THE Physiologist MAGAZINE
SEPTEMBER 2022

GUIDED BY SCIENCE

Junie Paula Warrington's path took her from high school teacher to researching lifesaving therapies for preeclampsia.

Comparative Physiology: From Organisms to Omics in an Uncertain World

San Diego, California

October 28–31, 2022

Advance Registration Deadline: September 20

physiology.org/Comparative2022

american physiological society®

This eighth APS Intersociety Meeting in Comparative Physiology is one of a few international meetings dedicated solely to the dissemination of conceptual and technological advances in comparative and evolutionary physiology.

Join us as we highlight some of the important work being done to understand physiological function in the face of climate change and other anthropogenic factors as well as the emergence of omics approaches in comparative physiology.

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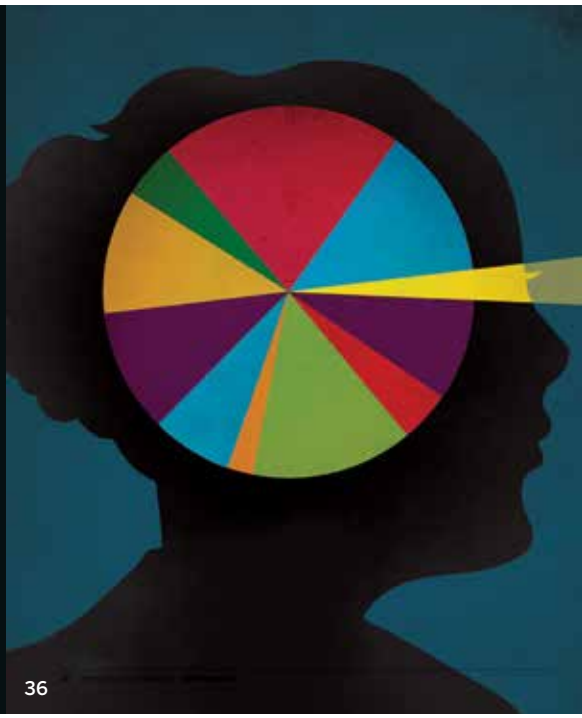

Cover photo by Bryan Tarnowski

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Present Alongside the Biggest Names in Physiology

Be a part of a historic moment for physiology by participating in the first-ever American Physiology Summit, April 20–23, 2023, in Long Beach, California. Attracting top names in physiology, the Summit offers a chance to share your science alongside leaders in your field. The abstract submission portal will open soon.

Stay tuned at physiology.org/APS2023.

american physiology summit

APRIL 20-23, 2023
LONG BEACH

Center for Physiology Education Launches

BY STACY BROOKS

Dear reader:

Happy September! As the weather (hopefully) starts to cool, we're reflecting on what's been a productive summer at APS. And just in time for students' return to campus, we are celebrating the recent successful launch of the Center for Physiology Education, a community of excellence focused on elevating the way we teach and learn physiology. More than 500 educators and researchers contributed to the development of the Center. We're excited for the physiology community to explore the more than 300 resources and modules organized around the Center's five themes: evidence-based teaching practices; inclusive teaching; teaching and learning integrative physiology; physiology education research; and curriculum development.

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Later in September, we will launch the APS Career Navigator, which will showcase the many types of work physiologists do across career sectors, from industry and government to nonprofit and academia. We're also revamping our Jobs Board (**jobs.physiology.org**) to help job seekers and employers find their ideal match.

But in the present moment, I hope you enjoy reading this issue of the magazine. In Review on page 10 recaps the action at the Institute of Teaching and Learning and #KidneyCamp conferences this summer. We recognize the career moves and achievements of APS members in Transport on page 40. Dates & Deadlines on page 43 lists upcoming webinars (back from summer hiatus!), calls for papers and events you don't want to miss. And there's so much more to explore.

OUR FEATURES

First up this issue is our cover feature about Junie Paula Warrington, PhD, of the University of Mississippi Medical Center. Warrington had no intention initially of moving to Mississippi for her postdoctoral fellowship, but you'll read about how she was encouraged to make one visit—and how that visit changed the trajectory of her entire scientific career. Learn about her fascinating journey and her preeclampsia research on page 24.

So much of physiology research depends on mice and rat models, but there are many other types of animals that are also critical to scientific research. We wanted to hear more about these "weird and unusual" animals and what our members are learning from them. On page 30, you'll read about some of these unique critters—we also hope you enjoy the artistic illustrations accompanying the story.

Finally, we wanted to provide an introduction to neurodiversity and specifically how it applies to science and in research labs. We start from the beginning: What is neurodiversity? We've all heard the word, but what does it mean? And why is it important to know more about it and embrace it in your labs? On page 36, you'll hear from researchers who identify as neurodiverse and their recommendations for making labs more inclusive.

WE WANT TO HEAR FROM YOU

Remember that you, members of the APS community, are the engine that drives *The Physiologist Magazine*. I invite you to email us at **tphysmag@physiology.org** to share your feedback, suggestions and story ideas. I look forward to hearing from you.

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

american physiological society®

WHAT is physiology?
WHERE is physiology?
WHY does it matter to you?

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#ISpyPhysiology

The Physiologist MAGAZINE

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Reflect. Remember. Celebrate.

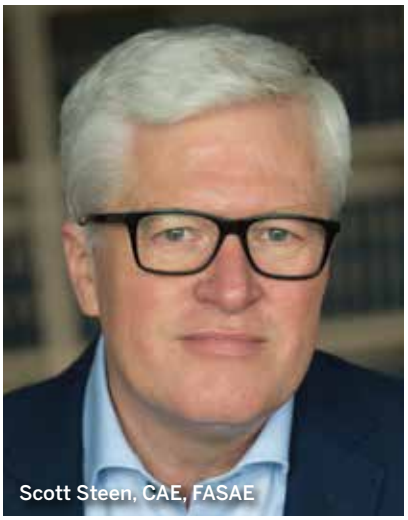
Proud to honor the members of our physiology community on the Member Memorial Forum.

physiology.org/member-memorial-forum

american physiological society®

How APS Can Support LGBTQ Members

APS Executive Director Scott Steen, CAE, FASAE, invited Troy Roepke, PhD; Jesse Moreira, PhD; and Melissa Bates, PhD, FAPS, to discuss their recent editorial "Challenges and inclusive practices for LGBTQIA2S+ scientists in the American Physiological Society," published in the *American Journal of Physiology-Heart and Circulatory Physiology*. They shared their experiences, thoughts and recommendations for how the Society and the greater scientific community can support queer scientists. Here's an excerpt of their conversation.


Scott Steen, CAE, FASAE

Steen: Troy, you're in New Jersey; Jesse, you're in Boston. You're in two of the most liberal, progressive parts of the country. Melissa, you're in Iowa. I wonder if part of your decision to be at the institutions you're at, for Jesse and Troy, had to do with your identity as queer scientists and if other institutions are losing great talent because they're not perceived as safe?

Moreira: Absolutely. When I was in my final year of my PhD, I have wonderful mentors, and they didn't mean anything by it, [but they would say], 'oh, you should go here; there's a person I know who you should work with. And I [would say], 'oh, well, that's Texas; oh, well, that's Arizona; oh, well, that's central Kansas.' I don't really want to go somewhere where I'm not sure that I won't be hate-crimed, to put it very bluntly. I mean, my nails are painted, I have five inch stilettos on right now and I am not changing this for anybody. … My lab right now [is] very, very warm; they're wonderful people. They keep a joke tally of how many times Jesse's worn a shoe without a heel this month to the lab. And it's usually not more than you can count on a hand.

Bates: That makes me so happy because 15 years ago when Troy and I were getting started, that was the majority of the [stuff] I used to take was wearing heels to work. But I want to be careful, Scott, with the implication about the East Coast versus Iowa. When I moved to Iowa, part of the reason I came here from Wisconsin was it was the first state to legalize gay marriage and it was a purple state, and it has changed over the years. And just because we're in the Midwest does not necessarily mean that you all are not as vulnerable to the tides. So, this is a fight that we have to fight every day to make sure our rights are protected at the national level and within our states—the right to control our own bodies, the right to present as we want, the right to feel safe in your workplace, the right to not be fired because of who you are. Just because I'm in Iowa doesn't mean that you all are not in danger, too.

Steen: How career-limiting is it to only have a few places available to you?

Roepke: When I was looking for a faculty job in 2008, 2009, I applied to 10 places because they were in states that had some sort of legal recognition for same-sex couples. In New Jersey and in Massachusetts, Connecticut at Yale and UMass Amherst and then Rutgers. And as soon as somebody offered me a job I took it because I figured I may not get one. It was during the recession, too, so I was like, 'I may not get one so I'm taking it.' And I'm glad I'm here; I'm very glad I'm here. But it was very limited, of course it was. I was born in Iowa, grew up in Nebraska; there was no way I wanted to move back in that direction.

Steen: I wanted to ask you about APS specifically. You had several recommendations for how we can create a more inclusive environment within the Society. Could you give me what you think of as your big ideas, what you'd really like to see us move on sooner rather than later?


Troy Roepke, PhD


Jesse Moreira, PhD


Melissa Bates, PhD, FAPS

Moreira: I want in some way, shape or form—and we had one meeting about this already—but I want to see a group, some internal structural organization that facilitates the voice of queer people in the Society. That's a big one for me. Whether it's a representative on the Diversity Committee or its own subcommittee advocating for these groups across the sections, I think there needs to be a seated position filled by a queer person to advocate for other queer people. And then that coincides with exhaustive demographic collection on the Society because we don't even know who's queer because we don't have the data as far as I know.

Steen: What I have often heard back around data collection is that people see this as very private. It's funny; it's like no one sees being heterosexual as very private, but there is a perception that people won't answer …

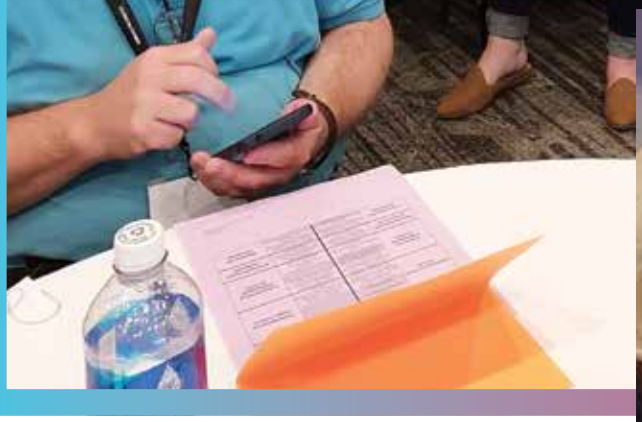
Roepke: And some people won't because they'll be afraid of being outed and they could have problems.

Moreira: Agreed. I think that that is a thing. Some people won't answer it; that's not a good reason not to even collect data on the five people who are willing to answer because now you know you've got five. I think the motivation for asking the question matters too, though, because if it's just random data collection, people are like, 'well, why do you need to know that?' But if it's like, 'hey, if people respond, we're interested in putting together networking opportunities for senior queer people to postdocs or undergrads or grad students, and we're interested in having a queer mixer at the annual meeting.' And people are like, 'Oh, I'd go to that.'

When you know you're going to be with a hundred other queer people, you're like, 'well they can't get us all.' You know what I mean? I'm tough; I'll beat you up with this high heel. So, you think safety in numbers and community building and you think, maybe I'm more likely to answer that question now. So, I think that a targeted campaign with collecting this data and telling them what we plan to do with it and how it's going to help the community is a core message.

View the conversation in full at **www.physiology.org/evolution**.

After three years away, educators gathered again for the APS Institute on Teaching and Learning, in Madison, Wisconsin, June 21–24, 2022



Dr. Patricia A. Halpin
@BSCIProf

#ITL2022 #APSTeaching Having a fun time with Elke and Rachael at ITL

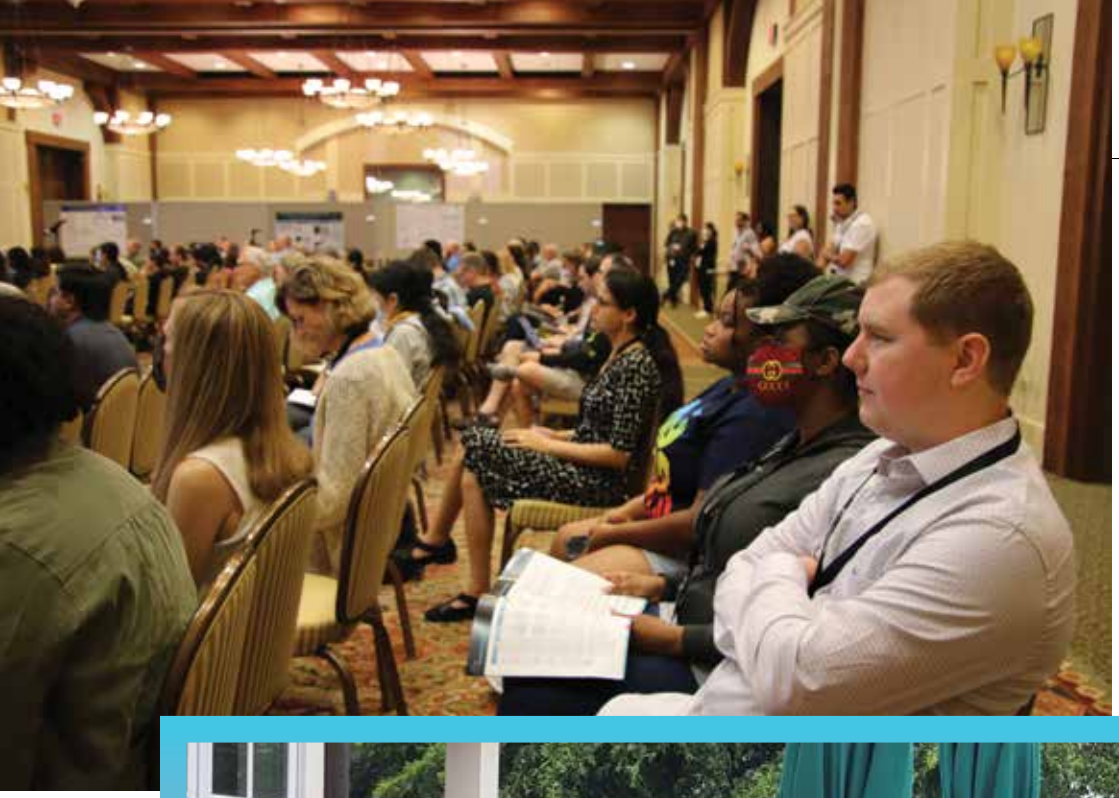
6:41 PM · Jun 21, 2022

Kidney Camp returned in June! The APS/ASN Control of Renal Function in Health and Disease Conference was held June 26–30, 2022, in Charlottesville, Virginia.

Austin Robinson, PhD
@AusRob_PhD

I couldn't make it this year but graduate student Mason McIntosh presented some data from our lab for his poster today at #KidneyCamp @APSPhysiology.

9:16 PM · Jun 27, 2022



Alexander Staruschenko
@staruschenko

Real #KidneyCamp meeting... Great to see old and new friends!

2:40 PM · Jun 27, 2022

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.

Follow APS on Twitter @APSPhysiology @SciPolAPS @APSPublications

LAB NOTES

STATS & FACTS

30%

The amount of increased productivity of teams that included neurodiverse members over fully neurotypical teams, in a preliminary study by Hewlett Packard Enterprise and Australia's Department of Human Services.

Harvard Business Review

RESEARCH FIZZ

Human temperature regulation under heat stress in health, disease and injury

This review looks at how people regulate their body temperature during exercise and other instances of heat stress.

***Physiological Reviews*, July 2022**

https://doi.org/10.1152/physrev.00047.2021

MENTORING Q&A | CAREER PREP

Industry Insights

How to maximize opportunities for a career in industry.

Each issue, we ask a trainee member to pose their career questions to an established investigator and mentor. Here, Ronald McMillan, PhD candidate at the University of Delaware and APS Porter Fellow, asks Irving Joshua, PhD, FAPS, professor and chair of the Department of Physiology at the University of Louisville, how to prepare for a career in industry.

Q: How much emphasis do you put on obtaining a postdoctoral position for a young physiologist interested in industry research?
A: The need for a postdoctoral experience as it relates to entering into an industrial research position depends on the requirements of the specific company. Many times companies prefer to

Left: iStockphoto; right: Illustrations by Kagan McLeod

train the PhD in a specific research area in which they are expected to work. Prior postdoctoral experience may be beneficial for demonstrating the individual's ability to work independently and, depending on the quality of the postdoctoral experience, possibly demonstrating some leadership or administrative qualities. Most of the time, grant and manuscript writing experiences are not essential for conducting industrial research, although experience with writing reports is a part of the responsibilities of industrial researchers.

Q: How did you increase your network? What tips do you suggest for a young investigator to expand their network?
A: There are a number of ways to increase or expand your science network. As a graduate student, you should depend on your primary research mentor as the one who would introduce you to individuals in your research area who would ultimately become a part of your science network. Many departments like mine invite established investigators in both academic and industrial research to participate in their seminar series and provide time for you to interact with them. In addition, when attending various national and local meetings students should initiate research discussions with individuals who are prominent in the research area(s) that they are interested in. You would be surprised how many times scientists remember those interactions when they are searching for a postdoctoral fellow and your name is in the pool of applicants.

Q: As a graduate student, outside of my current academic project, how do I acquire additional opportunities to gain experience in the research industry?
A: Many graduate students are pursuing their PhD in research laboratories that have a number of other investigators (junior faculty, postdoctoral fellows, other graduate students). These represent opportunities for students to collaborate in research areas that may complement their PhD research. These interactions could lead to co-authorships and exposure to new research techniques and approaches to gain knowledge and experience in new areas that might be directly or tangentially related to your PhD research.

Sometimes members of the PhD dissertation committee provide expertise or technique training in an area that complements the student's PhD research area. This may provide the student with an opportunity to add to the breath of their PhD research experience. PhD students should also be looking at opportunities to do a postdoctoral fellowship in an area that might be different than that of their PhD but provides training that complements their prior training and thus makes them a more attractive faculty or independent research candidate.

Q: What qualities do you look for in mentees who strive to be successful like you?
A: There are a lot of characteristics that contribute to a student becoming a successful physiologist, but one of the most important is possessing an inquisitive mind. The excitement of asking a question that has never being asked, or discovering something that no one has ever found, is the prime motivator for successful researchers.

The other attributes include good writing skills, ability to read with comprehension, good communication skills and an ability to pay attention to detail. Another important attribute is having a reasonably extroverted personality that allows you to interact with fellow scientists and verbally express your scientific ideas to others. Finally, I think all good researchers must have a great deal of patience and perseverance to weather many of the ups and downs associated with conducting scientific research and with developing a successful academic or industry-based research career.

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.

iStockphoto

STATS & FACTS

165,017

The number of 'other' Animal Welfare Act-covered species involved in research or teaching in the U.S. in 2019.

U.S. Department of Agriculture

RESEARCH FIZZ

Impact of breakthrough COVID-19 cases during the omicron wave on vascular health and cardiac autonomic function in young adults

This study found that vaccinated young adults who had COVID-19 during the "omicron wave" of late 2021 and early 2022 did not have lasting vascular impairment after active infection.

American Journal of Physiology-Heart and Circulatory Physiology, July 2022

https://doi.org/10.1152/ajpheart.00189.2022

STATS & FACTS

5–7%

The portion of all pregnancies affected by preeclampsia.

Circulation Research

STATS & FACTS

35

The number of results with Greenland shark (Somniosus microcephalus) in the title or abstract returned by PubMed.gov.

National Library of Medicine

RESEARCH FIZZ

Taking to 'heart' the proposed legislation for permanent daylight saving time

This perspective piece urges lawmakers to permanently adopt standard time rather than daylight saving time because it is less harmful to cardiovascular health.

American Journal of Physiology-Heart and Circulatory Physiology, July 2022

https://doi.org/10.1152/ajpheart.00218.2022

STATS & FACTS

10–20%

The percentage of the global population that is considered neurodiverse.

Deloitte Insights magazine

POLICY IQ | SCIENCE ADVOCACY

Finding Inspiration in Challenging Times

BY ERICA DALE, PHD

Over the years, our world seemingly becomes more and more tumultuous. Given the chaotic and often unsettling news that we're bombarded with every day, from the lack of trust in scientists and sexual and racial discrimination to a pandemic and increasing reports of violence across the U.S., it can sometimes feel like there's no hope for our future. Yet, I have found that despite occasional bouts of self-pity and helplessness, I feel even more inspired to act. This is part of why I love being a member of the APS Science Policy Committee and why that committee's annual Capitol Hill Days are so important to me. (See page 18.)

I moved from the University of California-Los Angeles to the University of Florida for some truly wonderful career opportunities. I knew without a doubt that this was the right choice to see my professional goals come to fruition. However, I also knew that I was moving to a state where some of my views were not reflected in the elected leadership, nor in some of the local communities around me.


Dale

My first foray into advocacy of any sort in Central Florida was to join a campus group that organized "Talk Science With Me," a program that sends scientists of all levels to bookstores, bars, cafes, etc. and sets them up with a table and a sign for the locals to simply join them and chat. It was through this experience that I quickly learned how to frame things in ways that people can relate to versus attempting to aggressively get a point across. This primed my ability to speak with representatives and staffers in the U.S. House of Representatives and Senate, both Democrats and Republicans, and to represent APS' positions on Capitol Hill Days. I've enjoyed these opportunities immensely.

With the help of fellow committee members and staff, during Capitol Hill Days we speak on several issues of importance to APS and the broader scientific community. This includes advocacy for funding increases for the National Institutes of Health, the National Science Foundation, Veterans Affairs Medical and Prosthetic Research and NASA. This year we also flagged several pieces of legislation that would support the scientific workforce by providing supplements to early-career researchers who experienced disruptions related to the COVID-19 pandemic; new STEM opportunities for scientists from underrepresented groups; and guidelines for combating sexual harassment in the sciences.

In many cases, we are the only scientific voices these staffers and members of

Top left and right: iStockphoto; Bottom left: courtesy of Erica Dale, PhD

Congress hear, and they're appreciative when we explain the importance of basic, biomedical, comparative and educational research. These formal meetings quickly become a personal conversation between a few people who come to the table with a genuine interest in building a better world.

This year APS' Capitol Hill Days occurred just weeks after the school shooting in Uvalde, Texas, and I was personally feeling motivated to advocate for gun violence research and prevention. At the time, this was not an issue on which APS had any formal position, so at the end of the meetings with my own Florida representatives and senators, I made it clear that I was putting on my "constituent hat" and speaking for myself when I raised the issue. To be perfectly frank, there were times during the preparation for our meetings that I felt frustrated and concerned that I wouldn't be heard. And yet, each time I shared my thoughts, I did feel heard and was always treated with respect and consideration.

"In many cases, we are the only scientific voices these staffers and members of Congress hear, and they're appreciative when we explain the importance of basic, biomedical, comparative and educational research."

Though I am acutely aware that one or two conversations a year with elected officials will not dramatically alter their policies, I've come to learn the importance of perseverance. Several of the policymakers we have spoken with also work in this way, hoping to collaborate to create bipartisan legislation that most can agree to, but that perhaps will only move the needle a small amount. I was also reminded that it's essential for our lawmakers to hear our scientific voices often, to learn about the issues important to us and to understand some of the nuances of what it means to be a productive scientist contributing to the economy, education and well-being of our communities.

Despite having sometimes very disparate viewpoints by way of policy, I have found again and again that the people I'm speaking with are also there for a lot of the reasons we are here in our own scientific profession: We want to make the world a healthier and safer place, and we want to make a difference. This feels like meaningful work, and I'm thankful to the APS Science Policy Committee for making it happen.

Erica Dale, PhD, is an assistant professor at the University of Florida College of Medicine and a member of the APS Science Policy Committee.

POLICY IQ | ACTION ALERTS

Speak Up for Science to Congress

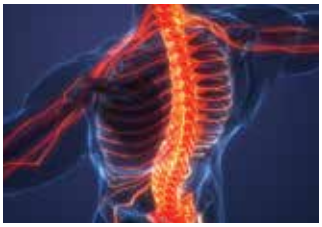
APS members are encouraged to sign up for APS Action Alerts, which provide strategic opportunities for members to speak out collectively on the issues that matter most to physiologists and the broader scientific community. The Action Alerts tool allows you to raise your voice in support of scientific research with just a few clicks.

Here's how it works:

1. When Congress is ready to take a vote on legislation that affects scientists, APS will develop template messages that you can personalize and send to congressional representatives and senators.
2. When you see an APS Action Alert email, follow the links and provide your information to accurately confirm your members of Congress. You only need to enter this information once.
3. Personalize your message or send it as written.
4. Amplify your message by sharing the alert with colleagues.

Sign up today at **https://bit.ly/APSActionAlertsSignUp.**

RESEARCH FIZZ



A model for self-organization of sensorimotor function: spinal interneuronal integration

This study looks at how local circuit neurons in the spine organize themselves using specific learning rules.

Journal of Neurophysiology, June 2022

https://doi.org/10.1152/jn.00054.2022

STATS & FACTS

70,000+

The global number of parental deaths caused by preeclampsia annually.

Circulation Research

RESEARCH FIZZ

13C-glucose-fructose labeling reveals comparable exogenous CHO oxidation during exercise when consuming 120 g/h in fluid, gel, jelly chew or coingestion

This study found carbohydrate oxidation rates during exercise to be comparable, regardless of the form of the carbohydrate (liquid, semisolid or solid).

Journal of Applied Physiology, June 2022

https://doi.org/10.1152/japplphysiol.00091.2022

POLICY IQ | CAPITOL HILL DAYS

APS Holds Virtual Capitol Hill Days

On June 7 and 9, 2022, APS Early Career Advocacy Fellows and members of the Science Policy Committee teamed up for a series of virtual meetings with congressional offices. Working in groups with staff guides, a total of 38 meetings took place.

In these meetings, APS members highlighted the importance of robust and consistent federal funding for biomedical research. Congressional offices are eager to hear from scientists in their state or district who can help them understand how federal dollars pay for cutting-edge research and training at their local institutions.

APS also advocated for innovation legislation that would reauthorize the National Science Foundation and recommend a major boost to the agency's research budget over the next several years. The innovation legislation also contains several provisions that would support the scientific workforce by creating initiatives to broaden participation of underrepresented scientists, provide resources for early-career researchers who suffered disruptions due to COVID-19 and address the problem of sexual harassment in the sciences by directing federal agencies to implement recommendations from the 2018 study from the National Academies of Science, Engineering and Medicine.

As part of the Capitol Hill Days, APS sent a message asking all members to participate from home by sending email messages to their congressional offices. Sixty APS members took the time to fill out the alert, generating over 170 messages to members of Congress.

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For pricing, benefits and details, visit

physiology.org/groupmembership.

STATS & FACTS

35%

The percentage of U.S. entrepreneurs with dyslexia—more than double that of the general population.

American Management Association

RESEARCH FIZZ

Disuse-induced skeletal muscle atrophy in disease and nondisease states in humans: mechanisms, prevention and recovery strategies

This review discusses the underlying processes of muscle loss as well as how to prevent and recover from muscle atrophy, especially in older adults.

American Journal of Physiology-Cell Physiology, June 2022

https://doi.org/10.1152/ajpcell.00425.2021

STATS & FACTS

~75%

The disparity between the portion of people with disabilities in the general population and their representation in the STEM workforce.

Geosphere

UNDER THE MICROSCOPE

Rapid Fire Q&A

Austin Robinson, PhD, shares a lab mishap, other scientists he admires and some of his hobbies.

Q: Most challenging laboratory technique you've learned to use?
A: Cannulating resistance arteries for pressure myography experiments (arrgghh).

Q: Items on your lab bench that you are most possessive of?
A: A set of good, sharp forceps back when I was cannulating resistance arteries.

Q: Favorite lab mishap story that you can share without incriminating the innocent?
A: I brought a colleague some Death Wish Coffee, "the world's strongest coffee." Later that day, they came out yelling about how their hands were shaking during their entire data collection that morning from the coffee. Luckily, I think they still managed to collect solid data.

Q: Best "MacGyver" moment in the lab?
A: My first standing desk was made of Styrofoam coolers (used to ship reagents) and a milk crate.

Q: If you could meet any scientist (living or dead) who would it be and why?
A: Edward William Hawthorne, MD, PhD, FACC. I only learned of Hawthorne a couple of years ago, but I admire him 1) because he was an African American physician-scientist in an era where he likely dealt with a lot of overt racism and yet he made substantial contributions, and 2) his research was on hypertension, so I am sure we would have several common research interests.

Q: If you could do a sabbatical with any scientist (living or dead) who would it be and why?
A: Kevin Hall at the National Institutes of Health because he does such cool (and expensive) studies related to metabolic health and energy balance. But I notice the group does not report vascular measures, so I feel like I could add some nice complementary outcome measures.

Q: What do you wish the general public understood about science or research?
A: I wish people understood how hard it is to create new knowledge versus passively consuming content. Doing all the work to create even one paper is infinitely harder than reading a lay article summarizing a new study or a popsci book.

Q: If you were a model organism, which model organism would you be?
A: Green anole, preferably in a field setting.

Photos courtesy of Austin Robinson, PhD

Robinson, far right, catches up with former lab mates Matt Babcock, PhD, and Joseph Watso, PhD, at the American College of Sports Medicine Annual Meeting 2022.

Left: Robinson and his wife, Sofia, visiting Virginia Beach on a road trip in 2018. Right: Robinson grabs coffee with his dog, Chaos, in Philadelphia.

Q: Favorite book about science (fiction or non-fiction)?
"The Sports Gene" by David Epstein, although recency bias brought "She Has Her Mother's Laugh" by Carl Zimmer to mind. Both are nonfiction.

Q: No. 1 guilty pleasure?
A: Meal prep days with my wife because I usually pig out and try all the food we're making for the week ahead in addition to some snacks.

Q: The scientific discovery or invention (made by someone else) that you wish you had made?
A: Making protein oatmeal a commercial product. I was adding protein to baked goods and my oatmeal years before these items became popular and I wish I could have cashed in.

Q: Tell us a surprising fact about you.
A: One of my favorite hobbies is vegetable gardening.

Q: Notable scientists you follow on Twitter?
A: I follow a ton of great scientists, but I guess two of them with larger followings are Adam Grant at UPenn (@AdamMGrant) and Mike Joyner at Mayo Clinic (@DrMJoyner).

Q: How would you describe your job to a child?
A: I get to do cool experiments on people with their permission and learn more about how the body works.

Q: One thing every researcher/scientist should try at least once in their life?
A: Western blot from start to finish. It's a mix of science and art.

Q: Favorite TV show, movie series or podcast to binge-watch/listen?
A: Marvel cinematic universe, especially the "Thor" movies. Podcast is The Drive by Peter Attia.

Q: The question we didn't ask that we should have?
Favorite hobbies: exercising, reading for leisure (nonfiction please), and hanging out with my dog, Chaos, a pit bull rescue.

Austin Robinson, PhD, is an assistant professor in the School of Kinesiology and director of the Neurovascular Physiology Laboratory at Auburn University in Alabama. His research interests are investigating the impact of nutrition and physical activity on cardiovascular health and disease. Robinson seeks to determine integrative strategies to prevent and treat cardiovascular disease.

Keeping Anaesthetized Rhinos Safe: A Collaboration between Researchers and South African National Parks

Professor Leith Meyer, from the University of Pretoria Faculty of Veterinary Science, is passionate about caring for one of the planet's most iconic species: the rhino. Meyer's work supports park rangers and conservationists at Kruger National Park, who dehorn rhinos to reduce the risk of poaching. Sedating a rhino during these surgeries is necessary for the safety of both animal and human. However, current data suggest that anesthetics pose a considerable risk to rhino health. Meyer's research aims to investigate changes in rhino physiology under anesthetic, find solutions that are practical for use in the rhino's natural habitat and advance veterinary care for rhinos to support conservation efforts.

Kruger National Park is set in the northeast corner of South Africa, bordering Zimbabwe and Mozambique, and covers nearly 20,000 square kilometers of grassland, wetland and bush. For over a century, the park's team of rangers, scientists and veterinarians have protected the animal group known as the "Big Five": elephant, lion, buffalo, leopard and rhino. It is no easy job to protect these iconic species, especially when it comes to the rhino.

In 2020, poachers killed over 500 rhinos across South Africa—roughly one every 22 hours. While this is an improvement on recent years, it is far too many for the highly threatened population to sustain. Even methods used to protect the remaining animals pose a risk. Techniques such as dehorning and translocation depend on chemical immobilization through anesthesia, which can have undesired side effects on animal physiology.

Meyer is collaborating with South African National Parks (SANParks) to change this.

Meyer teaches wildlife pharmacology and medicine at the University of Pretoria, where he spearheads research related to wildlife capture and chemical immobilization. His goal is to improve the safety of rhinos during veterinary procedures in the field. "We want to be able to inform people better in terms of what these

Once the rhino is immobilized, Meyer's team use a PowerLab system to monitor the rhino's ventilation, tidal volume, respiratory rates and metabolism during anesthesia.

drugs do, to improve the welfare of the animals and reduce the risks during anesthesia."

Rhinos are particularly sensitive to anesthesia. They can suffer from severe cardiorespiratory depression, with respiratory rates dropping from a typical 19 breaths per minute down to as low as three or four breaths per minute. "When you look at the data of their physiology, these animals are actually sitting on a knife's edge. It's really important for us to improve how we do things during rhino anesthesia."

Meyer is also focused on finding solutions that will work out in the field. "Using oxygen from a big cylinder is very effective in rhino, but it doesn't always help—especially when you're working from a helicopter—because you can't take that cylinder with you. When you're darting a rhino from a helicopter and you need to dehorn or treat it, you want to make sure the animal has the best physiological response to the drugs used; you don't have any fancy equipment to revive the animal."

A white rhino can be up to two meters tall at the shoulder, and the average male weighs over two tons, although there are reports of the largest animals reaching four tons. Their sheer size makes any kind of intervention a difficult proposition. Any treatment plan needs to consider human safety, as well as the animal's.

So how exactly do you collect physiological data from a rhino?

Once the rhino is immobilized, Meyer's team use a PowerLab system to monitor the rhino's ventilation, tidal volume, respiratory rates and metabolism during anesthesia. He has adapted transducers from human exercise physiology gear, specifically a gas analyzer and spirometer. As rhinos are obligate nasal breathers, Meyer's modified equine endotracheal tubes can measure airflow, CO_2 and O_2 each time the rhino breathes out through its nostrils. Calculating VO_2 and VCO_2 gives an indication of how much O_2 the rhino is burning up and how much CO_2 it is producing. To monitor blood pressure and other variables such as blood oxygenation and pH, a catheter is inserted into an artery in the rhino's ear.

Capture drugs often make the animals hypermetabolic. Meyer's team is aiming to develop ways to reduce this elevated metabolism. The team's findings allow the capture process to be fine-tuned for the rhino and keep the animal as healthy as possible. A better understanding of rhino physiology is already paying dividends, leading to changes in how drugs are used during dehorning operations, in which park staff spend up to an hour removing the rhino's horn, thereby reducing the risk of poaching. Alongside colleagues from other South African national parks, Meyer now helps run an advanced capture course for experienced wildlife vets from around the world, in which delegates learn about the latest developments and research in the field of wildlife medicine.

Meyer is passionate about research, although for a long time being a researcher was never the plan. "I always wanted to be a wildlife vet, but I've always had lots of questions in my head about what we are doing to the animals that we work on and the effects of the drugs that are used. I ended up doing more research to try and better understand what happens when we do these procedures. It's always exciting. There's always something new. There's always something that we can do to help, and there's always so much that we can learn."

For the full story and to see Meyer's team in action, visit the ADInstruments website at **adi.to/leith-meyer**.

Guided by Science

Junie Paula Warrington's path took her from high school teacher to researching lifesaving therapies for preeclampsia.

BY MIKE DE SOCIO

Junie Paula Warrington, PhD, was sitting at a welcome dinner at the University of Mississippi Medical Center, and if she was being honest, it was a place she never envisioned being. It was far from her home in the Caribbean, for one thing, and the school had not been on her radar.

She was on the hunt for a postdoctoral fellowship and already had her heart set on the one program she had applied to. But her graduate mentor insisted: You need to at least consider some other options. Warrington obliged and landed the interview in Mississippi, with "absolutely no intention of ever moving there." She was simply checking a box for her mentor.

Photo, facing page, by Bryan Tarnowski

Warrington with then-APS Executive Director Martin Frank, PhD, FAPS, at an Experimental Biology meeting.

But when Warrington arrived at the medical center, she was blown away by what she was hearing. "Honestly, when I came to Mississippi for the interview, I was sold on the evening that I arrived at the dinner," Warrington says.

The program heads were describing a program for postdocs the likes of which Warrington had not seen at all in her search so far. She was intrigued by the in-depth, specific training plan they had for their students. And the program had data to back it up, showing how successful its trainees had been. She immediately realized she needed a program like this if she wanted to be successful, too.

"I have ambitions and goals. And, you know, coming from outside of the U.S., you come here with a mission, to get your education, to be as successful as possible," Warrington says.

She accepted the spot in Mississippi and was offered research in preeclampsia—an area that promised to combine the vascular research Warrington was already doing with her interest in neurology. Plus, it would push her studies an extra step, toward physiological approaches and functional experiments. The unexpected move would come to shift the course of her academic career and was one of many serendipitous opportunities that led Warrington to where she is now: an assistant professor at the University of Mississippi Medical Center, studying preeclampsia-complicated pregnancies via translational animal models.

ENCOURAGED TO FOLLOW SCIENCE

When Warrington first came to the U.S. to study psychology, she was a high school teacher laser-focused on a different goal: Returning to her home country—the small Caribbean island nation of Dominica—with the skills she would need to counsel her young students and help them live better lives.

"Being a teacher, I was very concerned. I had a heavy burden to help young people to make better decisions," says Warrington, who was teaching math and basic science to high school students in Dominica.

She had an early interest in science, but she hadn't considered pursuing research; it simply wasn't something she had heard of anyone from Dominica doing. Her parents had not completed elementary school, and she didn't come from a strong tradition of education, but she decided to become a teacher, a popular choice for many of her peers. However, she eventually felt the pull to the U.S. and a degree in psychology. "I've always wanted to come to America. This is the place that you only dream of ever visiting and ever living in," she says.

Photos, pages 26–27, courtesy of Junie Paula Warrington, PhD

"I have ambitions and goals. And, you know, coming from outside of the U.S., you come here with a mission, to get your education, to be as successful as possible."

From her first freshman-year class, her professors at Fort Valley State University—a historically Black university in Georgia—saw her potential and urged her to change her major to biology. "I didn't take it seriously because I was still focused on that goal of attaining my psychology degree," she says.

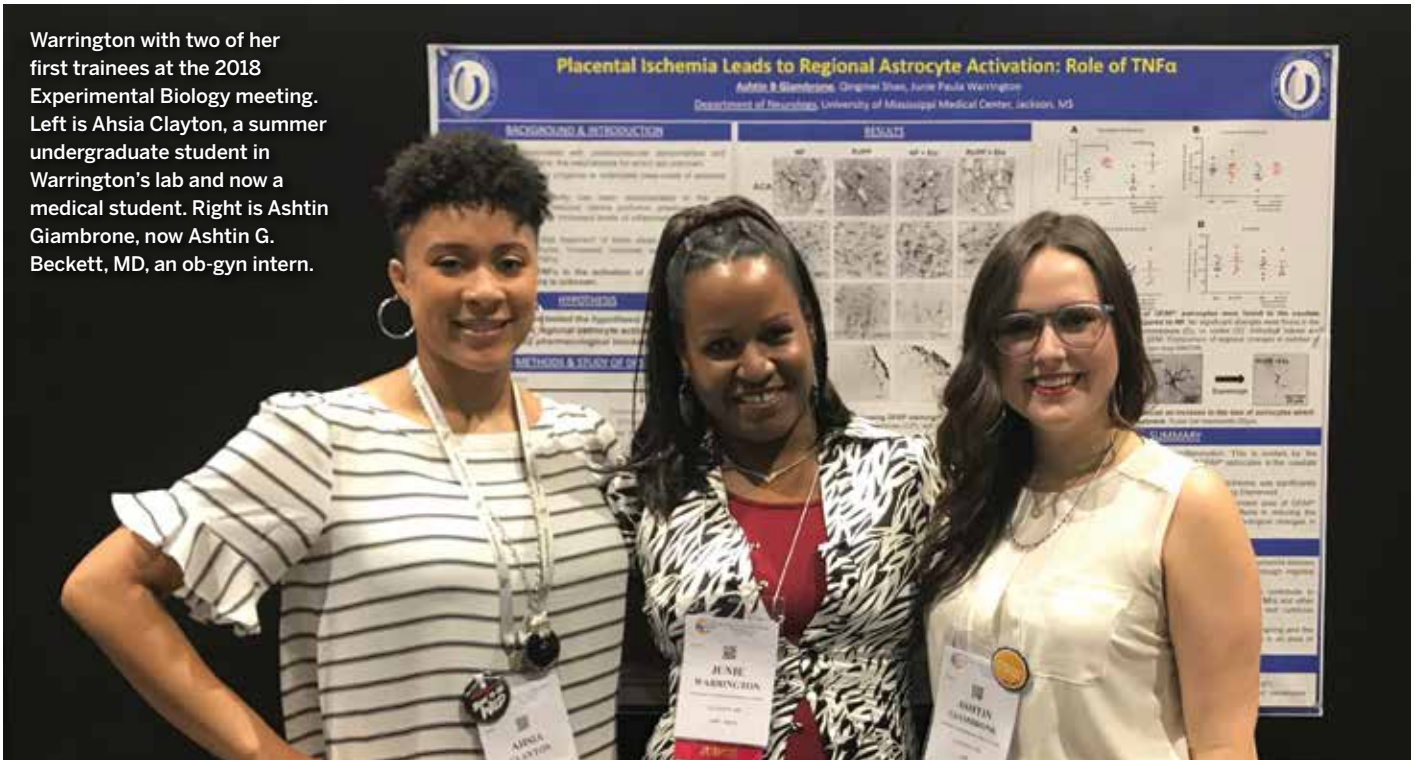
It wasn't until the summer, when she worked in a plant science lab on campus—one of the only jobs she was allowed to hold as an international student—that she started to fall in love with research. She shifted her electives and spent the following summer in an animal science lab. When it came time to pursue graduate school, she decided to combine her interests and focus on neuroscience.

Today, Warrington's work still connects to her early ambitions, in a way: While she's not counseling kids directly, she has the opportunity to mentor numerous high school, undergraduate, graduate and medical students. Plus, her research has the potential to improve the lives of generations of children.

STUDYING THE LONG-TERM EFFECTS OF PREECLAMPSIA

Preeclampsia is a sometimes-fatal pregnancy complication that affects not only the pregnant person but also the baby. Often, preeclampsia leads to premature births that pose high risks to infants, while putting the mother at serious risk of seizures or even death.

When Warrington entered the field, she knew of only one other researcher focusing on the effects of preeclampsia on the brain. As she and others began to explore the area more, they realized that the symptoms of preeclampsia don't go away after birth. Indeed, Warrington is finding that the impacts can stretch much farther into the future. Years later, individuals with a history of



Warrington with two of her first trainees at the 2018 Experimental Biology meeting. Left is Ahsia Clayton, a summer undergraduate student in Warrington's lab and now a medical student. Right is Ashtin Giambrone, now Ashtin G. Beckett, MD, an ob-gyn intern.

Warrington is asking questions such as: What is causing neurovascular changes in preeclampsia patients? Which factors increase a mother's chance of having learning and memory disabilities post-pregnancy? Why do some women have seizures and others don't?

preeclampsia are at increased risk for developing vascular dementia and are at higher risk of mortality from Alzheimer's disease and stroke.

Warrington's current research aims to identify what causes those long-term effects and how they might be prevented. To do that, she is developing animal models that mimic the characteristics found in human patients. So far, Warrington has shown that there are reliable rodent models that exhibit some of the same symptoms. Working with those models, Warrington is asking questions such as: What is causing neurovascular changes in preeclampsia patients? Which factors increase a mother's chance of having learning and memory disabilities post-pregnancy? Why do some women have seizures and others don't?

As Warrington's research paints a fuller picture of the systems at work—and potentially answers some of these questions—these findings can be applied to prevention. "Now we're trying to see what if we were to prevent this from happening during pregnancy? Can we prevent all these long-term changes?" Warrington says.

One avenue for prevention might lie in the endocannabinoid system, a biological system that is manipulated through cannabis usage and is the subject of one of Warrington's current projects. She still considers the research to be in its early stages, but it is laying the groundwork for potentially lifesaving therapies. It could also help address disparities, as African American women, in particular, tend to have a higher rate of preeclampsia.

"To me it is a highly impactful area of research because generations of people are affected," Warrington says.

DEALING WITH SELF-DOUBT

But even now, as an established professor and researcher pioneering a novel field of study, Warrington still has moments of uncertainty. "When you look at social media, you see a lot of posts about imposter syndrome," she says. "That is real to everybody, and for me it's even more of a reality because of the fact that I came to biomedical research late in my career."

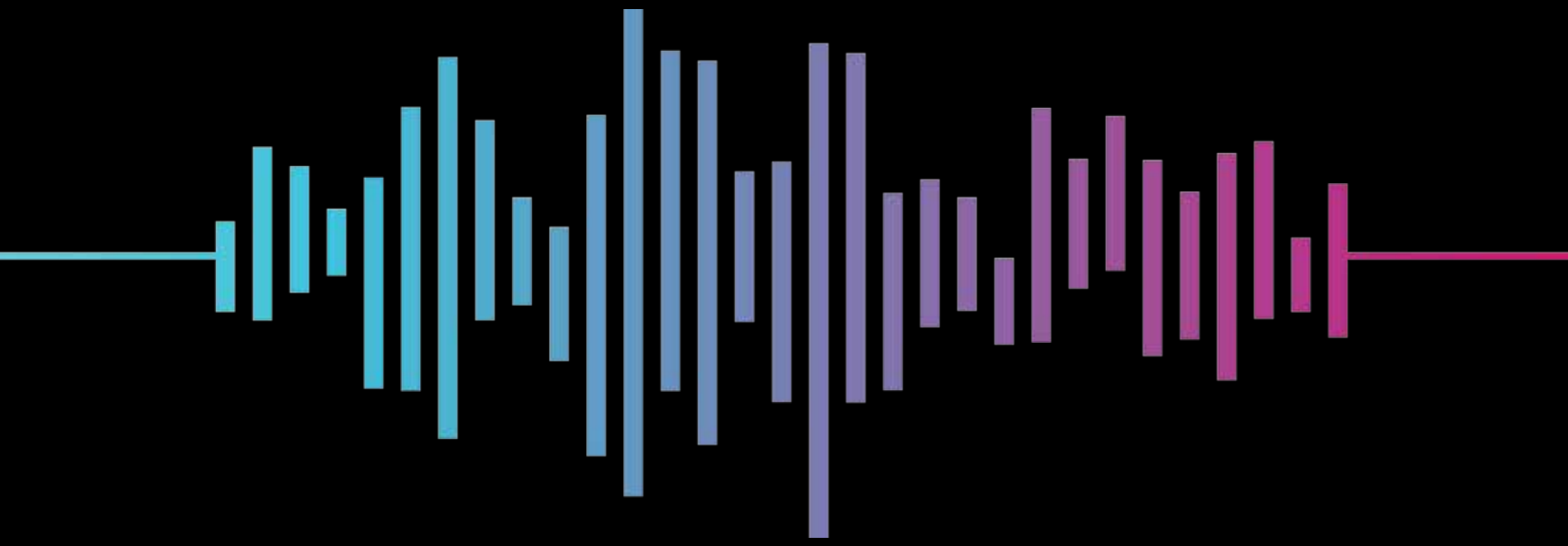
When Warrington was working on her PhD, she felt like she had to struggle to catch up to everyone else's general baseline of knowledge because she had not taken the same courses in undergrad.

"I still have self-doubt; I have knowledge gaps for sure," Warrington says. And she often feels the pressure of running her own lab and keeping her researchers (and herself) fully funded. "I'm now responsible for their salaries and their livelihood," she says.

But when she comes home each night to her sons, ages six and seven, she tries to put that all aside. "The clock stops when I get home—that is, the work clock—until they're in bed," Warrington says. "I really enjoy just spending time with them."

Owing to her childhood in the Caribbean, Warrington loves to work outside. She's cultivating a lush vegetable garden at home, with the help of her sons and husband. This year, they're growing onions, tomatoes, three types of peppers, potatoes, ginger, herbs, cucumber, asparagus, broccoli, strawberries, ginger, watermelon and "hundreds of collard greens"—the result of last year's seeds they collected and shook all over the garden.

While Warrington may be thousands of miles away from the natural paradise she grew up in, her life today is, in some ways, not all that different. She is working on finding a way to improve the lives of mothers and children, and she's created a small patch of natural beauty all her own.



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APS ACTION ALERTS

Stranger Things

These researchers go beyond traditional mammal models to investigate the weird and unusual in the animal kingdom.

BY MARIJKE VROOMEN DURNING, RN

When thinking of animal studies, most laypeople think of rats, mice or other mammals as test research subjects. But if we go back to the 17th to 19th centuries, biologists didn't study mouse models; they looked at a variety of organisms to learn and understand general principles of biology.

"The comparative approach really is a founding approach to understanding how biological systems operate," explains James W. Hicks, PhD, FAPS, a professor of ecology and evolutionary biology at the University of California, Irvine. His research focuses on vertebrates and spans several groups, from fish to humans. "You can look back, all the way to the 1660s when Robert Boyle was using his pneumatic engine to investigate the effects of lowered air pressure on a whole variety of animals. Boyle placed birds, mice, eels, snails and flies [in an air pump] and noticed that some of the animals, such as the eels, were more tolerant of the reduced air pressure and that the lower air pressure influenced the insects' ability to fly."

Illustrations by Sam Falconer

> **"There are examples throughout history where the comparative approach suddenly revealed something that people didn't know or think about, such as the study of fever, which, historically, was thought of as something that wasn't a good thing."**
>
> **—James W. Hicks, PhD, FAPS**

Looking at animals outside the mammalian model organism allows researchers to reveal what evolutionary possibilities exist in the process of natural selection. It allows them to examine potential physiological mechanisms that one would never imagine if researchers only focused on purpose-bred rodents or other mammalian model organisms, such as pigs.

"There are examples throughout history where the comparative approach suddenly revealed something that people didn't know or think about, such as the study of fever, which, historically, was thought of as something that wasn't a good thing," Hicks explains.

Studying mammals helped researchers learn what fever might mean, but by the early 1970s the role or purpose of fever remained unknown. Physiologist Matthew Kluger, PhD, wondered what happened in reptiles who regulate their body temperatures differently from mammals. "What it revealed was that fever was actually something that was very old evolutionarily and may actually have a benefit," Hicks says. Kluger's work changed the view of fever. Relying wholly on mammalian models, this fundamental feature would have been missed.

THE HELPFUL HISSING COCKROACH

Heidy Contreras, PhD, who moved this summer from her associate professor of biology position at the University of LaVerne, in LaVerne, California, to work at California State University, San Bernardino, chose early in her career to study insects. She began with fruit flies, beetles and moths and then settled on hissing cockroaches.

"Insects are invaluable," she says. "They provide so many services, ecological services, that we don't even think about. Like cockroaches—they're scavengers and they go in and clean up our environment without us even thinking about it. … They're really important in all sorts of ecosystems."

Hissing cockroaches are fascinating, she says. While working on a project on the specific dynamic action of these insects, she and her students kept getting odd data. They pulled back and went back to the fundamentals, like figuring out how long it took for the cockroaches to process meals. "We discovered that there is still a lot that needs to be discovered about the physiology of cockroaches, including basic metabolic pathways and mechanisms."

Getting people to understand her fascination with these creatures can be challenging. Still, Contreras says that when she gets potential students in the lab, they hold a cockroach, and although they may still feel some disgust over the insect, their curiosity is sparked. They start asking questions, like how to tell whether it's male or female. "It really changes their perspective," she says.

Contreras' research goals include understanding the physiology, ecology and evolution of animal behavior and motivating and advancing the field of conservation biology. These goals have led to her work within the community. To help declining animal populations recover, we need students interested and engaged in science in school and outside the classroom, she explains, but we also need members of the local communities engaged in the work.

Before the COVID-19 pandemic, Contreras started a program in which she and her students traveled to an Indigenous community in Guatemala to establish a community-based research project. They explored the connection between insect physiology and behavior as it relates to changes in water quality due to climate change. She and her students will apply the same work in a California lake closer to home.

"I am interested in local communities learning more about the effects of climate change on the physiology and behavior of important organisms such as insects and other invertebrates," Contreras says.

LOBSTER LOVE

According to Patsy Dickinson, PhD, Josiah Little Professor of Natural Sciences and director of the

neuroscience program at Bowdoin College in Brunswick, Maine, invertebrates have a lot to teach researchers. Dickinson's research focuses on lobsters and crabs as she works on understanding the ability of the nervous system to generate flexibility in patterned movements, among other things. She discovered the lobster research randomly, she explains.

"I went to a lab in France to do a postdoc, and they worked on spiny lobsters," she says. "I realized that crustacean nervous systems had a lot to offer. The nerves are very well-defined, and there are networks that are made of relatively few nerve cells, so you can really see what is happening."

While she acknowledges that lobsters and mammal systems are very different, crossovers in findings help scientists understand how the networks work.

"Not all the details are going to be the same," she says, "but the basic principles that govern the function of these tend to be similar across species."

Like Hicks' opinion about the value of earlier physiology research from other types of animals, Dickinson believes that studying invertebrates allows researchers to learn a lot about the complexities of seemingly simple systems.

"The first thing I worked on was a single neuron," she explains. "If you stimulate it, it just changed the entire output of the system; the same network was producing a very different output. That had never really been seen before. It was sort of astounding that you could have one neuron that would change the way the pattern was acting."

Dickinson believes that physiologists entering the field need to learn where the science comes from.

"A lot of the fundamentals of our understanding of physiology came from these other systems, and a lot is still being done in them," she says. "If you think about physiology broadly, you think about the Krogh principle, which basically says that there are some systems and species that are best for looking at each aspect of physiology and it's not necessarily all mice and rats."

She points out that there isn't one animal equivalent to humans, so the more details researchers get from different species, the more they have to work with.

BIRD BRAINS

Birds are another animal that many may not consider when thinking about animal research. Still, they play an essential role in a lab at the University of Florida in Gainesville. Jessica Whitaker-Fornek, PhD, a postdoctoral fellow at the university, grew up on a farm surrounded by ostriches and other birds. Before settling on her current research, Whitaker-Fornek worked with ducks (in a cypress swamp), beetles and wild mice.

She also worked on a project that studied bird behavior related to loud noise in the environment before studying chicken embryos. "I was studying their movement behavior because chicken embryos are just like a human baby in the womb," she says. "They kick and move their legs around, and this experience is very important to them because once they hatch, they're able to walk correctly."

Whitaker-Fornek then became interested in how the birds' nervous system developed within the egg so that they could move around and start finding food when they were ready to hatch. She eventually ended up studying baby zebra finches, which start breathing within the eggshell about a day before they hatch. "So that way, when they are completely free of the eggshell, they're able to breathe normally," she explains. "The full two weeks leading up to hatching they're not using their lungs at all to breathe; they're just using these vascularized membranes surrounding the eggshell."

Although Whitaker-Fornek is currently studying mice, when she becomes a principal investigator, she intends to return to birds with her own lab. Birds are surprisingly similar to humans in some ways, she explains.

"In general, birds have inhalation and exhalation, and they are endothermic, or warm-blooded," she says. "They also have an upright posture, which is similar to humans. And when their babies hatch, they are developmentally immature, so they require a large amount of parental care. What we can learn from them, hopefully, will also inform us as to how our own breathing circuits develop when we are in the womb."

Much early research was done on birds, Whitaker-Fornek points out. "If you're reading the scientific literature, in many papers from the early- to mid-1900s, a lot of the work is performed in birds or bird embryos. Now there's been a move away from working with birds. For example, Jason Pilarski's lab at Idaho State University where I worked was definitely the only lab that was studying the development of breeding circuits in birds."

TENRECS—THE 'DINOSAUR' OF MAMMALS?

Frank van Breukelen, PhD, a professor in the School of Life Sciences at the University of Las Vegas, studies animals that survive in harsh environments such as hibernators. He was inspired by his undergraduate research mentor, Steven Wickler, PhD, DVM. Wickler asked how animals that hibernate can maintain muscle strength when they emerge from hibernation after six months of inactivity. Van Breukelen asks: "How do animals even hibernate?" "It didn't make any sense to me," he said.

Van Breukelen's work focuses on tenrecs, which are mammals endemic to

Frank van Breukelen, PhD, and his colleagues first brought tenrecs to the lab in 2015, and they learned that the animals do things that nobody else can do. "We're looking at that ancestral condition. This is how mammals used to hibernate. We were biased because we all studied hibernation in modern mammals, and now the tenrecs are changing how we look at hibernation."

Madagascar. Tenrecs are nocturnal animals that look similar to hedgehogs, but the two aren't related. Van Breukelen was drawn to the animals because of Barry Lovegrove, PhD, who was a senior professor and specialist in evolutionary physiology in the School of Biological and Conservation Sciences on the local campus of the University of KwaZulu-Natal in Durban, South Africa.

"Barry died earlier this year, but he gave a talk at a meeting where he was talking about how [tenrecs] don't do interbout arousals. In my mind, I had established all these models for hibernation that involved the interbout arousal. And suddenly there was this animal that doesn't do it."

Usually, when animals hibernate, they don't just go into a state of hibernation and stay torpid the entire time. "What they do—in the case of ground squirrels, for example—is they go down for one to three weeks, then they come up for 24 hours or so and then they repeat the cycle over and over again, up to 15 times per year. These interbout arousals allow for resetting of homeostasis. But tenrecs don't do that," van Breukelen says.

He and his colleagues first brought tenrecs to the lab in 2015, and they learned that the animals do things that nobody else can do. "We're looking at that ancestral condition. This is how mammals used to hibernate. We were biased because we all studied hibernation in modern mammals, and now the tenrecs are changing how we look at hibernation."

While most people think of hibernation as something associated with winter and cold weather, the work with the tenrecs shows something different. "I would argue that hibernation did not evolve for overwintering or for cold temperatures. That's a later addition." Instead, the researchers believe that hibernation was more for predator avoidance. Van Breukelen points out that it's quite hot in much of Madagascar, furthering this belief.

Tenrecs "are really sort of a throwback to something different," van Breukelen says. In another example, tenrecs have a cloaca, one common cavity at the end of the digestive tract and genital opening. This is present in birds, reptiles and other animals, but not other mammals.

If van Breukelen has any regrets when it comes to his research, he says it's that he didn't start studying these fascinating animals earlier.

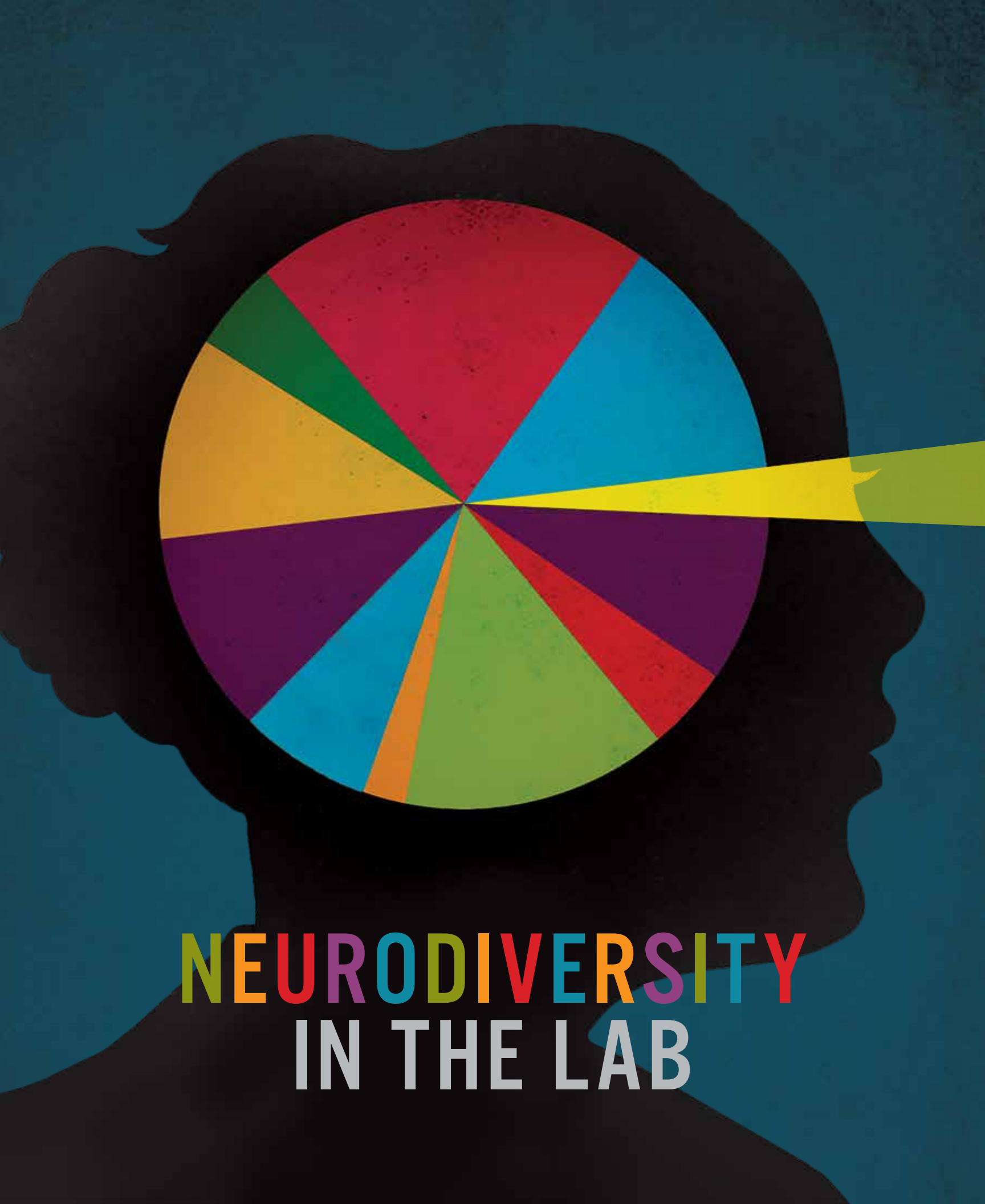
THE PLACES YOU WILL GO

Research with "nontraditional" animals can lead scientists down paths they never expected. Hicks, for example, was a consultant for the popular 2008 Pixar movie "WALL-E." One of his colleagues had worked with the company on the movie "Finding Nemo," and when Pixar came calling for "WALL-E," the colleague referred Hicks because he had been working with a grant from NASA on the effects of weightlessness.

"I gave a lecture to the entire crew and everybody involved in the film about what happens in space and microgravity," he says. "I think that's where it spurred the idea of having the humans on floating chairs that took them everywhere."

Microgravity affects the human body on Earth and is researched with bedrest studies, for example. "The studio wanted to know as much science as possible."

Given the definition of comparative physiology—learning about evolutionary relationships between different organisms and animals—working with animals outside of rodents and other small mammals allows researchers to dig deeper into the evolution of biological functions. This may lead to a better understanding of human behavior and the world around us.


NEURODIVERSITY
IN THE LAB

All brains work differently. Supporting that diversity can improve your research.

BY JENNIFER L. W. FINK

After Dave Caudel earned his PhD in condensed matter physics, he took a job that had little to do with what he studied. He became the executive director—and now the associate director—of the Frist Center for Autism and Innovation at Vanderbilt University in Nashville, Tennessee. He says he just "couldn't say no" to an opportunity to decrease the odds of others having to go through what he did: "figuring out how to make this weird world work for me."

As an autistic person, Caudel perceives and interacts with the world differently than a non-autistic person. Well before he was diagnosed with autism spectrum disorder (ASD) in his mid-30s, Caudel realized that his natural thinking patterns and behavior were often misunderstood. He also realized that other people seemed to easily be able to do things that were difficult for him.

"All of us who are neurodivergent realize early on that we live in a world that's not optimized for us," Caudel says. People with dyslexia, for instance, may struggle with written language. Those with dyspraxia—a neurological condition that affects motor learning and coordination—may have poor eye-hand coordination, jumbled speech and difficulty planning and coordinating tasks. Individuals with sensory processing disorder (SPD) may be overwhelmed by the lights or noise in a typical laboratory, and people with Tourette syndrome—a neurological disorder characterized by involuntary and repetitive movements and vocalizations—may blink, grimace or grunt frequently. Adults with attention deficit-hyperactivity disorder (ADHD) may hyper-focus and lose track of time. These are just a few of the common neurodevelopmental conditions that affect the way individuals think, process and engage with the world.

In years past, autism, dyslexia and other neurologic or developmental differences were often considered disabilities. Increasingly, though, there's been a push toward acceptance and inclusion—and toward recognition of the value of neurodiversity. There is not one agreed-upon definition of "neurodiversity," but Australian sociologist Judy Singer came up with the word in the 1990s to refer to the limitless variability of human cognition.

"The word 'neurodiversity' was coined to bring attention to the fact that there's no such thing as a 'normal brain,'" Caudel says. In fact, all brains work differently, and that diversity can be an advantage in any workplace, including research labs. Strengths of some neurodiverse people include innovation, complex non-linear thinking, big picture thinking and having the ability to link disparate ideas—all of which can make people excellent scientists.

For example, Caudel says, autistic people can be very detail-oriented. "Many of us are very logically driven, so we can be particularly adept at mathematics and puzzle-solving," he says. "We have superior pattern recognition and visual spatial capabilities."

Those skills may not be immediately recognizable though, as many people with ASD have a tough time reading social cues and may come across as "awkward" or "weird," he says. In fact, many autistic individuals (and other people with communication or social difficulties) don't make it past school or job interviews because interviewers mistakenly assume that the applicants don't have much to contribute or won't be able to function in an academic or laboratory environment.

That's a mistake because "we are losing all that potential," says Sara Rankin, PhD, a professor of leukocyte and stem cell biology at the National Heart and Lung Institute, Imperial College London. "We're missing people who could make significant contributions as scientists." Rankin identifies as dyspraxic and dyslexic.

Neurodiversity in the lab increases the likelihood of effective problem-solving. "When you're tackling a complex problem, you don't want 30 brains that are identical to one another working on it because then you're just going to get 30 copies of the same answer," Caudel says. "If you have a diverse staff, working collectively, some of those solutions may be terrible, but some will be brilliant and outside of the box."

To maximize the capability of a diverse workforce, principle investigators and others in the lab must create a supportive, neurodiverse-friendly workplace. Here's how:

Illustration by Brian Stauffer

EDUCATE YOURSELF ABOUT NEURODIVERSITY

Take the initiative to learn more about neurodiversity and common presentations and challenges of oft-encountered conditions such as ASD, ADHD, dyslexia and dyspraxia. The website of the Frist Center for Autism and Innovation (**www.vanderbilt.edu/autismandinnovation**) is a great place to start; it includes links to free informative webinars and lots of info about neurodiversity in the workplace. (Click on "Tools and Resources.")

The Neurodiversity Hub (**www.neurodiversityhub.org**) is another reliable source of information, and the Learning Disabilities Association of America (**www.ldaamerica.org**) has information about dyslexia, dyspraxia, ADHD and non-verbal learning disabilities.

Don't rely on neurodiverse individuals to educate you about themselves, but listen carefully to their comments and feedback. Sharon Miligram, PhD, director of the Office of Intramural Training and Education at the National Institutes of Health, has learned to value input.

"When students share with me that I should slow down, I appreciate that and listen," she says.

And remember: Each neurodiverse individual is unique, so don't expect each autistic or dyslexic person you meet, for instance, to behave similarly or require the same accommodations.

BE PATIENT AND CURIOUS

Don't assume that people aren't paying attention or are deliberately ignoring instructions or being difficult. "If you see somebody doing something you think they obviously shouldn't do, don't be so quick to think they're a bad person," Caudel says. "They may be neurodivergent."

What seems obvious to you may not be obvious to someone else. Instead of reacting angrily or defensively, respond with patience and curiosity. You can calmly state what you observed, such as "I noticed you were doing X," and then ask if they need assistance or more information.

Your tone of voice, words and emotional presentation matter. Calm and curious creates openings for connection; anger and harsh words convey hostility and decrease the probability that neurodiverse individuals in your lab will feel comfortable asking for accommodations or disclosing their neurodiversity.

TALK ABOUT NEURODIVERSITY

Initiate conversation by openly acknowledging neurodiversity. During a team meeting, Caudel suggests you say something like: "I want to make it clear to everyone this is a neurodiverse-friendly space. We recognize that not everybody's brain works the same way. We recognize that we all have strengths and weaknesses, and we're here to support one another. If any of you feel like you're struggling, please feel free to come and talk with me. We'll figure out a way to try and work this out."

Such open conversation may help some individuals feel safe enough to ask for accommodations. "A lot of autistic people don't disclose it because they worry that their colleagues may look at them differently and alienate them," says Shiraz H. Robinson II, an autistic pre-med student at the University of Maryland, College Park, who studies plant biology and statistics. Robinson plans to become a physician-scientist and applied mathematician with core competencies in computational medicine, integrative medicine and quantum computing.

CONSIDER YOUR HIRING PRACTICES

A standard interview—or tour of your lab—can be overwhelming for

Glossary

Neurodiversity: "Individual differences in brain functioning regarded as normal variations within the human population" (Merriam-Webster).

Neurodivergence: "A nonmedical term that describes people whose brain develops or works differently" (Cleveland Clinic). Some people prefer "neurodiverse" to "neurodivergent" because "neurodivergent" implies that there's a "normal" or "typically" functioning brain.

Neurotypical: "Not having, or not associated with, a brain condition, especially autism, that is often considered as different from what is usual" (Cambridge Dictionary).

The terms "neurodiversity" and "neurodiverse" are intended to underscore the wide range of variation in brain function, while "neurodivergence," "neurodivergent" and "neurotypical" imply that there is "normal" and "different than normal" brain function. The word "neurotypical" is a divisive word, however, says Rankin, so it may be best to avoid its use.

Autism spectrum disorder (ASD): "A neurodevelopment disorder that is characterized by difficulties with social communication and social interaction and restricted and repetitive patterns in behaviors, interests and activities. ... The term 'spectrum' is used because of the heterogeneity in the presentation and severity of ASD symptoms" (American Psychological Association). What was once known as "Asperger's syndrome" is now considered part of the autism spectrum.

some people. Rankin recommends describing your usual interview process to applicants, suggesting a couple acceptable alternatives and then asking them what accommodations they'd like. A Zoom interview, for instance, can substitute for in-person conversation.

Sharing a list of topics you'd like to discuss with applicants in advance can also be helpful, as some people require time to process their thoughts before answering and might otherwise freeze or panic during an interview.

OFFER ACCOMMODATIONS

While some neurodiverse people will ask for necessary or helpful accommodations, many will not due to fear, stigma and prejudice. It's best to ask new team members (and veteran staff!) what they need to help them succeed. Saying something like, "I know some people prefer a quiet place to work" can signal your willingness to respect individuals' needs. Then, act on their requests and suggestions.

Accommodations can include more frequent breaks, private space to work, the ability to wear headphones to block out excessive noise, or permission to attend meetings via video conferencing (or to skip the meeting and submit data in advance). Vicky Bowskill, a PhD researcher studying sustainable management of floodplain meadows, has dyslexia, dyspraxia and autism. She wears tinted glasses and headphones in the lab to control her exposure to noise and light.

"The general rule is that you're not allowed to wear headphones in the lab due to safety concerns, but I wasn't able to cope with the pervasive drone of computers, machines and bright buzzing lights," she says. Her accommodation allows her to work in an environment that she couldn't otherwise tolerate.

It's also a good idea to ask team members what might allow them to work more effectively—and what you (or other team members) are doing that might inadvertently make their job more difficult. Such feedback can be difficult to hear but could also be the key you need to unleash the talent in your lab.

USE CLEAR, CONCISE, MULTI-FACETED COMMUNICATION

Some neurodiverse people find reading and writing difficult; some prefer written communication to oral communication. Others do not understand sarcasm or misread non-verbal cues.

A neurodiverse-friendly lab must embrace multi-faceted communication. Use clear, concise language; avoid sarcasm and innuendo. Share essential information in multiple forms: written (long-form and bullet points), infographics and illustrations, audio and video. Take advantage of tech tools that convert written text to audio and create captions for videos. Whenever possible, allow team members to communicate in the ways that are most efficient for them.

Rankin, for instance, would much rather create a multi-media presentation than write a formal paper.

Most importantly, you must consistently continue your efforts to support everyone in your lab. "You have to be accommodating even when it's hard," says Elizabeth Stivison, PhD, a postdoctoral researcher at Vanderbilt University and columnist for *ASBMB Today* who covered this topic in her article "Neurodiversity: How to make your lab more inclusive (part 1 and 2)." (Read at **www.asbmb.org/asbmb-today/careers/052220/neurodiversity-how-to-make-your-lab-more-inclusive**.)

"It comes down to, do we really want the best people in science? Or do we just want the best people of this small group that is very easy to mentor and needs no accommodations?" Stivison says. "If we really want the best people in science, then we have to really make an effort to accommodate all different kinds of people."

Freelance writer Andrew Meissen contributed to this article.

A Word About Language

What's the difference between describing someone as "a diabetic" versus "a person with diabetes"? The former is an example of "identity-first" language, while the latter is an example of "person-first" language. The push to use person-first language began in the 1960s and took hold in the 1990s. The intent was to emphasize the humanity of the individual, instead of leading with health information.

Person-first language looks and sounds like "woman who stutters," "child with epilepsy" or "person with autism." Identify-first language would instead say "stutterer," "epileptic child" and "autistic person." Recently, many people within the autism community have expressed a preference for identity-first language, as they believe that autism is an integral part of their personhood. Some members of other communities (such as the Deaf community) also prefer identity-first language.

It's best to ask individuals how they prefer to be described and honor their preference for either person-first or identify-first language.

Carter Named Dean at Baylor University

Jason R. Carter, PhD, has been named dean of the Robbins College of Health and Human Sciences at Baylor University in Waco, Texas. He was formerly the vice president for research, economic development and graduate education at Montana State University. Carter is a past member of the APS Council and has been a member of the Society since 2002.

Hyndman Receives Research Excellence Award

Kelly Hyndman, PhD, is the 2022 recipient of the University of Alabama at Birmingham's (UAB) Dean's Excellence Award in Research. The award honors faculty who have made "incredible contributions" in the area of research. Hyndman, an assistant professor in UAB's Division of Nephrology, studies the mechanisms of fluid-electrolyte balance in kidney health. She has been an APS member since 2002.

Kregel Becomes FASEB President

Kevin C. Kregel, PhD, FAPS, began his term as president of the Federation of American Societies for Experimental Biology (FASEB) on July 1. He has served on the FASEB and APS Science Policy committees, is a former FASEB vice president for science policy and was the APS representative to the FASEB board from 2018 to 2020. Kregel is executive vice president and provost at the University of Iowa. He has been an APS member since 1988.

Lindsey Named Graduate Studies Dean

Merry Lindsey, PhD, FAPS, has been named dean of the School of Graduate Studies and Research at Meharry Medical College in Nashville, Tennessee. She was previously chair of the Department of Cellular and Integrative Physiology at the University of Nebraska Medical Center (UNMC) and the founding director of UNMC's Center for Heart and Vascular Research. As dean, Lindsey will focus on preparing students for careers in the health sciences. She has been an APS member since 2003.

MacPherson Receives Teaching Excellence Award

Rebecca MacPherson, PhD, associate professor of health sciences at Brock University in Canada, has received the 2022 Faculty of Applied Health Sciences Award for Excellence in Teaching. She was recognized for her "positive impact on and dedication to her students." MacPherson teaches human anatomy, human pathology and pathophysiology of the metabolic syndrome. She has been an APS member since 2016.

Pluznick Presented with Young Investigator Award

Jennifer Pluznick, PhD, is the 2022 recipient of the Donald W. Seldin Young Investigator Award. The award, co-sponsored by the American Society of Nephrology and Council on the Kidney in Cardiovascular Disease of the American Heart Association, honors those who have shown an "outstanding record of achievement and creativity in basic or patient-oriented research related to the functions and diseases of the kidney." Pluznick is an associate professor of physiology at Johns Hopkins University School of Medicine in Baltimore. She has been a member of the Society since 2002.

Sands Receives ASN Lifetime Achievement Award

Jeff Sands, MD, FAPS, has been awarded the 2022 Homer W. Smith Lifetime Achievement Award by the American Society for Nephrology. This prestigious honor recognizes "one of the major intellectual forces in renal physiology" who has made outstanding contributions that fundamentally affect nephrology. Sands is the Juha P. Kokko Professor of Medicine and renal division director at Emory University School of Medicine in Atlanta and was the 91st president of APS. He has been a member of the Society since 1986.

Staruschenko Honored as ASN Distinguished Researcher

Alexander Staruschenko, PhD, FAPS, is the 2022 recipient of the American Society of Nephrology's (ASN) Distinguished Researcher Award. This award recognizes those who have made significant research contributions and display innovation and excellence in the area of nephrology. Staruschenko is a professor in the University of South Florida College of Medicine's Department of Molecular Pharmacology and Physiology. He has been an APS member since 2004.

OPPORTUNITY KNOCKS

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

POSTDOCTORAL SCIENTIST—CARDIOVASCULAR

UNIVERSITY OF CALIFORNIA

Postdoctoral research positions focused on cardiovascular science are available in the lab of Dr. Robert Ross, professor of medicine (cardiology) at University of California, San Diego.

Read more at www.physiology.org/UCSD.

Wenceslau Receives Early-career Investigator Award

Camilla Ferreira Wenceslau, PhD, is the 2022 recipient of the American Heart Association Council on Hypertension's Harry Goldblatt Award for Early Career Investigators. This award recognizes an early-career scientist whose work significantly contributes to the understanding of the causes of hypertension and related cardiovascular disease. Wenceslau is an associate professor at the University of South Carolina School of Medicine Columbia and has been an APS member since 2012.

NEW EDITOR

New *Physiological Reports* Editor-in-Chief Appointed

Josephine C. Adams, PhD, has been appointed the next editor-in-chief of *Physiological Reports*. She will succeed Thomas Kleyman, PhD, FAPS, when his term ends December 31, 2022. Adams received her PhD from the Institute of Cancer Research, University of London, followed by postdoctoral training at Imperial Cancer Research Fund London (now CRUK-LRI) and Harvard University. Since 1994, her laboratory has researched on extracellular matrix and its effects on cell behavior, with emphasis on cancer cell adhesion/motility, and tissue fibrosis. She is now emeritus professor of cell biology at the School of Biochemistry, University of Bristol in the U.K. Read more at **https://bit.ly/AdamsPhysRepEIC**.

NETWORKING OPPORTUNITY

Join the NIDDK's Network of Minority Health Research Investigators

BY RUDY ORTIZ, PHD, FAPS

If your research includes areas relevant to the National Institute of Diabetes and Digestive and Kidney Diseases' (NIDDK) mission with a focus on minority health and you are considered a member of an underrepresented minority (URM) group, then you are eligible to join the Network of Minority Health Research Investigators (NMRI).

NMRI membership is free and offers a supportive community of researchers with similar goals from very diverse backgrounds—and who are excited to network and collaborate. Being a member has been a wonderful experience for me because it has provided new networking opportunities and chances to meet and mentor outstanding young investigators. I am currently chair of the NMRI Oversight Committee.

National Institute of Diabetes and Digestive and Kidney Diseases

We are planning for our next annual workshop to be in person in Bethesda, Maryland. Save the date for April 19–21, 2023. Meetings are open to all. For more information on the group and events, please visit **https://bit.ly/AboutNMRI**.

For more information on NMRI, email Winnie Martinez at **martinez@extra.niddk.nih.gov**.

APS CHAPTER NEWS

Introducing a New APS Chapter: the Rio Grande Physiological Society

The APS Chapter Advisory Committee is pleased to announce the introduction of a new chapter to the affiliated APS chapter program. The Rio Grande Physiological Society encompasses the state of New Mexico and border regions of Colorado and Texas.

The Rio Grande Physiological Society (**https://riograndeps.org**) is spearheaded by Harald Stauss, MD, PhD, from Burrell College of Osteopathic Medicine in Las Cruces, New Mexico. Stauss formerly served in various officer roles for the Iowa Chapter and the APS Chapter Advisory Committee.

After his move to Burrell from the University of Iowa, Stauss connected with over 60 physiologists from 30 institutions in the Rio Grande Valley region and, in 2020, APS Council approved the formation of the Rio Grande Physiological Society. In 2021, the Rio Grande Physiological Society was officially incorporated in New Mexico and received nonprofit status in early 2022.

Currently, the Rio Grande Physiological Society has 25 active members from six different institutions within the region plus one international member. The initial steering committee and inaugural board were comprised of Stauss; Nancy Kanagy, PhD, University of New Mexico; Matthew Barlow, PhD, Eastern New Mexico University; Pedro Del Corral, MD, PhD, Burrell College of Osteopathic Medicine; and Sudip Bajpeyi, PhD, University of Texas at El Paso.

The chapter has been supported by APS Chapter Advisory Committee Chair Harold Schultz, PhD, FAPS, and APS Senior Director of Membership Growth and Engagement Nicole Edmund. The inaugural meeting of the Rio Grande Physiological Society is planned for fall 2022.

The Rio Grande Physiological Society joins 12 other APS-affiliated chapters: Arizona; California; the Washington, D.C., region; Indiana; Iowa; Kentucky; Michigan; Midlands (Nebraska-South Dakota); Missouri; Ohio; Oklahoma; and Puerto Rico.

Interested in starting an APS chapter in your region? Let us know! Visit www.physiology.org/start-a-chapter.

AWARDS

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

APS Fellows (FAPS) (September 15)

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

Visual Career Abstract Award (November 5)

Annual Marion J. Siegman Lectureship Award (November 14)

Postdoctoral Fellowship Letter of intent (November 15)

Beverly Petterson Bishop Award for Excellence in Neuroscience (November 18)

Hugh Davson Distinguished Lectureship (Apply anytime)

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

More details: www.physiology.org/awards

CALLS FOR PAPERS

American Journal of Physiology-Cell Physiology

- Tumor Host Interactions in Metastasis (September 1, 2022)
- Advances in GPCRs: Structure, Mechanisms, Disease and Pharmacology (September 30, 2022)
- Cellular and Tissue Clocks (September 30, 2022)
- Deciphering the Role of Proteoglycans and Glycosaminoglycans in Health and Disease (September 30, 2022)
- Epitranscriptomic Regulation of Cell Physiology (September 30, 2022)
- Mathematical Modeling of Cellular Processes (September 30, 2022)
- Non-coding RNAs in Cell Physiology (November 30, 2022)

American Journal of Physiology-Heart and Circulatory Physiology (October 1, 2022)

- What's Lymph Got To Do With It?

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

MEETINGS & EVENTS

APS Intersociety Meeting in Comparative Physiology

Conference dates: October 28–31, 2022, San Diego

- Advance registration deadline: September 20, 2022
- Registration deadline: October 14, 2022
- Housing deadline: October 25, 2022

More details: www.physiology.org/Comparative2022

WEBINARS

APS-EverMedTV: Physiology in Disease Modeling and Drug Development Roundtable, sponsored by Cytokinetics September 8, 2022

APS-Alzet Osmotic Pump Webinar September 13, 2022

APS Respiration Section–Coy Labs Webinar September 21, 2022

APS-Elements SRL Webinar September 29, 2022

APS-Tecniplast Animal Research Advocacy Webinar: Large Animals and Practical Policy Skills October 5, 2022

WEBINARS (CONTINUED)

APS-FAUNABIO WEBINAR SERIES

Careers Entrepreneurship Roundtable Session 1 September 15, 2022

Careers Entrepreneurship Roundtable Session 2 September 22, 2022

APS CARDIOVASCULAR (CV) WEBINAR SERIES

Androgens and Cardiovascular Diseases in Women: From Basic Research to Clinical Practice September 14, 2022

Cardiac Research Using Microelectrode Array September 21, 2022

Inflammation and Vascular Damage in Hypertension September 28, 2022

Cardiovascular Regenerative Medicine: Deconstructing Regenerative Therapeutics October 12, 2022

Investigating a Novel Regulator of Atrial Contractility October 19, 2022

Cardiometabolic Disease Pathophysiology and Novel Therapies October 26, 2022

Cardio-Renal-Lymphatic Disease November 9, 2022

APS DIVERSITY, EQUITY AND INCLUSION WEBINAR SERIES

The Importance of Mentorship October 20, 2022

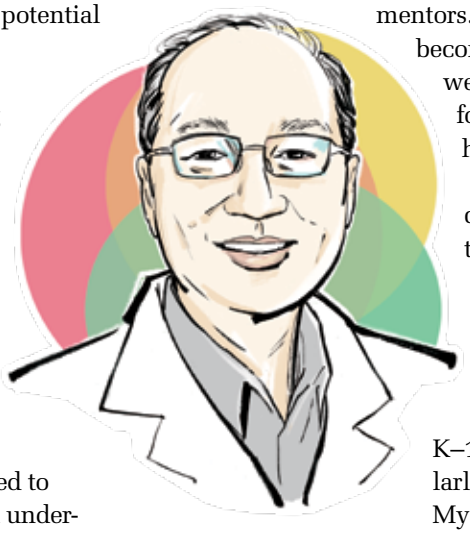
More details: www.physiology.org/webinars

What We Learn from Our Most Junior Team Members

BY TZONGSHI LU, PHD

I have been fortunate to have the privilege to work with outstanding trainees in my academic career, from high school students to clinical fellows. High school students, you ask? Yes! And the young mind's tremendous potential may surprise you.

The biggest challenge to working with motivated young scientists is their imaginative thinking and questions—and sometimes they break things. However, their questions, and even their mistakes, are also part of the beauty of being a mentor and colleague to these smart young people.



Early in my career, teaching in graduate and medical school made me accustomed to advanced students with a good understanding of basic scientific knowledge. But I learned an important lesson when I gave a kidney disease awareness lecture to a mixed audience of scientists and lay people. A student—who became my first high school trainee—asked me a simple question after my talk: What is the difference between endothelial cells and epithelial cells in the kidney, and how does their dysfunction damage the kidney? I thought, "Didn't I just explain that in my presentation?" This reminded me of the importance of keeping concepts simple and accessible so any listener can get excited about science.

I thought back to my first biology class in high school and the beautiful chalk-painted cell structure my high school biology teacher drew on the blackboard. It sparked my enthusiasm for biology and my biomedical research career. As researchers, we tend to get very excited about our research areas and default to using fancy teaching materials. We must instead remember to first think of simple, detailed and easy-to-understand ways to explain our work. Science should not be the privilege of scientists; it should be a friend of everyone. So, how do we do this? We can learn the answer from our junior team members!

In addition, our high school trainees have a positive impact in several ways. First, our team is full of fun! There always seems to be some unexpected, non-lethal "accidents" that raise interesting questions and allow opportunities for me and senior team members to hone our skills in troubleshooting. Second, their presence and enthusiasm for science inspires our senior-level trainees, helping them learn how to be good mentors. The senior trainees often become more motivated and see the weak points they would never found have found unless they had become a mentor.

Lastly, and the most precious thing, is that our junior trainees can make their dream of working in science come true—an opportunity at their early age that can influence their life tremendously. It also underscores how crucial K–12 STEM education is, particularly in the life sciences.

My colleagues ask me why I keep working on K–12 STEM projects that bring local high school students into my lab. I always joke that I am lowering their burden because I'm preparing a pipeline of highly motivated next-generation scientists. But honestly, I feel called to work with students at this level. Seeing both my high school and senior trainees growing up and maturing into researchers is truly the best reward and shiny medal for me as a biomedical educator in physiology!

I encourage my fellow APS members to connect with local high schools and consider incorporating younger students into your team. The benefits for you and your students will be great, both now and in the future.

Tzongshi Lu, PhD, is an instructor in medicine at Harvard Medical School and an associate biologist in the renal division at Brigham and Women's Hospital in Massachusetts. He is also a member of the APS Program Working Group.

Illustration by Brett Affrunti

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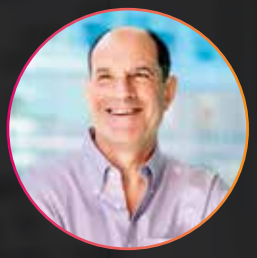

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