangerous volume of water coming into the system. "And regardless of your body's need for that water, it will move forward and start the process of diuresis. So, if you consistently drink smaller amounts over the course of the day, it's less of an alert to the body," Johnson says.

In addition, much of our fluid comes from the food we eat. There are the obvious foods, such as soup, but fluid makes up a large part of many of our other foods, such as fresh fruit, yogurt and much more. Often, people who say they rarely feel thirsty are actually getting enough fluid from their overall diet, says Joseph G. Verbalis, MD, a professor of medicine and chief of endocrinology and metabolism at Georgetown University in Washington, D.C. "People who like soups and other foods that have a high water content are obviously going to get more water than people who eat more dry types of foods," he explains. "But, the combined water content of food, plus your thirst-driven intake, is plenty sufficient to maintain normal hydration."

Despite that, the mantra of drinking eight glasses of water took off, and it's now commonplace to see people toting water bottles as they go about their daily activities. But the initial recommendations never said that the fluid had to be water. In fact, if people want to abide by this rule, most fluids count, including caffeinated drinks, milk, juice and maybe even beer, according to Valtin's 2002 article.

The idea that drinks such as coffee and beer work against hydration rests with the belief that these drinks increase the need to urinate, which could be interpreted as losing fluid. However, this isn't the case. "You can drink a beer and you will probably lose a little bit of it," says Tamara Hew-Butler, DPM, PhD. But it's not enough to affect your hydration, she says. Hew-Butler is an associate professor of exercise and sport science at Wayne State University in Detroit.

Some people believe the same of caffeinated drinks, but this isn't true either. "That's actually another myth," Hew-Butler says. "Studies have shown

that caffeine is not really a diuretic. If you're taking in more coffee or tea, it's the fluid that is driving the urination."

Baker agrees: "All beverages count in terms of hydrating throughout the day. So coffee counts, tea, juices, electrolyte beverages, carbohydrate electrolyte beverages, they all count," she says. That said, athletes are encouraged to be selective when choosing their beverages in relation to their exercise.

"There are some beverages that are better than others," Baker says. "For example, if athletes participate in an exercise where it's a longer duration, high intensity in the heat, then they need to start thinking about including sodium in addition to the water to help replace those losses and help support hydration and plasma volume, which is important for their cardiovascular function and performance."

But while other fluids can count toward the encouraged fluid intake, there may be other issues at play. For example, sugar-sweetened beverages add to caloric intake and could negatively affect blood glucose regulation, Johnson says.

OVERHYDRATION IS RARE

Overall, for the healthy adult, drinking a lot of water is not a big concern and simply leads to more frequent trips to the bathroom, Verbalis says. But every so often, a news outlet describes how someone has died from "water poisoning," or drinking too much water. As tragic as these situations are, they are rare enough that they make the news when they happen. "In the extreme—and I do stress extreme—patients who ingest excess water have died from hyponatremia," Verbalis says. "It takes a lot of water retention to do that." Cases like this are often related to peer-pressure incidents, such as fraternity hazing, or over-the-top contests, like what happened in 2007 in California.

A radio station hosted a contest, offering a Nintendo Wii gaming system to the person who could drink the most water without "wee-ing." A 28-year-old woman died of "water intoxication," according to the coroner. Initially, contestants were given eight-ounce bottles of water, which they were to drink every 15 minutes. After several of these smaller bottles, they were given larger ones. The woman drank roughly two gallons of water in three hours before she died later that day at home.

Hyponatremia occurs when blood sodium drops into the 120s. Normal blood sodium levels range from 135 to 145 mEq/L. "Once it is about 125 or below, you definitely have the risk of fatal brain edema, as a result of the water retention," Verbalis says.

AN IDEAL DAILY FLUID INTAKE?

Much like the recommendation that healthy adults should consume 2,000 calories per day, a recommendation that adults consume 64 ounces of water a day is also a generalization, according to Hew-Butler. "It's a one-size-fits-all that doesn't fit all," she says. "It's not going to work for everybody in all situations."

Everyone's fluid needs will fluctuate depending on their individual circumstances. Some people may have a medical issue that restricts the amount of fluid they should consume on a daily basis, while others may need to increase their fluid intake, such as people with kidney stones or hypercalcemia.

But most people should consider matters such as how active they are, how warm the weather is, their diet and their size. These are all vital issues in helping determine if someone is drinking enough.

Athletes must find that right balance to help them reach their peak performance. "We inform athletes that each athlete is unique, and each athlete loses different amounts of sweat when they're exercising," Baker says.

"We're also starting to notice that female law enforcement officials are reducing their water intake because they have to wear so much gear on their belt. For them to use the restroom is like a 10-minute procedure."

—Evan C. Johnson, PhD

While not essential for the average person, timing of fluid consumption is also important for these athletes, she adds. "We recommend athletes start thinking about their hydration before exercise, about four hours before." She follows the American College of Sports Medicine guidelines, which recommend slow consumption of 5 to 7 mL of fluid per kilogram of body weight at least four hours before exercise.

Thirst is the primary driver for fluid intake. Humans need to maintain a balance between the fluid lost during everyday activities—through sweat, urination and even the vapor in their breath—with what they consume. As people lose that fluid, blood volume decreases, increasing the ratio of salt and other minerals in the blood. Blood osmolality increases, and the brain responds by releasing an antidiuretic hormone, prompting the kidneys to retain fluid and triggering thirst. The feeling of thirst is also activated by the release of the peptide hormone angiotensin II.

Johnson provides an example of how physical activity and environment affect thirst: "Down in Mesoamerica and Central America, the people cutting sugar cane can drink up to 15 liters of water a day. They're sweating a lot. That's meeting their water needs. Would I recommend that same amount for a person who's working in an office job in an air-conditioned office and maybe walking for an hour a day? No way, that's way too much water for that person."

Limiting fluid intake can limit inconvenient trips to the bathroom. Some may limit fluid intake because they're traveling or don't want to get up in the middle of the night to urinate. Children may also skip drinks because they don't want bathroom breaks to interfere with their play, as might people who work in occupations where it may be difficult to get to a bathroom. "Nurses and doctors in hospital settings are notoriously under-hydrated because their job is so busy," Johnson says. "We're also starting to notice that female law enforcement officials are reducing their water intake because they have to wear so much gear on their belt. For them to use the restroom is like a 10-minute procedure."

Is this unhealthy? Not necessarily, not as long as they end up getting the right amount of fluid in the long run. "I think another misconception is that you have to replace everything right away at real time, but a lot of times you make up the difference at your meals," Hew-Butler says.

There are times when we can't rely on our feeling of thirst to stay hydrated. People with dementia or brain injuries, such as a stroke, may lose their ability to feel thirst. Caregivers are often left trying to find ways to ensure the person is well-hydrated. This is where a caregiver may want to offer foods that are higher in fluid, rather than relying on drinks that the person may refuse. They may also have to be creative, such as offering one pill at a time so the individual must take several sips of water or juice per pill. This may be particularly important in a heat wave, for example.

Consumer health advice often refers to urine color as a good way to indicate a person's hydration status—the lighter the urine, the more hydrated. Baker agrees that athletes can check their urine color to quickly assess their status. "If it's dark or highly concentrated, then drink a bit more," she says. "If it's a light or pale yellow color, then that's an indication that you're good to go."

But while this is a practical method, urine color may not be the best way to determine hydration. "Urine is a by-product of your blood trying to maintain a balance between water and salt," Hew-Butler says. "What comes out doesn't really reflect what actually is going on in our body." So, while it doesn't hurt to monitor your urine color, it's not necessarily the best indicator.

The general take-away of the hydration debate is to drink as much as your body tells you to. If you're thirsty, drink. If you're not thirsty, take sips of water or just wait until you feel thirst. Unless there are specific medical indications or situations, most people won't overhydrate, nor will they become dehydrated. So while the so-called 8x8 rule isn't harmful for healthy adults, you can take it off your "must do" list.

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The Gender

Gap

Female athletes have reached the pinnacles of success in sports. But science on sports performance among women and girls has been slow to catch up.

BY CHRISTINE YU

There have been many times when Emily Kraus, MD, sports medicine physician and director of the Stanford Female Athlete Program at Stanford University in California, felt frustrated on behalf of her patients, especially her female athletes. As an endurance athlete herself, Kraus understands that women face different physiologic demands compared to their male counterparts. Yet, health care providers don't always consider this nuanced context during their consultations and often miss the mark when it comes to interpreting complaints from active women.

Photo by Jose Breton-Pics Action/Shutterstock

Left: The U.S. Women's National Soccer Team celebrates its historic fourth World Cup title in 2019.

For example, if a woman's iron levels are on the low end of the normal range, she may be told her levels are healthy. But that baseline doesn't quite fit someone who's an athlete, where subclinical abnormalities can negatively affect performance and training. That woman might leave with a blanket prescription for training, nutrition and recovery, feeling like her concerns were misunderstood or dismissed.

Kraus knows there are numerous opportunities to dive deeper into areas related to a woman's physiology, like her menstrual cycle, and to explore how these aspects influence training, performance and health. "We're overlooking a lot of more important details underneath the hood," she says.

The problem? Experts say there are huge gaps in the understanding of female physiology within the context of physical activity and sports, and there isn't enough evidence-based research to provide concrete recommendations.

It's a peculiar gap. On the one hand, the number of girls and women participating at all levels of sports—from physical activity to professional sports—has boomed over the past 40 years. There are over 3.4 million opportunities for girls to participate in high school sports. Opportunities for female athletes in the National Collegiate Athletic Association have increased 291% since the early 1980s. At the global level, women will represent 48% of total athletes expected to compete at the Tokyo Olympics, the highest percentage of female athletes during the modern Olympic era.

Despite this growing interest and involvement in women's sport, scientific research hasn't kept pace, leaving women underrepresented and understudied in the fields of exercise physiology and sports science. That means the current model for athletic training, performance, injury prevention and return-to-sport is based on evidence found in men and then broadly applied to women. This ignores important physiological and biological differences between men and women.

Kraus is part of a growing number of practitioners and scientists dedicated to closing the research gap. "I want to be an advocate for female athletes through doing research and then eventually translating that research so we can be better clinicians, better coaches and even better parents of female athletes," she says. By specifically studying women, researchers may uncover strategies to maximize performance, reduce injury and help girls and women get into and stay in sports in a healthy way.

Despite the growing interest and involvement in women's sport, scientific research hasn't kept pace, leaving women underrepresented and understudied in the fields of exercise physiology and sports science.

LEAVING WOMEN OUT OF SCIENTIFIC RESEARCH

It's no surprise that the traditional paradigm of biomedical research is based on men. Men have long dominated the fields of medicine and scientific research, largely dictating research priorities. Male bodies have been seen as the gold standard while women have been considered deficient in comparison, a belief dating back to the 19th century. There have also been

concerns about conducting research on women, particularly after the sedative thalidomide was found to cause birth defects when taken by pregnant women in the 1960s. Afterward, the National Research Act of 1974 prohibited pregnant women from participating in research studies.

Sex can be a confounding variable. In particular, the menstrual cycle has complicated the research process. Fluctuating sex steroid hormones can cause physiological variability and create noise in the data that's burdensome and expensive to account for. Researchers have to run additional tests to determine a woman's menstrual phase throughout the research timeline. In the past, it was easier to eliminate the female sex from the research process across cell, animal and human studies. Even if women were used in studies, the data weren't always reported or analyzed by sex.

The problem is that women are not men. "We cannot extrapolate the data that we collected in men to women and treat them the same way," says Lacy Alexander, PhD, professor of kinesiology at Penn State University in State College, Pennsylvania, and past chair of the APS Exercise & Environmental Physiology Section. Alexander is also an APS Councilor. "We have to figure out appropriate therapeutics that make sense in terms of the physiology," she says.

Take prescription drugs, for example. Women metabolize medication at a different rate than men, but because dosing guidelines are universal, women may experience more side effects. When women took the sleep aid zolpidem (prescribed as Ambien), they reported symptoms such as cognitive impairment, sleep walking and even "sleep driving." Only then did the U.S. Food and Drug Administration issue sex-specific dosing guidelines for the medication in 2013, approximately 20 years after the drug was first approved.

"We cannot extrapolate the data that we collected in men to women and treat them the same way. We have to figure out appropriate therapeutics that make sense in terms of the physiology."

—Lacy Alexander, PhD

Even the 2017 hypertension guidelines from the American College of Cardiology and American Heart Association are based on research data derived primarily from men. Men comprised 70% of the study participants that informed the guidelines, and the evidence doesn't hold up in women, says Jane Reckelhoff, PhD, FAPS, professor and chair of the Department of Cell and Molecular Biology at the University of Mississippi Medical Center in Jackson and past president of APS. Despite the fact that women make up half of the world's population, hypertension recommendations for women are included in a separate section titled "Special Patient Groups."

The scientific community is playing catch-up when it comes to recognizing the importance of sex differences. It wasn't until 1993 that scientists were required to include women and minorities in clinical trials funded by the National Institutes of Health (NIH). In 2016, NIH enacted a new policy requiring the inclusion of sex as a biological variable in the design, recruitment, analysis and reporting of cell, animal and human research.

SEX DIFFERENCES AND ATHLETIC PERFORMANCE

Anthony C. Hackney, PhD, professor of exercise physiology and nutrition at the University of North Carolina at Chapel Hill, realized over 40 years ago that female athletes weren't studied to the same extent as male athletes. With his interest in endocrinology, he understood that sex steroid hormones coordinate more than just reproductive function. They also have important roles related to metabolism, thermoregulation and hydration. He wondered: Could reproductive hormones—that change across the menstrual cycle and across a lifetime—affect a woman's potential to exercise and perform?

Hackney was an outlier. Most researchers didn't ask the question and weren't very interested in studying sex differences. According to a 2014 study in the *European Journal of Sport Science*, women comprised only 39% of total participants in studies published in three leading sports science journals, and fewer than 14% of studies investigated women only. What's more, a 2021 study in the *Journal of Science and Medicine in Sport*

found that between 2000 and 2020, women represented just under 25% of first authors of randomized control trials in 14 of the top sports science journals. Women also occupied only 18.3% of editorial board positions, which could, in part, account for why female-related topics aren't prioritized.

As a result, there are few studies that specifically examine why differences may occur between female and male athletes or explain what that means for female athletes. According to Kraus, without data, the sports science and sports medicine community can't come up with evidence-based treatment and management protocols to help women prevent injury and achieve their athletic and personal potential. In failing to interrogate these questions, Hackney says we leave unexplored the nuances in female physiology and miss opportunities to improve women's health and training and lower women's risk of injury. And at the elite levels, where races and medals are won by slim margins, those nuances could mean the difference between first and fourth place.

HELPING FEMALE ATHLETES EXCEL

In recent years, there has been growing recognition that women and men experience exercise and sport differently and that women could benefit from sex-specific guidelines based on their physiology and lived experience. For example, studies indicate that women are two to eight times more likely to rupture their anterior cruciate ligament (ACL) compared to men and are more likely to retear their ligament. Women also return to sport at a lower rate after an ACL injury. In sports such as soccer, where men and women play with the same rules and equipment, women experience concussion at a higher rate. They also report a greater number and more severe symptoms with brain injury, particularly vestibular and ocular symptoms, and take longer to recover and return to play, school or work. Even how female and male athletes perform in hot conditions can differ due to differences in sweat rate and body fluid regulation.

In particular, researchers have turned their attention to the menstrual cycle to understand how the dynamically fluctuating hormonal environment influences areas such as performance, chronic training adaptations, injury, endurance and strength. Plus, most people who menstruate acknowledge that their cycle and its accompanying symptoms—such as cramps, bloating, fatigue, nausea—affect their fitness and how they feel when active. Understanding these changes can provide opportunities for female athletes to optimize their performance potential while mitigating symptoms they may experience.

While the jury's still out on the definitive impact of the menstrual cycle and hormonal contraceptives on exercise performance, it has opened a larger conversation about female-specific factors in sport. For example, in the lead-up to its historic fourth World Cup title in 2019, the members of the U.S. Women's National Soccer Team tracked their menstrual cycle and symptoms. It was another piece of the performance puzzle for the team, just like injury prevention or nutrition. Players became more attuned to their bodies. Based on this information, the team's high-performance staff helped players manage their anticipated symptoms with nutritional interventions, recovery strategies or even just reminders to get more sleep.

IT'S NOT JUST ABOUT FEMALE ATHLETES

Kraus points out that studying sex difference doesn't just benefit women; it can benefit all humans. "You can flip the research the other way too and understand male athletes better," she says. Take research on the female athlete triad, for example. The triad describes the interrelationship between energy availability, menstrual function and bone mineral density, where inadequate nutrition can lead to menstrual cycle dysfunction and low bone mineral density and put a woman's health at risk. While the triad was first noted in female athletes in the 1980s and 1990s, research and discussion in this area opened the door to consider similar hormonal disruptions in male athletes, Kraus says. It has led to the identification of new research areas such as the male athlete triad and relative energy deficiency in sports.

Alexander says that learning more about biology and physiology can also shed light on non-binary and transgender athletes. "What are the health implications of hormone therapy? What do we need to think about? What do we need to do from a study design perspective?" she says. "It's really important. We need to address these things."

Still, there's a long way to go in terms of building an evidence base of quality research on female athletes. But Alexander is optimistic and excited for the future. "There are a lot of really great women and men scientists who are examining sex as a biological variable," she says. "I'm excited for what we're going to find and how understanding these differences is going to benefit the public."

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Yates Wins Share Your Research Competition

Brandon Yates, MS, a certified strength and conditioning specialist, is a 2021 winner of the iBiology Share Your Research competition. The iBiology project produces open access videos about biology research in partnership with the Albert and Mary Lasker Foundation and the Rita Allen Foundation. Yates, a PhD student at the Indiana University School of Medicine, won for his research exploring the post-exercise cognitive function of older adults with regard to hydration status. Yates has been a member of the Society since 2018.

Brown Receives Eliza Lo Chin Unsung Hero Award

Alyssa Brown, a PhD student in the Department of Physiology and Biomedical Engineering at the Mayo Clinic School of Biomedical Sciences in Rochester, Minnesota, is a recipient of the American Medical Women's Association's (AMWA's) Eliza Lo Chin Unsung Hero Award. Chin, MD, MPH, is a former president of and the current executive director of AMWA. The award recognizes an AMWA medical student member that makes "substantial—but unrecognized—contributions" to the organization. Brown completed three years of medical school at the University of Louisville School of Medicine in Kentucky and plans to complete her final year of medical school in 2021. She has led the AMWA's social media team since 2018 and is an APS graduate student ambassador.

Crecelius Named a 'Woman of UD'

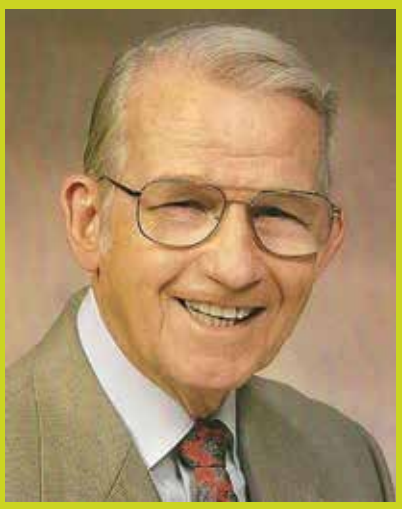
Anne Crecelius, PhD, associate professor at the University of Dayton (UD) School of Education and Health Science in Ohio, was named a 2021 "Woman of UD." The honor, based on the theme "Leading with Character and Resilience," recognizes honorees' resilience, drive, character and tenacity as they met the challenges of the coronavirus pandemic, social and political unrest, and economic uncertainty of the past year. In addition, in 2021, Crecelius received a scholarship award for tenured faculty and a student-selected Inspirational Educator Award from the School of Education and Health Science. She has been an APS member since 2008.

Goldberg Receives Passano Award

Alfred Goldberg, PhD, FAPS, professor of cell biology at Harvard Medical School in Boston, has received the prestigious 2021 Passano Award, which recognizes established investigators for exceptional research that leads to clinical medical applications. Goldberg was recognized for introducing the proteasome inhibitor MG132, which is now widely used as a research tool, and for initiating the research for the development of the inhibitor bortezomib, now a primary treatment for multiple myeloma. Goldberg has been an APS member since 1970.

Smuder Wins Excellence Award

Ashley Smuder, PhD, assistant professor in the Department of Applied Physiology and Kinesiology at the University of Florida (UF), received a UF 2021 Excellence Award from the College of Health and Human Performance. The award recognizes outstanding tenure-track assistant professors. Smuder is the director of the UF Molecular Cardiology and Myology Laboratory, where her research focuses on preventing cardiorespiratory function caused by disease and disuse conditions. She has been an APS member since 2013.



Charles M. 'Tip' Tipton, PhD, FAPS (1927–2021)

BY JEROME A. DEMPSEY, PHD; RALPH F. FREGOSI, PHD; AND FRANK W. BOOTH, PHD

Charlie Tipton was a Depression-era child in Illinois and Maryland and served his country in World War II. After receiving his bachelor of science degree from Springfield College in Massachusetts, he taught and coached briefly in high school before returning to complete his PhD in physiology under the tutelage of R.E. Johnson at the University of Illinois in 1962. His academic career included 21 years at the University of Iowa and 14 years at the University of Arizona.

Starting in 1963 in Iowa, Tip pioneered a landmark, cross-disciplinary National Institutes of Health-supported graduate program in exercise physiology that emphasized an in-depth education in the basic sciences. These programs graduated 30 PhDs and provided research experiences for many underrepresented high school students and teachers. Tip authored 200 peer-reviewed publications,

and his progeny contributed another 2,000 research articles in the broad area of exercise physiology.

Contributing to the success of professional organizations such as APS and the American College of Sports Medicine (ACSM) were high priorities for Tip. He served and chaired the APS Publications and History committees and the Environmental & Exercise Physiology (EEP) Section. He was also an APS Councilor and associate editor for the *Journal of Applied Physiology* (1988–1997). Post-retirement, Charlie published several biographies of physiologists and edited two editions of a history of exercise physiology as well as advanced exercise physiology textbooks.

Tip's dedication to our profession has been recognized by APS (Orr Reynold's History Award, EEP Honor Award), ACSM (Honor Award and Tipton Student Research Award), American Academy of Kinesiology and most recently by the Charles Tipton Annual Lectureship at Springfield College.

Charles is survived by his beloved wife of 68 years, Betty Jane Tipton, in Tucson, Arizona, and by daughters Teresa, Paula, Barbara, Lisa and Pat. Tip enjoyed a long and highly productive life in the service of others. We have lost a leader and good friend and will miss him greatly. A more detailed remembrance of Tip will be published in the *Journal of Applied Physiology*.

Jerome A. Dempsey, PhD, is professor emeritus and director of the John Rankin Laboratory of Pulmonary Medicine at the University of Wisconsin-Madison. Ralph F. Fregosi, PhD, is a professor of physiology at the University of Arizona in Tucson. Frank W. Booth, PhD, is a professor of physiology at the University of Missouri in Columbia.

MEET THE EDITOR

Michael J. Caplan, MD, PhD, FAPS

Physiology

Michael J. Caplan, MD, PhD, FAPS, will begin his term as editor-in-chief of *Physiology* on July 1, 2021.

"Considered against the timeline of the discipline of physiology, *Physiology's* founding in 2003 seems recent. Notwithstanding its relative youth, however, *Physiology* has become a valuable asset in efforts to highlight the discipline's vitality.

More personally, the birth of *Physiology* 18 years ago marked a milestone in my career development. I was fortunate to be invited by founding Editor-in-Chief Walter Boron to serve with Ulrich Pohl as associate editor. My nine years in this role, learning from extraordinarily smart and scientifically diverse editorial board members, were foundational in shaping my appreciation for the breadth, reach and excitement that characterize the modern discipline of physiology.

I completed my MD/PhD training at Yale in 1987, doing my thesis in cell biology with Jim Jamieson and George Palade. In 1988, I moved down one flight of stairs and into a new field, becoming a faculty member in Yale's Department of Cellular and Molecular Physiology. I have spent the ensuing 33 years in this department, serving as its chair for the past 11. From this vantage point, I have come to appreciate the centrality of physiology, and the types of questions that it asks, to every biological discipline.

My goal in returning to *Physiology* as editor-in-chief is to share this awareness with the broader scientific community. We hope to build on the success of Walter Boron and Gary Sieck by expanding *Physiology*'s readership and contributors to include the very large community of scientists who are physiologists but who do not necessarily realize it yet."

MEET THE EDITOR

Hilary A. Coller, PhD

Physiological Genomics

Hilary A. Coller, PhD, will begin her term as editor-in-chief of *Physiological Genomics* on July 1, 2021.

"I am currently an associate editor of *Physiological Genomics* and section head of the journal's Cell States and Their Regulation and Single Cell Genomics section.

Physiological Genomics welcomes original papers, reviews and rapid reports with a focus on the use of high-throughput approaches to uncover the connections between genes and cellular function at all levels of biological organization.

Two decades after the initial sequencing of the human genome, next-generation sequencing technologies in combination with CRISPR editing have resulted in a deeper and more profound understanding of genetic data. This transformation of biomedicine is fueled by a dramatic increase in diverse quantitative data and information-intensive approaches that have accelerated the pace of discovery and produced tangible results in the form of deeper insight into cell and organ function and better treatment of disease and injury.

My vision for *Physiological Genomics* is that it will continue to develop as a journal at the cutting-edge of scientific advances and technological innovation in the field of high-throughput and data-rich cell biology and its relationship to tissue and organ function. I picture *Physiological Genomics* at the forefront of efforts to decipher genetic and epigenetic information; define biological circuits that establish tissues, contribute to their function and response to their environment and become aberrant with disease; discover and disseminate new quantitative methodologies to advance the field; and translate new information into tangible benefits to society."

continued on the next page

MEET THE EDITOR

Mark R. Frey, PhD

American Journal of Physiology-Gastrointestinal and Liver Physiology

Mark R. Frey, PhD, will begin his term as editor-in-chief of the *American Journal of Physiology-Gastrointestinal and Liver Physiology* (*AJP-GI*) on July 1, 2021.

"I have been a member of the *AJP-GI* editorial board since 2009 and have always viewed the journal as a cornerstone of the gastrointestinal and liver research community. I am delighted and humbled to now take on the stewardship of this publication.

During my tenure, I intend to grow *AJP-GI*'s brand as a preferred destination for cutting-edge, mechanistic articles that make substantive advances in our understanding of digestive organ physiology and pathophysiology. The editorial team will also be soliciting work in critical emerging areas of interest to the field. Expect calls for papers on the mechanisms by which gastrointestinal and liver physiology influence other organ systems, development of novel model systems and leading-edge technology and other hot topics.

Beyond publishing outstanding research, *AJP-GI* has an important role to play as a Society journal. I intend to expand the journal's interaction with the APS Gastrointestinal & Liver Section, not just to bring in more great papers (although, of course, that is a goal!) but also to have a clear sense of the interests of the section members to serve our constituency as best we can. I also hope to leverage the journal's partnership with the Gastrointestinal & Liver Section to serve as a resource for young GI physiologists and help build a more vibrant and diverse GI and liver research community.

On behalf of the incoming *AJP-GI* editorial team, we look forward to seeing your manuscripts at the journal!"

MEET THE EDITOR

Liliana Schaefer, MD

American Journal of Physiology-Cell Physiology

Liliana Schaefer, MD, will begin her term as editor-in-chief of the *American Journal of Physiology-Cell Physiology* (*AJP-Cell*) on July 1, 2021.

"I am a professor of pharmacology at the Institute of Pharmacology and Toxicology, Goethe University in Frankfurt/Main, Germany, and an adjunct research professor of pathology, anatomy and cell biology at Thomas Jefferson University, Philadelphia. In addition, I am president of the Histochemical Society and chair of the Gordon Research Conference on Proteoglycans 2022.

My laboratory has made significant contributions to the field of innate immunity by discovering that proteoglycans of the extracellular matrix (decorin and biglycan),

when in soluble form, act as endogenous 'danger' signals triggering Toll-like receptors.

Over the course of my career, I have been appointed editor of many prominent peer-reviewed journals, including *Matrix Biology*, *Cellular Signalling* and the *Journal of Histochemistry & Cytochemistry*. I am honored to now shape the future of *AJP-Cell*. As editor-in-chief, I will work to include new topics bearing on cellular processes to attract a broad spectrum of authors and readers while also maintaining traditional aspects of the journal. I will encourage high-quality submissions from Asia, Japan and Australia and seek even more European submissions. I will also attract young career researchers. Together with my excellent and diverse editorial board, I will guarantee a rapid, professional and instructive review process. I encourage you to submit your next voluble manuscript to *AJP-Cell*."

MEET THE CHAIR

Gary C. Sieck, PhD, FAPS

APS eBook Committee

Gary C. Sieck, PhD, FAPS, will begin his term as chair of the APS eBook Committee on July 1, 2021.

"I have been a member of the American Physiological Society (APS) for nearly 40 years, serving as the 82nd president in 2009–2010. I also served as the president of the Association of Chairs of Departments of Physiology. This service has given me a

broad perspective of APS and the discipline of physiology.

Throughout my academic career, I have been very actively involved in the peer-review process, serving as an associate editor and then editor-in-chief of the *Journal of Applied Physiology*. More recently, I served as editor-in-chief of *Physiology*, as well as associate editor of *Comprehensive Physiology* and *FASEB BioAdvances*. I strongly believe that the peer-review process is critical for ensuring scientific rigor and reproducibility in biomedical research, which is critical for advancing discoveries. In this respect, I look forward to continuing my APS service as chair of the eBook Committee.

I am particularly honored to follow in the footsteps of Dr. Dee Silverthorn, who has provided exceptional leadership. I firmly believe that the APS eBook Committee under her leadership is now on the right path for the future as one of the main pillars for the dissemination of physiological knowledge by APS. Like the APS journals, books are an important part of our overall dissemination of information. Toward that end, APS has partnered with Springer-Nature to publish ebooks that will reach a very broad audience."

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.

FULL PROFESSOR (TENURE TRACK)

SAINT LOUIS UNIVERSITY

Saint Louis University and the Department of Pharmacology and Physiology in the School of Medicine is seeking a highly motivated investigator in pain research at the professor level within the tenure track. **Read more at www.physiology.org/SLU-Prof.**

TENURE-TRACK ASSISTANT/ ASSOCIATE PROFESSOR

SAINT LOUIS UNIVERSITY

The Saint Louis University Henry and Amelia Nasrallah Center for Neuroscience is seeking a highly motivated investigator in pain research at the assistant/associate professor level within the tenure track. **Read more at www.physiology.org/SLU-A/AProf.**

FACULTY POSITION— ASSISTANT OR ASSOCIATE PROFESSOR

SAINT LOUIS UNIVERSITY

Saint Louis University is seeking applicants for a tenure-track faculty position at the level of assistant or associate professor in the Department of Pharmacology and Physiology in the School of Medicine. **Read more at www.physiology.org/SLU-faculty.**

DATES & DEADLINES

AWARDS

Ernest H. Starling Distinguished Lecture of the APS Water & Electrolyte Homeostasis Section (Deadline: July 1)

Teaching Experiences for Bioscience Educators (TEBioED) Fellowship Program (Deadline: July 15)

A. Clifford Barger Underrepresented Minority Mentorship Award (Deadline: September 15)

Bodil Schmidt-Nielsen Distinguished Mentor and Scientist Award (Deadline: September 15)

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

More details: www.physiology.org/awards

CALLS FOR PAPERS

American Journal of Physiology-Cell Physiology (September 30, 2021)

- Epigenetic Regulation of Cell Signaling

American Journal of Physiology-Gastrointestinal and Liver Physiology (no expiration)

- Adaptations of Physiologic Systems to Promote Cancers
- The Chronification and Treatment of Visceral Pain
- Coronavirus Disease (COVID-19) and Digestive System
- Gastrointestinal Issues in Neurological Diseases
- Microbiome-based Therapeutics and Their Physiological Effects
- The Physiology of Cellular Organelles

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

- Getting It Right

Physiological Genomics (July 1, 2021)

- Comparative Physiological Genomics

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

WEBINARS

INFLAMMATION AND IMMUNOPHYSIOLOGY SERIES

Cardiovascular Diseases Associated with HIV and SARS-CoV-2 Infections
September 9, 2021

SCIENCE OF AGING SERIES

Quality, Quantity and Timing: Regulating Healthspan and Lifespan with Diet
July 7, 2021

Special Vulnerabilities of the Aging Brain to Cognitive Decline and Dementia
July 28, 2021

From "Artificial" to "Real": What 24/7 Home Cage Monitoring Teaches Us in Pre-clinical Neurodegenerative Disease Models
September 15, 2021

Aging and Skeletal Muscle Plasticity
September 29, 2021

More details: www.physiology.org/webinars

Magnifying 'The Tyranny of Distance'

BY CAROLINE A. RICKARDS, PHD

8,994 miles or 14,474 kilometers. That's how far away I am from my homeland of Australia, as I sit in my Texas home. Over the past year, this distance might as well have been a million miles. The "tyranny of distance," a phrase often used to describe the isolation of the island continent from the rest of the world, was suddenly magnified.

When the pandemic first hit in early 2020, we all watched in astonishment and fear as the case numbers and death rate started to rise. Travel plans were canceled, new safety restrictions were put in place and we were abruptly sent home to work. For those of us with family and friends outside the U.S., we also watched as international borders began to close, travel restrictions were established and plans for visiting home were put on hold indefinitely.

"The stress and anxiety of not being able to jump on a plane to visit family if something catastrophic were to happen can often be overwhelming."

For much of the pandemic, my greatest fear has been that one of my parents, both now in their 70s, will get sick (or worse), and I won't see them again, except perhaps for our last goodbyes via a computer screen. Indeed, this was the heart-wrenching case for many this year, regardless of the distance they lived from their loved ones. Thankfully, both of my parents have remained COVID free and have been able to live relatively "normal" lives—except for the occasional lockdown and state border closure to keep the country's low case numbers under control.

Back in 2013, I wrote a mentoring forum column for *The Physiologist* titled "Far From Home—Challenges facing international graduate students, postdocs and professionals living and working in the U.S." None of us knew back then that one of the greatest challenges for those of us living far from home during a pandemic is fear of the unknown. When will it be safe to travel 17 hours on a plane? Will I be able to visit my family without a mandatory two-week quarantine? If I do go home, will I be able to leave and return to my family in Texas? As we begin to turn a corner in the U.S., with vaccination rates climbing and case numbers falling, I can see some distant light at the end of this long and winding tunnel, and I have some final thoughts:

Be kind. Be kind to your colleagues, and particularly to your trainees, who have family and friends living outside the U.S. The stress and anxiety of not being able to jump on a plane to visit family if something catastrophic were to happen can often be overwhelming. Some days I wish my parents and siblings were just a "mere" 17-hour drive away.

Don't forget. As we slowly start to reenter the post-pandemic world, don't forget how much we have all learned about ourselves over this past year. Maybe you have surprised yourself with your resilience, your problem-solving skills and self-reliance, your patience and forgiveness, or your resourcefulness. Also, don't forget the pain and suffering many have endured as they have watched, helpless with the "tyranny of distance."

Caroline A. Rickards, PhD, is an associate professor of physiology and anatomy at the University of North Texas Health Science Center. She is past chair of the APS Women in Physiology Committee and a member of the Exercise & Environmental Physiology Section Steering Committee.

Illustration by Brett Affrunti

american physiological society®

CALL FOR NOMINATIONS
EDITOR-IN-CHIEF

American Journal of Physiology-Endocrinology and Metabolism®

Nominations are invited for the position of editor-in-chief of *American Journal of Physiology-Endocrinology and Metabolism* (**ajpendo.org**) to succeed André Marette, who will complete his term as editor on June 30, 2022. The American Physiological Society (APS) Publications Committee plans to interview candidates in the fall of 2021.

Nominations due: August 1, 2021

Applications due: August 15, 2021

How to Nominate

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

Meet the Team

journals.physiology.org/ajpendo/edboard

Submit Your Best Work

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American Autoimmune Related Diseases Association, Inc.

2021 Inflammation and Immunophysiology: An Exploration of Pathophysiology

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Research topics covered in this series will include:

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- Innate versus adaptive immunity
- Mechanisms of cancer immunology and advanced treatments
- Mechanisms of autoimmune diseases and treatments
- Non-alcoholic fatty liver disease (NAFLD) and steatohepatitis (NASH)
- Aging and inflammation

Register today at:
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