

THE Physiologist MAGAZINE

JANUARY 2024

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A FAVORITE ANIMAL MODEL

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TO IMPROVE MILITARY
PERSONNEL'S EXPERIENCES
AND ENVIRONMENTS

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TOP OF HIS GAME

Hear Nobel laureate
Brian Kobilka, MD, at the
American Physiology
Summit in April.



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Top of His Game

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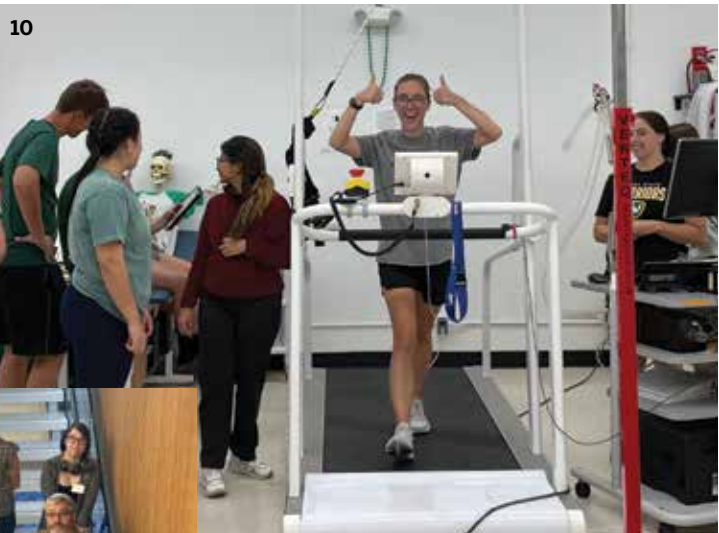
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Thank You Participating Institutions

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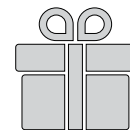
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Looking Ahead to the New Year

BY MEEGHAN DE CAGNA, MSc, CAE



Dear reader:

Happy New Year! It is the time of year when we often feel a sense of renewed optimism that comes with the arrival of the new year. We flip the calendar, and it's a clean slate. I love that!

The new year is an opportunity to evaluate and set goals—whether personal or professional—with a fresh focus. But that work can seem daunting, and we often set ourselves up to fail. Studies show 80% of New Year's resolutions fizzle out by February.

However, a different approach could lead to success. I recently read an article about the “anti-resolution resolution.” The concept is that you choose a “word of the year” that will help you gradually move to a different choice whenever you think of it. Some words might be growth, reconnect, engage, listen, adventure. Choose a word that represents an area you want to give attention to in your life. It's about shifting your mindset, rather than setting resolutions. My 2024 word is “resilience.” May it help me get on my Peloton, eat healthier, reduce stress and celebrate achievement.

Whatever your intention for 2024, whether it's to grow in your career, reconnect with your peers, engage with your students, listen to new (game-changing) ideas, or expand your research focus, you do not want to miss the 2024 American Physiological Summit.

The Summit gives you the opportunity to come together with your colleagues and leaders in your field, April 4–7, in Long Beach, California. You will leave the Summit feeling

energized and informed and with stronger connections—just what you need to carry you through the rest of the year.

OUR FEATURES

This week's cover profile is a sneak peek at the Summit. Nobel laureate Brian Kobilka, MD, will be the opening keynote speaker. Read more about his unconventional path to biochemical research and what it was like to receive that Nobel phone call, on page 18. And then be sure to attend the Summit's opening keynote, where Kobilka will explore the science behind the biggest issues affecting life and health today.

We had a lot of fun with the article on page 22. Enjoy our homage to the weird and wonderful zebrafish. This small and strange creature has been contributing to science for at least 60 years, thanks to the fact that 70% of its 26,000 protein-coding genes have a commonality with

a human gene. Read how some physiologists began working with zebrafish and what their research has uncovered.

Finally, on page 28, we feature physiologists who work with the military. Though mostly civilians, these researchers work closely with various U.S. military branches to study areas such as how human physiology responds to heat, high altitude or multiple traumas. Seeing real-world applications of their work and being able to speak with end users, such as soldiers and pilots, are pluses of this unique work environment.

WE WANT TO HEAR FROM YOU

Members, you are what makes *The Physiologist Magazine* happen. We couldn't do it without you, so please share any feedback, suggestions or story ideas with us at tphysmag@physiology.org. Wishing you a wonderful 2024! 🍷

Meeghan De Cagna, MSc, CAE, is APS chief community and learning officer and associate publisher and editor-in-chief of *The Physiologist Magazine*. You can reach her at mdecagna@physiology.org.

“Choose a word of the year that represents an area you want to give attention to in your life. It's about shifting your mindset, rather than setting resolutions.”

Contemplating graduate school as the next step in your education and career?

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Interested in listing your program?

Contact **Jacob White** for more information.

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The Progression of Biomedical Research and Teaching

John Williams, MD, PhD, FAPS, is emeritus professor and former chair of molecular and integrative physiology at the University of Michigan Medical School in Ann Arbor and a past APS president. Prior to retiring in 2022, he was a biomedical scientist whose research focused on the exocrine pancreas and its function. He recently published his memoir, "The Pancreas and Me: My Life as a Biomedical Scientist." *The Physiologist Magazine* caught up with Williams to talk about his memoir, career and advice for up-and-coming researchers.

Writing a memoir is relatively uncommon for biomedical scientists. What drove you to write your memoir?

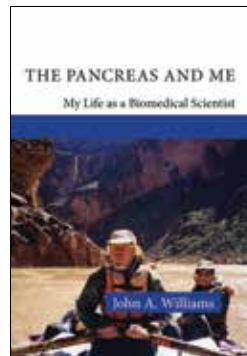
In 2021, my lab was getting ready to close, and I had just completed editing two multi-authored books, "Pancreatitis" and "The Pancreas: Biology and Physiology." I was looking for a new writing project and realized that my career had spanned many changes in research and teaching that I could cover as a student, a professor and a department chair. I had to settle on a target audience. This started with my family, the scientists who had worked in my laboratory, and other academic colleagues and administrators. I chose to intersperse sections on my personal and academic lives and keep the science in separate sections with the focus on those who had carried out the research. I discussed the concept for the book with Charles Watkinson, the head of Michigan Publishing, and he encouraged me to continue and told me about Maize Books, a newer imprint of Michigan Publishing, which he felt would be a good fit. I also had many relevant photos that could serve as illustrations.



John Williams, MD, PhD, FAPS

Your book is available through open access. What does that mean, and how did it work for you?

Open access books are being experimented with, especially by university publishers. The University of Michigan has developed a platform, Fulcrum, where Maize Books are mounted and can be freely accessed by anyone. Fulcrum supports multiple readers, as well as allowing PDF downloads. Paperbound copies of the book are sold as usual, and my book is available from the University of Chicago Press and Amazon. Michigan Publishing arranged copy editing and typesetting and helped design the book cover. To help cover the costs, I had to pay a subvention, which works similar to page charges for a journal article to keep the price reasonable and get it into the hands of as many readers as possible.



What drew you to your main area of research, the pancreas?

My initial research was on the electrophysiology of the thyroid gland, a project suggested by my PhD adviser, J. Walter Woodbury at the University of Washington. However, I realized that most endocrine glands secrete peptide hormones packaged in secretory granules. While carrying out a postdoctoral fellowship with Keith Matthews at the University of Cambridge, I was introduced to the exocrine pancreas. It secretes digestive enzymes, and George Palade and colleagues had carried out beautiful research on pancreatic acinar cells that became part of the foundation for the new field of cell biology. Little was known about the control mechanisms that turned on and regulated secretion. I collaborated with several others, including Ole Peterson in the Matthews lab, to show that calcium ion released from intracellular stores stimulated secretion.

When I moved to UCSF as an assistant professor of physiology, studies of the exocrine pancreas took over the focus of my laboratory. While we continued studies of intracellular calcium, we extended the work to receptors on the cell membrane, and with a colleague, Ira Goldfine, we began working on regulation of the exocrine pancreas by insulin from the Islets of Langerhans. By this time, I had become a leader in the gastrointestinal (GI) research community, was teaching GI science, and was invited to be the second editor of the *American Journal of Physiology-Gastrointestinal and Liver Physiology*.

How important was teaching to you, and how has it changed during your 60-year career?

Teaching has always been an important part of my life. I learned by observing my teachers and from tutoring classmates in college and medical school. My early goal was to be direct and logical. I emphasized having clear illustrations. With experience, I realized that I needed to add humor whenever possible.

My classroom teaching primarily involved medical students, with some effort devoted to graduate students. My main teaching, however, was in the laboratory, teaching learners at multiple levels how to carry out research. The major changes in teaching during my 60 years have been how it was organized and the technology used to present it. When I started at the University of Washington, distinct classes covered different disciplines. Over time, knowledge was integrated into functional blocks with my area being the gastrointestinal system.

Technologically, I went from writing with felt pens on acetate sheets projected on a screen, to 35mm color slides, to projecting digital files that the students follow on a laptop or iPad. Lectures are also recorded, and many students stream rather than come to class. For more on this area, see my opinion piece published in *Advances in Physiology Education*, “Sixty years of learning and teaching physiology.”

Was maintaining work-life balance a challenge?

Yes. One of my biggest challenges was finding the time to spend with my family. Sometimes this was pointed out by family members, as when my son Matt complained about me being gone on

Exploring a Half-Century of Research Changes

Linda Samuelson, PhD, FAPS, past APS president, has worked alongside John Williams, MD, PhD, FAPS, for more than 30 years at the University of Michigan.

“I joined the Society when I was an assistant professor, and it was largely because John advised me to,” Samuelson says. “John has been an important mentor for me, and I’m currently the John A. Williams Collegiate Professor of Gastrointestinal Physiology, which reflects his important role for me in advancing my career.”

Samuelson says Williams’ influence through his mentorship, research, teaching and leadership has been enormous. “His memoir is not only the story of a highly successful physiologist, but it is also a fantastic way to appreciate the enormous changes that have taken place in biomedical research over the past 50 years,” she says.



his birthday. He was not happy with my explanation that I could not control the timing of the Federation of American Societies for Experimental Biology meeting scheduled in early April. I prioritized family on weekend outings, starting with toddlers in a backpack carrier and progressing to nature walks, camping, fishing and hiking. One important thing was family dinners with serious conversation every evening.

What’s your advice for preparing for a career in biomedical research?

First, being a biomedical scientist, or for that matter any type of scientist, is a great life. You get paid for engaging in your passion. The most important parts of PhD training are learning how to think analytically, to research a topic, and to communicate both orally and in writing. A PhD opens many doors even if you decide laboratory research is not for you. Within biomedical science, only a fraction of new PhDs will follow the path I took to become an academic scientist in a medical school. If this sounds like a well-polished spiel, it is one I tried to give to all PhD applicants visiting our department when I was chair. ☺

Know someone we should meet?
Email tphysmag@physiology.org.

Physiology labs can be a hub of activity and fun, along with research and education, as these posts make clear.

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



Isaac Agumadu

www.linkedin.com/in/isaac-agumadu

I recently had the opportunity to give my first teaching lesson at the Graduate Physiologist Seminar in the Human physiology program. The topic I covered was neuromuscular recruitment and its importance in body control and coordination for both ALS patients and athletes. It was an incredible experience for me as a future medical professional in the field. As part of our training, it is essential to develop our teaching skills to future educate our students, patients and our overall community!
[#humanphysiology](#) [#bostonuniversity](#)
[#sargentcollege](#) [#sportsmedicine](#)



Waynflete

@waynflete

Did you know that the anatomy of a cow's leg is similar to a human's? Upper School students used bovine femur bones to examine marrow, growth plates, tendons, ligaments, and muscles. This lab allowed them to deepen their understanding of the skeletal system and bone physiology.



Dr. Mike Todorovic

@drmiketodorovic

When teaching physiology:

- ✓ Concepts first
- ✓ Details second

One of the things I still see is educators trying to get 6hrs of info across in 60 mins. Details mean nothing without an understanding of the how and why. [#meded](#) [#MedTwitter](#)



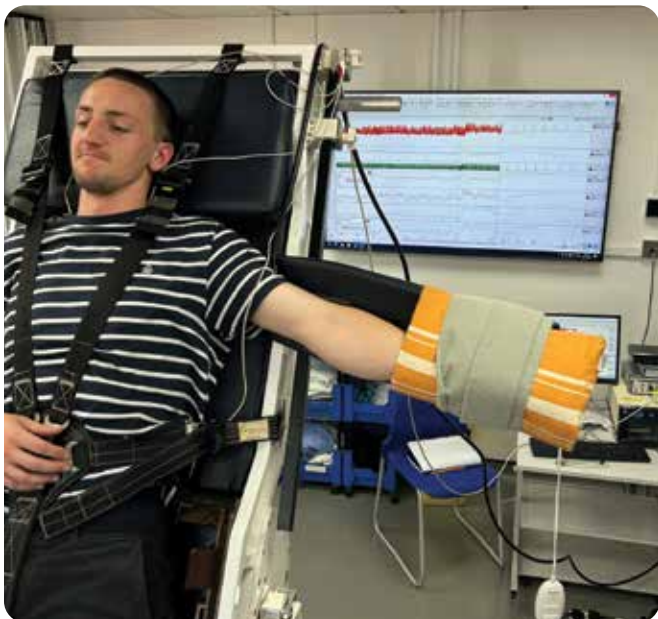
Tami
@hyponaqueen

My class is WAY more fun than your class 😁 #ILoveExPhys



Physiology at KCL
@KclPhysiology

Back in the lab with MSc students looking at control of blood pressure during tilting and the Valsalva Manoeuvre.



Ruffin NeuroLab
@RuffinNeuroLab

Today marks the 1 year anniversary of when I had the grand opening. Thank you to all who were apart of this journey. Celebrate the Resource.



#RuffinNeuroLab #RNLSTEAMWarrior



Jen Heemstra
@jenheemstra

When choosing a graduate research advisor, do all you can to choose someone who will not only be a great mentor now but who will be there for you throughout your career.

You never know where your career will take you and having a mentor as a supporter and advisor is invaluable.

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www.youtube.com/APSPHysiology

X (Formerly Twitter): @APSPHysiology, @SciPoIAPS
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LABNOTES

MENTORING Q&A YOUR QUESTIONS ANSWERED
POLICY IQ PHYSIOLOGY ON THE HILL AND IN THE HALLS
RESEARCH FIZZ BUZZ-WORTHY RESEARCH
STATS & FACTS PHYSIOLOGY BY THE NUMBERS
UNDER THE MICROSCOPE OUR MEMBERS, UP CLOSE
PUBLISH WITH POLISH BUILD A BETTER RESEARCH PAPER

STATS & FACTS

~430

The number of papers published in APS journals by U.S. Army Research Institute of Environmental Medicine scientists.

APS Publications

RESEARCH FIZZ



Browning of perivascular adipose tissue prevents vascular dysfunction and reduces hypertension in angiotensin II-infused mice

This mouse study finds that fat browning can protect vascular function and prevent the development of hypertension.

American Journal of Physiology-Regulatory, Integrative and Comparative Physiology, September 2023

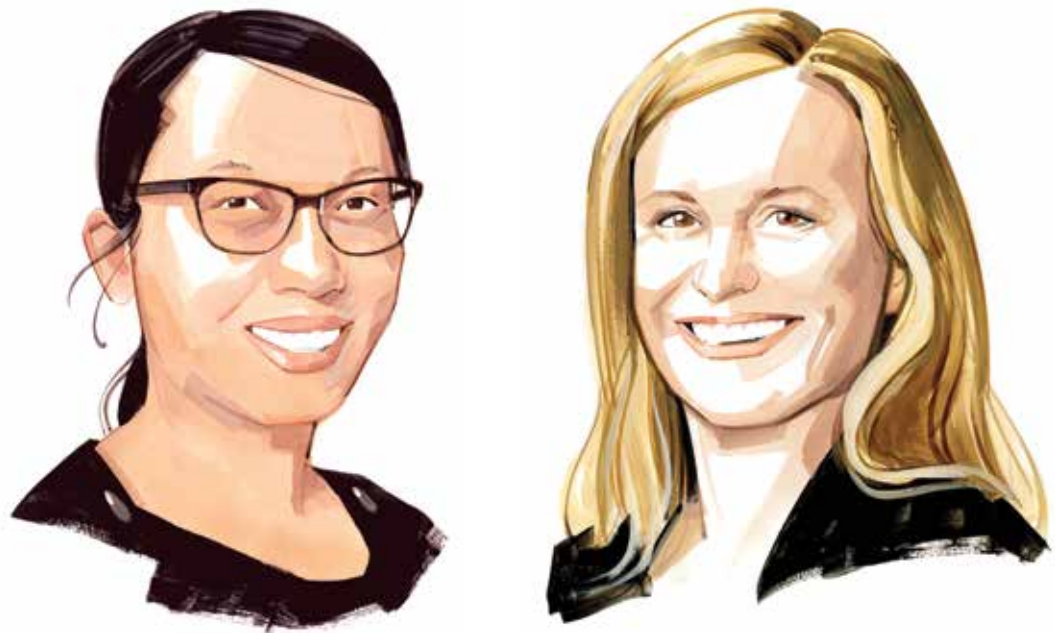
<https://doi.org/10.1152/ajpregu.00043.2023>

STATS & FACTS

227

The total number of individuals who have been awarded the Nobel Prize in physiology or medicine.

The Nobel Foundation



MENTORING Q&A | POSTDOCTORAL PLACEMENT

Tips for Trainees

How to find the right environment and sharpen your career development skills.

Each issue, we ask a student or early-career member to pose their career questions to an established investigator and mentor. Here, Yanna Tian, PhD, a postdoc associate in the Kathleen M. Caron Lab in the Cell Biology and Physiology Department at the University of North Carolina-Chapel Hill School of Medicine, asks Jill Barnes, PhD, associate professor in the Department of Kinesiology at University of Wisconsin-Madison, questions about how to find the right training environment.

Q: What are the important things a trainee should consider when looking for a good training environment?

A: There are a few important things to consider: first, the ability to communicate with your mentor. This means feeling comfortable enough to have difficult discussions and feeling like your mentor will listen to your questions or concerns.

Second, that the laboratory has a good track record of productivity. Having a good training environment means being able to meet your goals in a reasonable amount of time; therefore the laboratory should be productive. This does not necessarily mean that the best environment is the most productive laboratory, but in an unproductive laboratory it will be difficult to meet your training and career goals.

Third, the “temperature” of the laboratory environment, meaning how well do other trainees or staff interact? The mentor of the laboratory often sets the tone of the environment, but you will be spending a lot of time working closely with other trainees and staff. Are you able to communicate with them? Do you feel like they would be supportive or your work?

Q: If you are in a training environment that is not supportive for you, what should

you do and when should you consider changing?

A: This is a difficult situation. Reaching out to a trusted person who is further along in their career is highly recommended. Sometimes we are in difficult situations because of the career stage, and it may help to get a different perspective. Sometimes this is an issue of miscommunication; other times this may be different personalities that do not work well together, and occasionally this may be an issue of a toxic environment.

Regardless, considering a few questions with a trusted person may be helpful. Is there a new way to approach the situation? Is there a way to communicate expectations or confusion with the mentor? Is there someone else in the environment who may be able to provide support to have these difficult conversations with the mentor? If these items have been explored and nothing is working, it may be time to think about finding a different training environment. That could be a laboratory down the hall, or it could be a laboratory at a different institution.

Q: In addition to technical advice on performing experiments, what other skills should a graduate student or postdoc be trained in for a career in academia?

A: Other important career development skills for

either academia or industry are critical thinking skills to be able to evaluate and discuss scientific literature; verbal and written communication skills to effectively communicate your science to a broad audience; project management skills and the ability to develop protocols, timelines and strategies to complete a project (on time!); and mentoring and teaching technical, scientific and communication skills to more junior trainees.

Q: When should a trainee apply for their first fellowship grant? Should a trainee seek advice from other mentors when preparing a fellowship application?

A: This is a great question. In my opinion, the timing of applying for the first fellowship grant should be highly individualized. Many mentors and institutions utilize individual development plans, known as IDPs, to set goals and timelines and to create steps to complete the goals. These should be individualized based on the trainee’s strengths and weaknesses.

Because of this, the timing of applying should also be individualized and sometimes is based on external factors, such

as eligibility, deadlines or funding availability. For any fellowship application, getting input (informally) or inviting a person as a co-mentor is a great idea to provide additional expertise and a different perspective.

“Scientific conferences allow a lot of time to ask questions of other scientists and trainees, connect with peers and network.”

Q: Describe some successful ways that trainees can promote their research to other scientists.

A: Many people use social media to promote their research, but there are many other ways of promoting it too. This could include presenting posters or talks at your institution, as well as local or national meetings, workshops and conferences.

In addition, scientific conferences allow a lot of time to ask questions of other scientists and trainees, connect with peers and network with experts in the research area. Lastly, writing a review article takes a lot of time but is a valuable way to share and summarize what is known about your specific area of research. ☞

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.

RESEARCH FIZZ



Structural and functional impairments of skeletal muscle in patients with postacute sequelae of SARS-CoV-2 infection

This study suggests exercise intolerance in people with long COVID stems from reduced mitochondrial function.

Journal of Applied Physiology, October 2023
<https://doi.org/10.1152/jappphysiol.00158.2023>

STATS & FACTS

1,900

The number of verified disease models curated by the Zebrafish Information Network as of 2022.

Genetics

RESEARCH FIZZ



Physiology of intracellular calcium buffering

This review explores the chemistry behind intracellular calcium buffering and how buffering affects the body in health and disease.

Physiological Reviews, October 2023
<https://doi.org/10.1152/physrev.00042.2022>

POLICY IQ | FEDERAL ADVOCACY

2023 in Review: How APS Advocated on Behalf of Physiologists

Last year was busy for APS's two policy-focused committees. Members of the Science Policy Committee (SPC) handle a broad range of issues that affect how physiologists do their work, including federal research funding, policies on peer review of grant applications, and research security requirements. Members of the Animal Care and Experimentation (ACE) Committee focus on animal research regulations and guidelines. Here are the most significant policy and advocacy activities from APS in 2023, with a glimpse of what's in store for 2024.

ADVISING AND ADVOCATING

In 2023, APS responded to requests for input from the National Institutes of Health's (NIH) Center for Scientific Review on two critical topics: proposed changes to the peer review criteria for evaluation of research project grants and requested feedback on how applications for National Research Service Awards are reviewed and scored.

APS also provided input on re-envisioning U.S. postdoctoral research training and careers and new research security requirements for institutions that receive federal research dollars. These issues affect APS members at every career stage, from trainee to established faculty. To review the full text

of APS policy responses, visit www.physiology.org/sciencepolicy.

Academic researchers depend on robust funding of federal research agencies to support research and training. Each year APS joins other advocacy organizations to set research funding targets for Congress for NIH, National Science Foundation, Department of Veterans Affairs and NASA. SPC members, APS Early Career Advocacy Fellows and APS leaders participated in more than 50 meetings with congressional offices to make the case for research funding in 2023. Using the APS Action Alerts system, more than 200 messages were sent to members of Congress throughout the year in support of funding for biomedical research.

SUPPORTING ANIMAL RESEARCH

Because physiology research often relies on animal models, APS is a strong advocate for responsible and humane use of research animals. APS also advocates for reducing the administrative burden of complying with the federal agency requirements and regulations in ways that do not compromise animal care.

The NIH Office of Laboratory Animal Welfare (OLAW) oversees requirements for researchers with NIH funding, including the function of Institutional Animal Care and Use Committees (IACUCs). Following obligations from the 21st Century Cures Act to reduce regulatory burden, OLAW issued several requests for input. APS advised the agency on

several policies related to IACUC review, the OLAW disclaimer statement that describes the role of the office’s policies, and proposed new guidance on the use of cephalopods in research.

As NIH sought to bring attention to the role of novel alternative methods, APS provided input on how these technologies can be used by academic researchers to complement existing methods, while acknowledging the current limitations of these methods for use in basic research. This promises to be an active area of interest for research funders seeking to advance technologies that do not involve the use of animals.

COLLABORATING WITH THE NATIONAL ACADEMIES

Continuing a collaboration started in 2022, on March 10, 2023, APS

members provided input to the National Academies of Sciences, Engineering and Medicine’s Standing Committee on the Guide for the Care and Use of Laboratory Animals during a three-hour listening session. The Standing Committee continues to work on initiating a long overdue revision of the Guide, and as a sponsor of the committee’s work, APS is focused on providing the perspective of working scientists.

LOOKING AHEAD TO 2024

APS would like to see more physiologists participating in policy and advocacy activities. To help members get started, the SPC is designing a new online course for physiologists who want to learn more about being involved in advocacy for science. Keep an eye out for the course to launch in the first half of 2024.

5 Ways to Take Action

APS shares information throughout the year on advocacy and policy initiatives, with an emphasis on opportunities for members to get involved. You can learn more and stay up to date by:

- Reading Science Policy News, which lands in your email inbox on the third Tuesday of each month.
- Signing up for APS Action Alerts at www.physiology.org/advocacy.
- Checking out the Policy IQ section in each issue of *The Physiologist Magazine*.
- Reading the “Science Policy” section of the biweekly APS News Update email.
- Following @SciPolAPS on X (formerly known as Twitter).

Headed to the American Physiology Summit in Long Beach, California, this April? Be sure to arrive in time for pre-conference sessions on Thursday afternoon. The SPC is presenting a can’t-miss session on how scientists can get started in advocacy (and why they should) at 12 p.m. on Thursday, April 4.

In February, the ACE Committee will hold a series

of meetings with congressional offices to talk about why animal research is important and how Congress can better support scientists. Meeting early in the year provides an opportunity to have these conversations right before the Appropriations Committees begin working on annual funding bills, where problematic restrictions on funding for research with animals often appear. 🗣️

POLICY IQ | CAPITOL HILL RALLY

APS President Rick Samson Rallies for Research

On September 14, 2023, APS President Rick Samson, PhD, FAPS, represented APS in the Rally for Medical Research. This annual event brings together advocates from both research and patient advocacy organizations to urge Congress to increase funding for the National Institutes of Health (NIH).

This year’s event included more than 240 advocates from 30 states taking part in over 200 meetings. Samson met with the Missouri congressional delegation, along with other advocates from the state, and joined the leaders of other prominent scientific organizations to meet with Robert Aderholt

(R-AL), chair of the House Appropriations Subcommittee on Labor, Health and Human Services, and Education, as well as staff for then-Speaker of the House Kevin McCarthy (R-CA). 🗣️



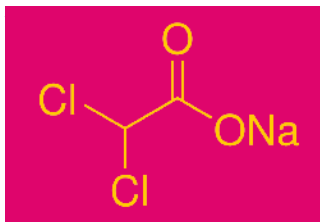
STATS & FACTS

\$210 million

The initial appropriation for Department of Defense Congressionally Directed Medical Research Programs in 1992.

U.S. Government Accountability Office

RESEARCH FIZZ



Dichloroacetate as a novel pharmaceutical treatment for cancer-related fatigue in melanoma

This study identifies the molecule dichloroacetate as a possible therapeutic target for cancer-related fatigue.

American Journal of Physiology-Endocrinology and Metabolism, October 2023

<https://doi.org/10.1152/ajpendo.00105.2023>

STATS & FACTS

\$16.3 billion

The funds managed by the Department of Defense Congressionally Directed Medical Research Programs from its founding in 1992 through fiscal year 2022.

Congressionally Directed Medical Research Programs



Gutierrez Huerta at the bench measuring the diameter of an arteriole.

UNDER THE MICROSCOPE

Rapid Fire Q&A

Cristhian A. Gutierrez Huerta explains how he switched his career goals to study to become a physician scientist—and shares which model organism he would be.

Q: What inspired you to become a scientist?

A: My first research experience at the Joint Genome Institute showed me how research and genetics could be used to help solve complex problems. The idea of being able to help the betterment of humankind is exciting!

Q: How has the pandemic changed the way you work?

A: The pandemic taught me to value my friends and family who I have around. They're such an important part of who I am and what motivates me to pursue this career path. It also showed me to be adaptable and #WorkFromAnywhere.

Q: Most challenging laboratory technique you've learned to use?

A: Arteriole vessel preparation.

Q: Favorite lab mishap story that you can share without incriminating the innocent?

A: One time, I realized that the samples I had been collecting for the last two months were inappropriately collected. Unfortunately, we had to throw them all out, but at least I learned my lesson.

Q: If you could do a sabbatical with any scientist (living or dead) who would it be and why?

A: Arthur Guyton. He has contributed so much to medicine and physiology!

Q: If you were a model organism, which model organism would you be?

A: A rat! They're calm, cool and collected. Plus, they can live more than two years.

Q: What do you wish the general public understood about science or research?

A: People who are engaged in science and research do not have something to hide or to gain from science. Science is science and can't be changed. We simply want to share knowledge!

Q: Most influential scientist on your career?

A: Roummel Marcia, PhD, at the University of California, Merced, who continuously pushed me to dream big.

Q: Tell us a surprising fact about you.

A: I originally went to college to be a high school math teacher, and now here I am pursuing a career as a physician-scientist.

Q: Favorite part of your job?

A: Meeting other people who are passionate about science.

Q: Least favorite part of your job?

A: Dealing with failure—it's hard to acknowledge our own flaws and limitations.

Q: One thing every researcher should try at least once in their life?

A: A five-minute flash talk. It teaches you a lot about how

to communicate effectively, yet efficiently.

Q: Next book on your reading list?

A: “Latino, Hispanic, or of Spanish Origin+ Identified Student Leaders in Medicine: Recognizing More Than 50 years of Presence, Activism, and Leadership” by John Paul Sanchez.

Q: Favorite TV show, movie series or podcast to binge-watch or listen to?

A: “Rethinking” by Adam Grant. 🎧

Cristhian A. Gutierrez Huerta is a fourth year MD/PhD student at the Medical College of Wisconsin. He grew up in Tulare, California, and is a first-generation college, medical school and graduate student. Gutierrez Huerta is passionate about investigating cardiovascular health, studying disease pathology and providing community-centered health care. He’s an aspiring physician-scientist with hopes of becoming a practicing cardiologist researcher.

Far right: iStockphoto



Gutierrez Huerta, lower left, with the Beyer lab group at the Medical College of Wisconsin.

PUBLISH WITH POLISH | OPEN SCIENCE

Making Strides in Open Access Publishing

The open access movement has evolved significantly in the past decade, with authors, funders and institutions ever more engaged in its success. APS supports all of these stakeholders in interconnected ways, from data collection to seamless processes to customer education. The best part: Authors reap the benefits of a streamlined open access experience.

Data collection is the first step in a smooth open access workflow. The APS manuscript submission system prompts authors to select standardized institution and funder names from curated databases. These are matched to persistent identifiers such as Research Organization Registry (ROR) for institutions and Open Funder Registry (OFR, formerly FundRef). This happens behind the scenes, displaying a green checkmark when the data are properly entered. This enables APS to accurately match a paper’s authors and grants to the proper schools and funders, which is essential for checking eligibility for APS Read, Publish & Join deals (<https://journals.physiology.org/librarians.read-publish-join>) and for reporting back to those same organizations.

The next part of the APS blueprint involves automated workflow processes. If an author expresses interest in APS Open Access during the submission process, its production system can automatically generate an invoice (complete with member discount, if applicable). Similarly, when an author from an APS Read, Publish & Join institution has their paper accepted, the

system recognizes this relationship and sends the authors a notification.

These solutions are only possible by having the correct metadata—accurate grant numbers and persistent identifiers such as OFR and ROR. Stacey Burke, APS publications director—open access transformation, digital and marketing engagement, summarizes this clearly in an interview from

Editage Insights for International Open Access Week 2023: “Proper workflows and data integration is critical to ensure that an author publishes OA seamlessly.” (Read the full interview at <https://bit.ly/BurkeInterview>.)

Finally, APS supports these key connections with author education. Open access funder and institution requirements have become more varied over time.

Europe has Plan S, and the U.S. is awaiting final implementation of the OSTP Nelson memo. APS has aimed to demystify the processes by providing webinars, author instructions and FAQs. APS will provide new information to authors and members as policies change and requirements evolve.

What is on the horizon? Many publishers are exploring new options for access such as Subscribe to Open (S2O). S2O is a subscription model that allows a publisher to convert journals from gated access to open access. APS will continue monitoring open access developments and innovative solutions. We are committed to evolving our processes as improvements become available. Our top priority is to offer a seamless open access experience for all authors. 🎧



MORE RESOURCES

Explore open access articles published by APS journals during the past three years: <https://journals.physiology.org/oa>. Check out our publishing-focused issue of *The Physiologist Magazine*, September 2023: www.physiology.org/TPMSeptember23.



TOP OF HIS GAME

Brian Kobilka's path to biochemical research might have been unconventional, but it led to a Nobel Prize.

BY MIKE DE SOCIO

The phone rang in the home of Brian Kobilka, MD, at around 2:30 in the morning. He figured it was a wrong number and let it go to voicemail. But when the phone rang again, Kobilka climbed out of bed and picked it up. The voice on the other end told him he had just been awarded a Nobel Prize.



Kobilka, left, receives his Nobel Prize from King of Sweden Carl XVI Gustaf at the Stockholm Concert Hall in December 2012.

Stunned, Kobilka didn't say much at first. He thought to himself, "Am I really awake?" Then a new voice came through the phone—someone Kobilka knew from Sweden—congratulating him and making sure he believed what was happening.

"Then after that, you don't go back to sleep again because the phone starts ringing and the news organizations come over," Kobilka recalls.

That fateful morning came in 2012, a year after Kobilka had published a paper on the structure of a G protein-coupled receptor (GPCR) activating a G protein—the culmination of some 30 years of research in the lab. The Nobel Committee recognized Kobilka's work uncovering the mechanics of cell receptors and the hormones that constitute communication between cells. He shared the Nobel Prize in chemistry with Robert J. Lefkowitz, MD, the leader of a lab at Duke University, in Durham, North Carolina, where Kobilka got his start working on this research.

The pair of scientists traveled to Sweden that year to accept the Nobel with an entourage of family members and colleagues. Kobilka remembers

spending the first few days of "Nobel Week" obsessing over his speech, adjusting it endlessly. But after he delivered the talk, he relaxed into the celebrations.

One particularly memorable part of the week for Kobilka was the "Students' Nobel Night Cap," the official after-party to the Nobel Banquet. In a converted classroom building, the honorees spread out into themed rooms off-limits to press and photographers. There, Kobilka and his family and colleagues mingled with other academics and students, everyone enjoying a late night fueled by free food and an open bar.

The Nobel experience was the pinnacle of a career that Kobilka never expected. "I didn't really plan for any of this to happen" he says. "I was very fortunate to find a good lab, where I could be trained, and to have people in the lab willing to take on an extremely inexperienced MD without really any graduate training."

Physiologists will hear more of Kobilka's story when he delivers the opening keynote during the 2024 American Physiology Summit, April 4–7, in Long Beach, California.

A WINDING ROAD

Kobilka's path into biochemical research was certainly unconventional. Growing up in a small town in Minnesota, he settled on an early ambition to become a physician, a profession shared by three of his friends' fathers and a close neighbor. It seemed like a respectable career, and Kobilka left high school on a trajectory for medical school.

By the time he graduated medical school, Kobilka had had several brief experiences in the lab, doing small research projects. The first was during his undergraduate years at the University of Minnesota, Duluth, where a professor brought him in to help in a biology lab. (It's here that Kobilka met Tong Sun Thian, who would become his wife). Then during medical school at Yale University in New Haven, Connecticut, Kobilka used his required thesis project to conduct original research on the genetic diversity of rotavirus.

"I found that I enjoyed working in the lab, trying to work out technical problems," he says. He was also fascinated by how things work on a molecular level and the opportunity to be the first person to learn or see something.

After earning his medical degree, Kobilka completed training in internal medicine, where he was drawn to intensive care medicine. It inspired him to pursue a clinical fellowship in cardiology at Duke, in the Lefkowitz lab. It was there that he started working on GPCRs, which he knew were foundational to some of the drugs he saw being used in intensive care units.

But Kobilka spent a good amount of his time at Duke playing catch-up. "I was the least-experienced person in the lab with the fewest lab skills and techniques," he says. "My skills weren't valuable to anybody.

“I didn’t really plan for any of this to happen. I was very fortunate to find a good lab, where I could be trained.”

But nevertheless, they taught me a lot and helped me to develop a toolbox [so I could] at least start a project on my own.”

In 1986, Kobilka and colleagues in the Lefkowitz lab succeeded in cloning the gene for the β_2 adrenergic receptor (β_2 AR), a GPCR that is the target for many asthma medications. This sparked his interest in obtaining a high-resolution structure of a GPCR. “I didn’t know at the time how overly ambitious that was with the technology available,” he says. “It was kind of a ridiculous goal because I had very little expertise in biochemistry and none in crystallography or structural biology.”

Nonetheless, he chipped away at it and carried the work over when he founded his own lab at Stanford University in California in 1990. Building on his experience with these receptors, it was here that Kobilka dug into the research that would earn him the Nobel Prize.

He would eventually reach that “ridiculous” goal, obtaining the structures of the β_2 AR in the inactive state and the G protein-coupled state. The discovery, published in a 2011 paper in *Nature*, is what Kobilka thinks pushed him over the mark for the Nobel Prize.

SEARCHING FOR NEW TREATMENTS

Today, Kobilka and his lab are still focused on this same area of research, which has broad implications for drug development and human health. The Nobel Foundation estimates that “approximately half of all medications used today” target GPCRs,

though Kobilka says it’s probably closer to a third.

Either way, understanding how the receptors work is critical. Kobilka readily admits that his 2011 discovery was not the end of the road. “It turned out that that was a really important structure, but there was a lot it didn’t tell us,” he says. There were many different types of GPCRs, and he needed confirmation that what he learned was applicable to other receptors. In the decade that followed the prize, Kobilka’s lab has obtained more receptor structures and worked to characterize them in different states.

“We’ve also become interested in some drug discovery projects, particularly for the treatment of pain,” Kobilka says, with a focus on modulators that target the cannabinoid receptor and the opiate receptor. His lab is working closely with chemists to use structural information for the design of new therapies.

Kobilka’s work is important to the worlds of physiology and health care. “The vast majority of hormones and

neurotransmitters work by activating G protein-coupled receptors,” he says. “And most of the communication within the body—either from neurons to other neurons, or neurons to muscle, smooth muscle, or hormones to distant cells in the body—they rely on G protein-coupled receptors for that signal.”

Indeed, Kobilka has contributed some of the most foundational research in the understanding of hormone receptors and their potential for use in treatment. During his Summit keynote, Kobilka plans to talk more about the drug discovery process and how these receptors can be challenging targets.

“It’s not easy, even though we have so many of them and a third of drugs target them; they’re still really difficult targets,” Kobilka says. He will share examples of why these targets can be challenging and talk about approaches for surmounting those obstacles.

For all of his expertise, Kobilka is quick to point out that he did not make any of his discoveries alone. A glance at the authorship for the 2011 paper reveals a large team of researchers—not to mention the many collaborators and mentors he’s had throughout his career and the support of his wife and family. “I’m really happy to have a Nobel Prize. But it certainly wasn’t all of my doing.”

Kobilka Keynotes American Physiology Summit

Hear Brian Kobilka, MD, in person and explore the science behind the biggest issues affecting life and health today at the 2024 American Physiology Summit, April 4–7, in Long Beach, California. The 2024 Summit will bring together over 3,000 researchers, educators and students from around the world who are teaching, learning and working in the physiological sciences. In addition, top scientists will present game-changer sessions on vital topics such as interorgan crosstalk and the molecular circadian clock. Learn more at www.physiology.org/APS2024.



A photograph of an adult transgenic zebrafish taken through a light microscope, showing the blood vessels (blue), lymphatic vessels (yellow), and the skin and scales (purple).

A clear Advantage

Once these researchers found zebrafish, no mammal model could measure up.

BY JENNA SCHNUER

Peer into any home aquarium and there's a good chance some zebrafish will dart by, easy to identify thanks to their namesake stripes. But that beginner-friendly aquarium species has, since the early 1960s, also been a favorite fish to watch for some researchers.

Turns out that zebrafish (*Danio rerio*), originally found in freshwater in India, have a surprising amount in common with humans. About 70% of the 26,000 protein-coding genes identified in the fish have at least one obvious orthologue—genes that evolved from a common ancestral gene—to humans, according to a 2013 paper in *Nature*.

That's not all. Though humans walked away with legs and arms versus the fins and other water-worthy features of zebrafish, both vertebrates claim ownership of everything from eyes to many internal organs and cartilage. Teeth, too. And, like with other vertebrates, zebrafish nervous systems evolved to help the animals avoid predators while on the hunt for food, shelter and mating partners.



The overlap makes zebrafish ideal subjects for researchers hoping to figure out animal behavior and developmental and other biological processes, as well as the reasons some diseases take hold.

One feature zebrafish definitely don't share with humans that makes them far better research subjects than their mammalian counterparts: The larvae are transparent. As imaging techniques have improved, the transparency has proved a greater and greater benefit. Take that, mouse model.

"Clinical researchers always scratch their heads when you tell them that something of relevance to human biology will come out of a fish or a fly," says Josephine Briggs, MD, editor-in-chief of the *Journal of the American Society of Nephrology* and director emeritus of the National Center for Complementary and Integrative Health at the National Institutes of Health. "I think learning our fundamental biological processes, a lot of which are shared between all of us and other eukaryotes, is very interesting and really quite productive."

FULL SYSTEM ACCESS

The ability to see a whole system and watch it develop is key for many zebrafish researchers. "I've always had big questions about the nervous system. Having a model that I can have genetic access to,

“Clinical researchers always scratch their heads when you tell them that something of relevance to human biology will come out of a fish or a fly.”

—Josephine Briggs, MD



as well as treat pharmacologically, makes it very accessible,” says Sarah Kucenas, PhD, professor of biology, cell biology and neuroscience at the University of Virginia in Charlottesville; co-director of the school’s Brain Institute; and director of the program in fundamental neuroscience. “And then maybe most importantly, which is why many of us use zebrafish, are the imaging capabilities. These fish are see-through, and as someone who wants to watch biology, it’s the perfect system to be able to do that.”

Joseph Fetcho, PhD, a snake model guy, dove into working with a fish model by the early 2000s. But those fish—goldfish—weren’t, to put it mildly, helping him move his research forward with any gusto. A researcher at Stony Brook University in New York at the time, Fetcho is now a Cornell University professor of neurobiology and behavior, the Dr. David & Dorothy Joslovitz Merksamer Professor of Biological Sciences, and the director of Cornell Neurotech-Arts and Sciences.

“I was getting sick of recording one neuron at a time,” he says. Fetcho knew about zebrafish and their potential. During a conversation with another Stony Brook postdoc, Donald O’Malley, PhD, Fetcho mentioned a recent paper that talked about labeling neurons with calcium dyes coupled to dextrans. Nerves damaged by the dye carried them back to the cell bodies of the neurons and labeled them, “and then you just have to look at them and watch them light up,” Fetcho says.

That all depended, of course, on having the right imaging equipment. Fetcho suggested they put the “latest greatest technology” in the lab O’Malley worked in to use, a commercial confocal microscope. The combination of the imaging equipment, the

dye and zebrafish would allow them to do something nobody had ever done before: “watch real activity inside of the vertebrae animal,” Fetcho says.

One other issue—Fetcho didn’t have any zebrafish. But this was in the days before the animal care rules. “I literally went to the pet store and bought zebrafish and marbles to put in the tank so the eggs would drop and be protected,” he says. “We had eggs the next day.”

He adds: “Within months, no one in my lab, when they saw what we were able to do, wanted to work on goldfish anymore.”

That zeal becomes endemic once researchers see what zebrafish can do. The model still isn’t the go-to for most labs, but it’s growing. In the early

2000s when Kucenas was a graduate student, “fish was really just becoming a really popular model.”

“While we were sequencing the genome, and we were able to do pharmacology, CRISPR wasn’t a thing then, so it was very difficult to make mutants. We had to do everything with mutagenesis,” Kucenas says.

Zebrafish zap that challenge, and even the mouse model people are catching on. “Technologies kept developing both in zebrafish, but also more broadly in biomedical sciences, and every time a discovery benefits biomedical sciences and is working in mice now, people are rapidly turning it into a tool that’s used in fish,” Kucenas says.

Fun Fishy Facts

Though zebrafish may top out at 4 centimeters, the diminutive swimmers continue to pull in a whale’s worth of attention from an ever-growing fanbase of aquarium enthusiasts and scientists alike. The love is well-deserved. Zebrafish are fascinating little pack animals who prefer sticking together. Here are a few facts about the species:

- Long before any zebrafish had been dropped into a fish tank in a lab or a fourth grader’s bedroom, the animals swam in the Ganges River in Eastern India as well as silty pools and rice paddies near streams.
- Zebrafish live on average for three years but can hang around for more than five years in a lab setting.
- Like humans, the fish can develop a spinal curvature as they age. (They do not, however, use walkers or canes.)
- When the fin of an adult zebrafish is injured, they can grow a replacement. Same goes for regeneration of the tail—and it takes just two to four weeks.
- Zebrafish pairs produce around 300 eggs per week. The larvae hatch two days after fertilization and, within three months, have grown into fully mature fish ready to do some breeding of their own.
- Scientists aren’t the only people futzing around with zebrafish genetics. A company called GloFish genetically modified zebrafish (and other species) to create fish with eye-popping stripes, including “sunburst orange,” “galactic pink” and “electric green.”
- Last summer, zebrafish joined a long list of animals that have traveled to space as part of scientific research. The Tiangong space station is now home to a school of zebrafish that are being used to study bone loss in astronauts and interactions between fish and microorganisms in a closed ecosystem.

“Within months, no one in my lab, when they saw what we were able to do [with zebrafish], wanted to work on goldfish anymore.”

—Joseph Fetcho, PhD

BUILDING THE BRAIN

For some researchers, the zebrafish model provides a way to start from the very beginning. A developmental neuroscientist, Kucenas wants to know “how you build a brain. How do you get a nervous system that functions and allows an organism to learn and have memories?”

What has to happen, she asks, “for the cells to be in the right place at the right time to make the right connections?”

At the Kucenas lab, they’re studying all things glia to chase the biology. They label the glia with different colors and “just watch.”

“There’s so many assumptions made,” she says, “because nobody’s really been able to watch the development of the nervous system. There’s just these assumptions.” But her lab work keeps serving up biology that “goes against the textbooks.”

As a postdoctoral fellow, Kucenas studied spinal cord and motor nerve development. The textbook knowledge about the nerves held that glial cells didn’t cross between the central nervous system and peripheral nervous system.

“What I discovered using zebrafish is that that’s totally wrong,” she says. “They migrate back and forth all the time. It was this ah-ha moment.”

Her first paper on this discovery was published in 2008. It took three

years of “seeing what we were seeing and then spending all that time making sure we were right” about this new biology.

Since that time, she’s encouraged other researchers in her lab to “just look, just watch.” Along the way, they’ve discovered new cell types and new behaviors for cells.

“It’s changing the way people think about how you build a brain. I mean, obviously, we knew it was complex but whoa, there’s so much more than we even imagined and the fish allow us to just watch,” Kucenas says.

MOVING IMAGING FORWARD

Fetcho’s lab also looks at the brain. His current focus, which he expects to take him through to retirement in about four years, is on finding the path to image the zebrafish brain “at any time from egg to grave.” It’s the latter part of the fishes’ lifespan that’s been the challenge at this point. As zebrafish age, their skulls become opaque, shutting out the ease of imaging during the larval stage.

But the imaging side of the science has caught up, which will allow Fetcho to capture what’s going on inside the intact skull of a zebrafish. The new technology, developed at Cornell, is long wavelength three-photon microscopy that provides the “deepest you can

image into the brain of any animal,” he explains.

“Because then you can do development,” Fetcho says. “You can do plasticity and learning, and you could do degradation and neurological disorders and stuff through the entire life of vertebrate animals.”

PEACE, LOVE AND ZEBRAFISH

In some areas, researchers aren’t really known for collaboration outside their lab. That is, until you get to the zebrafish community. “People share lines or tools before they’ve even published,” Kucenas says. “It’s part of our ethos.”

The community’s characteristics stem from the early days of zebrafish research at the University of Oregon. Called the “founding father of zebrafish research” by the International Zebrafish Society, Oregon’s George Streisinger, PhD, started bringing researchers together informally in the 1960s to share his zebrafish knowledge from the get-go.

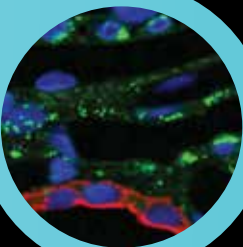
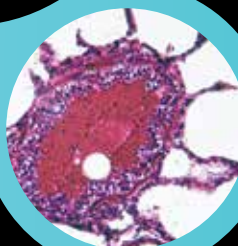
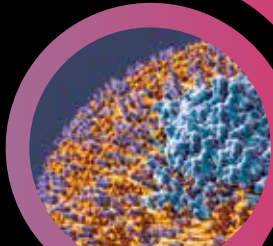
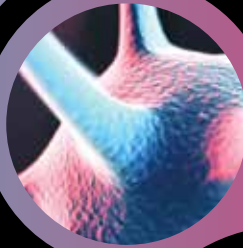
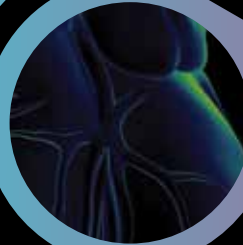
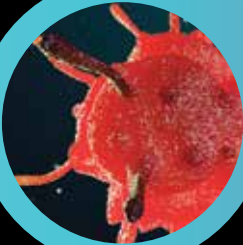
Other Oregon researchers—including Judith Eisen, PhD; Monte Westerfield, PhD; and Charles Kimmel, PhD—“were incredibly generous, and that set the tone,” Fetcho says. “They taught people how to do anything they wanted to learn. It’s not true in a lot of animal communities.”

The sharing hasn’t stopped.

In January 2024, the International Zebrafish Society will host the 10th Strategic Conference of Zebrafish Investigators and, in August 2024, the 18th International Zebrafish Conference.

Oregon remains the center of the zebrafish model world thanks to ongoing research and its hosting of the Zebrafish Information Network. Showcasing the zeal factor: The university’s weekly meeting of labs that use the model is called the Zebrafish Groupie. 🐟

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ON THE FRONTLINES

Physiologists strive to improve military personnel's experiences and environments.

BY KATHERINE O'BRIEN

When Stephanie Marshall, PhD, CPT, was working as a postdoc focusing on chronic disease research, she felt an itch to move in a new direction. In her mid-30s, she was “free and single” and wanted some adventure in her life. Academia was starting to feel stale, and she couldn't picture herself as an academic principal investigator for the long term.

Photo by U.S. Air Force Master Sgt. Becky Vanshu



Idaho Army National Guard Staff Sgt. Lauren Cox during an 11-mile trek with a 40-pound pack in Idaho in September.

“I fell in love with science again when I joined the Army as a researcher. My values align with the mission, and it’s easy for me to feel the purpose.”

—Stephanie Marshall, PhD, CPT

Marshall also wanted to serve her country, which perhaps made her a perfect candidate for the U.S. military’s 71 Bravo program, which recruits physiology PhDs to do research. “I fell in love with science again when I joined the Army as a researcher. My values align with the mission, and it’s easy for me to feel the purpose of the work done in the Army,” she says.

Stepping out of academia into military research as a commissioned officer proved to be the right move for Marshall, now an Army captain and program manager for both the blood and shock resuscitation and hemorrhage and vascular dysfunction programs at the U.S. Army Institute of Surgical Research in San Antonio. Marshall, who would like to eventually work in a deployed unit, is the only commissioned officer featured in this article—the others are civilian employees—but all of them started out in academia, and all point to the direct effect their research has on the end user as one of the pluses of working in a military environment.

“I can see some of the direct applications of my work somewhat more immediately, or they seem closer to me because I work with people in uniform” who might get deployed or sent off for special training at any time, says Nisha Charkoudian, PhD, FAPS, chief of the Thermal and Mountain Division at the U.S. Army Research Institute of

Environmental Medicine (USARIEM) and an expert on the integrative physiological responses to environmental extremes of heat and high altitude.

Marshall says academia is more focused on understanding all the nuances of getting the best model and the best drug, while “in an ideal scenario, [the Army] can give money for three years and you’ll go from zero to a product.”

HELPING POLYTRAUMA SURVIVORS

Marshall is trying to find a drug that can extend the survival of soldiers who have hemorrhage, orthopedic trauma and radiation injury. Recently, her team conducted a study—the first study to investigate this type of polytrauma over days as opposed to hours—that showed that the measures of kidney function in rats with multimodal injuries had a decrease in protein concentrations in the blood. This doesn’t match up with the glomerular filtration rate and most likely indicates a gastrointestinal injury from radiation exposure, Marshall says. “I would love to figure that out. It’s complicated and complex and takes various thought and dedication, but if we could get more insight there, that would be very exciting,” she says.

Marshall points out that each case of trauma is different. “Patients rarely have a similar etiology, and their responses are all different depending on their current physiological state or

background,” she says. She loves how dynamic the research is—the only downside is that she must switch gears very quickly at times.

The U.S. Department of Defense is one of the rare entities that funds trauma research. In fact, science and technology programs received more than \$22 billion in direct appropriations across the Defense Department—more than 18% above fiscal year 2022 funding and nearly \$6 billion more than requested, according to *National Defense* magazine. Still, the funding for individual projects isn’t necessarily stable. “You can get really involved in an area of focus here and really fall in love with it and get some momentum, but then you get a new commander or a director or Congress changes; then, all of a sudden, the funding for that topic is no longer there,” Marshall says.

PREVENTING EXTREME HEAT-RELATED ILLNESSES

Charkoudian, who left an 11-year career as a faculty member at the Mayo Clinic in Rochester, Minnesota, describes her current workplace as a hybrid between a military post and an academic department. Although many of the day-to-day tasks are similar to those in academia, the culture is a little different—she had to learn about military ranks, for example. Plus, all research must go through a clearance process before it is published or presented. “You need a certain level of patience to deal with some of the red tape or bureaucracy surrounding some of the processes that we need to do in order to get our research done,” she says.

The research USARIEM does around understanding responses and adaptations to heat exposure is becoming increasingly relevant as climate change continues, she says. Each year, on training bases, soldiers collapse from heat exhaustion, and someone



Army cold weather training in Alaska.

dies from exertional heat stroke every few years. “It’s just not acceptable,” Charkoudian says. “It’s so tragic and so sad. ... It’s rare, but it does happen.” Her division is working toward more definitive practices that can prevent heat-related illnesses and death from happening on the battlefield and in training bases.

Charkoudian is particularly excited about research she’s done showing that female reproductive hormones (estradiol and progesterone) have significant influences on autonomic regulatory pathways that can alter thermoregulatory and cardiovascular responses during exercise in extreme heat. “With increasing combat roles and various roles open to women over the past five to seven years, it’s important that we dispel any myths that might be still out there about women being somehow more fragile,” she says. She points out that some research on sweating shows that women on average sweat less than men during intense exercise, which—if that research bears out—can be an

advantage or a disadvantage depending on the situation. More studies need to be conducted on women in terms of military relevance and exercise as most of the research has been conducted on men, she adds.

ENHANCING THE PERFORMANCE OF MILITARY ORGANIZATIONS

Improving performance at high-altitude is the type of research that most intrigues Charkoudian’s colleague, Roy Salgado, PhD, USARIEM research physiologist. In 2014, while working as a non-tenure track professor, he applied for a postdoctoral research fellowship to help further his goal of becoming a tenure-track professor. The Thermal and Mountain Division was a natural fit: Salgado grew up in a military family, and his graduate research looked at the impact of high altitude on the human body.

Now an Army civilian employee, Salgado has not ruled out going back to academia, but right now

he’s enjoying his current position, which allows him to mentor and train junior USARIEM staff. He also appreciates that the institute has some of the best resources available to conduct intricately designed studies. He points to USARIEM’s hypobaric chamber—which can simulate almost any environment on earth—located in its research facility in Natick, Massachusetts, and its Pikes Peak High Altitude Research Facility, located on the summit of Pikes Peak at about 14,115 feet in Cascade, Colorado.

“What I’m really challenged with is trying to find those potential countermeasures or solutions to mitigate performance decrements,” Salgado says. Since the 1960s, high-altitude researchers have been trying to mitigate the problem of decrements in endurance performance, but so far, he says, the only effective solution is through altitude acclimatization (residing at operating altitude for a prolonged period) or altitude



Army Reserve Sgt. Conner Williams trains on an obstacle course.

staging (residing at a low altitude before going to higher altitude). As he points out, both strategies require access to high-altitude areas.

Although his research is applicable to anyone who spends time in high-altitude environments, such as rescue workers or hikers, the primary end users are military organizations, such as the Colorado Army National Guard. He regularly talks to such organizations about the performance challenges they face in high altitude, working with them to design solution-oriented research projects.

One such project studies whether the combination of erythropoietin (EPO) and acetazolamide can improve the performance of endurance tasks at high altitude.

Acetazolamide stimulates the body to breathe more but does not augment endurance performance, while EPO, which increases the number of red blood cells and thus the ability to carry oxygen, has been shown to have ergogenic benefits at sea level, Salgado says. He adds that it's also unclear whether

combining the physiological responses of these two pharmaceuticals will have ergogenic benefit at altitude.

GETTING THE INSIDE SCOOP

Having conversations with end users is also a critical part of the work of John Harrell, PhD, research physiologist at the 711th Human Performance Wing, U.S. Air Force Research Laboratory, Wright-Patterson Air Force Base, in Dayton, Ohio. In fact, some of his research projects are based on anecdotes from airmen and airwomen, including one that investigates whether exposure to heat, dehydration and mild hypobaria (low blood pressure) has a detrimental effect on flight-relevant tasks. Harrell was surprised to learn that the heat inside a jet can significantly affect acute respiratory function—he had no idea how hot airplanes could get until he talked to pilots. (Harrell is not allowed to disclose the temperature inside fighter jets.)

Harrell originally planned to stay in the academic world for life, but, like Charkoudian, he had to rethink career

plans after a move. While in academia, Harrell, who loves studying the cardiovascular system, researched blood flow responses to stressors in different groups. He points out that researchers pursuing National Institutes of Health funding have a bit more leeway to generate research ideas than those in the military. Still, he can sometimes find “that sweet spot” where his research interests align with the Air Force’s mission to sustain or enhance the performance of airmen and airwomen. For instance, one of his projects investigates physiological variables such as venous compliance and arterial stiffness that might help pilots better tolerate acceleration.

Harrell has been surprised by the complexity of the work, everything from how money flows for research projects to regulations in terms of what can and cannot go into the human centrifuge or hypobaric chambers and who can be used as subjects. In academia, your subjects could be almost anyone if they fit your inclusion criteria—not so in the Air Force, Harrell says. “You can’t just pull someone off the street,” but must keep a pool of trained active-duty airmen and airwomen on hand.

One of his goals is to let physiologists know about research opportunities in the military. Most aerospace physiologists, like Harrell, have backgrounds in exercise or integrative physiology. “You’ve got to come in with open eyes and open ears because of the lack of programs. ... You’ve got to be willing to absorb as much information as you can about airplanes, about the aerospace environment. You’ve got to be willing to ask questions.”

That’s probably sound advice for anyone doing physiology research in the military. The more questions you ask, the easier it will be to find solutions to the medical problems faced by those who serve on land, sea and air. 🐦

APPLY FOR SOCIETY AWARDS



The American Physiological Society (APS) offers more than \$800,000 in awards and fellowships each year as part of our mission to encourage excellence in physiological research and education. These awards are a vital investment in our researchers and educators of all career levels.

Learn more about all the available opportunities and apply for the awards highlighted below at [physiology.org/awards](https://www.physiology.org/awards).

January
5

Dale J. Benos Early Career Professional Service Award

\$1,000 honorarium. Honors a member who has made outstanding contributions to and demonstrated commitment to furthering the goals of the physiology community.

The Charlie Bates Research Award

\$1,000 honorarium. Honors equality and social justice for LGBTQ+ scientists. This award identifies a meritorious abstract to the American Physiology Summit.

January
5

January
15

Porter Physiology Development Fellowship

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

Graduate Student Ambassador Fellowship

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

January
24

Beth Beason-Abmayr Named to Endowed Teaching Professorship

Beth Beason-Abmayr, PhD, was named the Kathleen and Randall Matthews



Teaching Professor of BioSciences at Rice University in Houston. Her research focuses on understanding student expectations and perspectives,

uncovering misconceptions, and evaluating learning gains with a special interest in the impact of the classroom environment on students' ability to accomplish a course's learning goals. This permanently endowed position was established to support a nontenure-track teaching professor position in the Department of BioSciences. Beason-Abmayr has been an APS member since 2000.

Pradeep Dudeja, Mark Frey Receive Research Mentor Award

Pradeep K. Dudeja, PhD, and **Mark R. Frey, PhD**, are 2023 recipients of the American Gastroenterological



Association's (AGA) Research Mentor Award. This honor acknowledges the achievements of AGA members who serve the gastroenterology and hepatology community as outstanding mentors in research.



Dudeja is a professor of physiology and director of scholarly activities in the University of Illinois College of Medicine's Division of Gastroenterology and Hepatology. His research focuses on ion transport mechanisms in the intestine

and understanding mechanisms underlying infectious or inflammatory diarrhea. Dudeja has been an APS member since 1995.

Frey is an associate professor of pediatrics and biochemistry and molecular medicine at the Keck School of Medicine at the University of Southern California. His research explores the role of ErbB receptor tyrosine kinases in intestinal homeostasis. Frey has been an APS member since 2011.

Sarah England Elected to National Academy of Medicine

Sarah K. England, PhD, the Alan A. and Edith L. Wolff Professor of Medicine and vice chair of research in the Department of Obstetrics and Gynecology at Washington University



School of Medicine in St. Louis, has been elected to the National Academy of Medicine. Membership in the Academy is one of the highest honors in the

fields of health and medicine and recognizes individuals who have demonstrated outstanding professional achievement and commitment to service. England is also director of the Center for Reproductive Health Sciences and specializes in understanding uterine function in pregnancy. She has been an APS member since 1991.

Jessica Faulkner Receives American Heart Association Early-Career Award

Jessica Faulkner, PhD, assistant professor in the Department of Physiology at the Medical College of Georgia at Augusta University, is the 2023 recipient of the American Heart Association's (AHA) Harry Goldblatt Award for Early-career Investigators. Sponsored by the AHA Council on Hypertension and the High Blood Pressure Research Council



of Australia, this honor recognizes significant contributions to our understanding of the causes of hypertension and related cardiovascular disease.

Faulkner studies high blood pressure, vascular damage and fetal growth restriction in pregnancy. She has been an APS member since 2011.

Osama Harraz Receives Rising Star Award, Endowed Professorship

Osama Harraz, PhD, assistant professor of pharmacology at the University of Vermont's Larner College of Medicine, received the college's 2023 Rising Star New Investigator Award. This honor is awarded to faculty for excellence in research. He has also been named the 2023–2025 Bloomfield



Early-career Professor in Cardiovascular Research. The endowed professorship aims to encourage and support early-stage independent investigators in

developing high-quality and competitive cardiovascular research programs. Harraz's research interests include neurovascular coupling and cerebral blood flow, and small vessel and neurodegenerative diseases. He has been an APS member since 2012.

Paule Joseph Receives FNINR Protégée Award

Paule Joseph, PhD, RN, is the 2023 recipient of the Friends of the National



Institute of Nursing Research (FNINR) Protégée Award. This honor recognizes an evolving nurse scientist who shows great promise in advancing

science in the early-career stage. Joseph is a Lasker clinical investigator and National Institutes of Health distinguished scholar at the National Institute on Alcohol Abuse and Alcoholism with a joint appointment at the National Institute of Nursing Research. Her work focuses on the neurological mechanisms of chemosensation and how they relate to ingestive behaviors, particularly in people with obesity and substance use disorders. Joseph has been an APS member since 2021.

Beth McCormick New UMass Chan Medical School Department Chair

Beth McCormick, PhD, has been named chair of the UMass Chan Medical School's Department of Microbiology and Physiological Systems. She is the Worcester Foundation for Biomedical Research Chair II and a professor of microbiology and physiological systems.



McCormick's research focuses on the pathophysiologic mechanisms of intestinal inflammation. Her work with enteric pathogens as models uncovered unpredicted bacterial virulence mechanisms and universal, previously unknown, host immune signaling cascades that drive pathology in inflammatory bowel diseases. McCormick has been an APS member since 2018.

Gordon Mitchell Named University of Florida Foundation Term Professor

Gordon Mitchell, PhD, FAPS, professor of neuroscience and physical therapy at the University of Florida (UF), founding director of UF's Center for Breathing Research and Therapeutics and deputy director of UF's McKnight Brain Institute,

has been honored with the UF Foundation Preeminence Term Professorship. This three-year award supports the university's preeminence goals to further advance



faculty research efforts. Mitchell's research in respiratory neuroplasticity explores how the neural system controlling breathing responds to intermittent hypoxia and how the resulting neuroplasticity can be harnessed to treat devastating neural injuries or disease, such as spinal cord injury and amyotrophic lateral sclerosis. He has been an APS member since 1978.

Nirupama Ramkumar Honored with Junior Investigator Award

Nirupama Ramkumar, MD, MPH, now associate professor at the University of Utah Health, is the 2023 recipient of the Department of Internal Medicine's William D. Odell and Margaret



F. Odell Junior Investigator Award. This award recognizes an assistant professor

who demonstrates leadership potential to become an academic or political leader in internal medicine. Ramkumar's research interests focus on hypertension and chronic kidney disease. She has been an APS member since 2012.

Claudia Stanescu Named Women in Medicine and Science Torchbearer

Claudia Stanescu, PhD, associate department head and associate professor of physiology at the University of Arizona College of Medicine-Tucson, is a 2023 recipient of the college's Office of Diversity,



Equity & Inclusion's Women in Medicine and Science (WIMS) Torchbearer award. The WIMS award is dedicated to fostering mentorship, networking, career development and institutional advancement for women faculty in the College of Medicine-Tucson. Stanescu directs the college's physiology and medical sciences program and oversees 22 undergraduate physiology courses. She has been an APS member since 2015. 



APS ELECTIONS

Your Voice, Your Vote

Voting for the next slate of APS leaders—president-elect and councilors—begins soon. Meet the candidates and see what they could bring to these roles at the virtual town hall in late January. After the town hall, ballots and a recording of the event will be emailed to all members. Watch your email for more details.

PRESIDENT-ELECT CANDIDATES

Robert L. Hester, PhD, FAPS

Professor, Department of Physiology & Biophysics University of Mississippi Medical Center



Paul A. Welling, MD

Joseph S. and Esther Handler Professor, Departments of Medicine (Nephrology) and Physiology Johns Hopkins University School of Medicine



COUNCILOR CANDIDATES

Patricia Halpin, PhD, FAPS

Professor of Biology & Biotechnology, Department of Life Sciences University of New Hampshire



My Helms, PhD

Associate Professor of Internal Medicine University of Utah School of Medicine



Scott Kirkton, PhD, FAPS

Professor, Department of Biological Sciences Union College



Beth A. McCormick, PhD

Professor and Chair, Microbiology and Physiological Systems University of Massachusetts Chan Medical School



Rory Morty, PhD

Professor and Chair, Department of Translational Pulmonology Heidelberg University Hospital



Michael Sturek, PhD

Chief Science Officer Corvus Biomedical, LLC and Corvus Foundation Inc.



LEADERSHIP

APS 2024 Class of Fellows Announced

The Fellow of the American Physiological Society (FAPS), the highest honor APS bestows upon a member, recognizes distinguished leaders who have made significant contributions to the physiological sciences and who have served the Society. Please join us in congratulating the 2024 FAPS inductees:

- Ryan Bavis, PhD, FAPS
- Tracy Baynard, PhD, FAPS
- Andreas Beyer, PhD, FAPS
- Kirsteen Browning, PhD, FAPS
- Jason Carter, PhD, FAPS
- Nisha Charkoudian, PhD, FAPS
- Craig Crandall, PhD, FAPS
- J. Thomas Cunningham, PhD, FAPS
- Ralph Fregosi, PhD, FAPS
- Beth Habecker, PhD, FAPS
- Patricia Halpin, PhD, FAPS
- Thomas Hawke, PhD, FAPS
- Michael Koval, PhD, FAPS
- Benedito Machado, PhD, FAPS
- Christopher Minson, PhD, FAPS
- Evangeline Motley-Johnson, PhD, FAPS
- Donal O'Leary, PhD, FAPS
- Javier Stern, MD, PhD, FAPS
- John Symons, PhD, FAPS
- Stephanie Watts, PhD, FAPS
- Erica Wehrwein, PhD, FAPS

APS PUBLICATIONS

New Editor Named

Larissa A. Shimoda, PhD, was named the new editor-in-chief of the *American Journal of Physiology-Lung Cellular and Molecular Physiology*. Shimoda is a professor and director of research in the Division of Pulmonary and Critical Care Medicine at Johns Hopkins in Baltimore. She is a pulmonary vascular physiologist studying cellular mechanisms contributing to the pathogenesis of pulmonary hypertension and endothelial cell barrier function.



MEETINGS

Register Early to Save: 2024 American Physiology Summit

Don't miss the premiere event for researchers exploring the science behind some of the most important questions affecting life and health. Registration for the 2024 American Physiology Summit is now open, and early registration ends January 17.

Come together with your colleagues and leaders in your field April 4–7, 2024, in Long Beach, California, to share the

most recent advances and breakthroughs in the research community.

This meeting is designed and programmed

by working scientists to share discoveries on the cutting edge of bioscience and connect you with your vibrant, diverse community.

All career levels are welcome, including established scientists, principal investigators, experienced educators and trainees. Learn more and register today at www.physiology.org/APS2024.

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physiology
summit**

APRIL 4–7, 2024
LONG BEACH

EDUCATION

APS to Launch Education Resources with Labster

Through a new partnership with Labster, a platform for virtual labs and science simulations, the APS Center for Physiology Education (CPE) will develop resources for undergraduate physiology educators that explore the implementation of virtual reality tools to improve the teaching of complex physiological processes.

Resources from the partnership between APS and Labster will be released in early 2024. They include an educational webinar and best practice guides designed to advise physiology instructors on the integration of virtual anatomy and physiology labs within their curricula. The webinar will feature anatomy and physiology instructor Christina Alevras, EdD, assistant professor of biology at the University of Saint Joseph in West Hartford, Connecticut. She will share her recent research on strategies to increase student engagement—and student success—in the undergraduate classroom. Not only do today's students come from more diverse learning backgrounds, but as digital natives, they generally have shorter attention spans but are comfortable with tech-enabled learning. Learn more about the webinar at www.physiology.org/Labster.

WEBINAR

Neuroscience Webinar Series Available On-Demand

Don't miss the last live webinar from the Neurophysiology: Exploring Basic Research & Clinical Consequences webinar series, "Compensatory Mechanisms in Parkinson's Disease," which will be held on January 17 at 11 a.m. EST.

You can also catch up on the rest of the series, now available on-demand. APS, along with the Society for Neuroscience,

the Federation of European Neuroscience Societies, the American Autonomic Society and InsideScientific, launched the joint webinar series covering late-breaking research, novel discovery, fundamental principles and research innovation in the field of neuroscience and related disease models. The series includes scientific lectures from researchers around the world, as well as technology and methods sessions, focused on innovative laboratory techniques central to neuroscience research and related models of disease. Topics include:

- Neurodegenerative disease
- Brain mapping
- Behavioral neuroscience
- Mental disorders
- Neurotrauma
- Autonomic regulation

Learn more about the series and watch the webinars on-demand at www.physiology.org/neurophysiology.

GET INVOLVED

Get Involved in the APS Publishing Community

Kick off the new year by getting involved in APS publications. Here are three ways you can share your research and help elevate the work of others:

Update your reviewer profile for APS journals. Reviewing for an APS journal benefits your career, your research and the field of physiology. Update your keywords in your reviewer profile to get connected with the right papers for your areas of expertise. Learn more about reviewing for APS at <https://journals.physiology.org/reviewers/how-to-become-an-aps-reviewer>.

Showcase your next article with a Spotlight Cover. Next time you submit your research to an APS journal, increase your impact through the Spotlight Cover Program. Your Spotlight Cover equips you with an easy and effective tool to visually highlight your work and raise your profile. Learn how you can participate and check out the Spotlight Cover gallery at www.physiology.org/spotlightcovers.

Submit to open calls for papers. Check out open calls for papers, including Exercise and the Kidney in Health and Disease, Hypertension, Decoding Fibrosis and more. Check out the top five reasons you should submit to a call for papers and see the full list of open calls at www.physiology.org/calls. 📄



AWARDS

*Award deadlines may be subject to change

- The Charlie Bates Research Award** (January 5)
- Dale J. Benos Early Career Professional Service Award** (January 5)
- Dependent Support Travel Award** (January 5)
- Porter Physiology Development Fellowship** (January 15)
- Teaching of Physiology Section Labfront Mid-career Educator Award** (January 15)
- Graduate Student Ambassador** (January 24)
- Comparative & Evolutionary Physiology Section August Krogh Distinguished Lectureship** (February 1)
- Cardiovascular Section Carl J. Wiggers Award** (February 8)
- Cardiovascular Section Gabor Kaley Lectureship** (February 8)
- Cardiovascular Section Robert M. Berne Distinguished Lectureship** (February 8)
- Central Nervous System Joseph Erlanger Distinguished Lectureship** (February 15)

- Carl W. Gottschalk Distinguished Lectureship of the APS Renal Section** (February 28)
- Renal Section Mid-career Achievement Award** (February 28)
- Environmental & Exercise Physiology Section Edward F. Adolph Distinguished Lectureship** (March 1)
- Environmental & Exercise Physiology Section Honor Award** (March 1)
- Environmental & Exercise Physiology Section Impact Award** (March 1)
- Cell & Molecular Physiology Section Hugh Davson Distinguished Lectureship** (March 15)
- Local Undergraduate Research Awards in Physiology** (Applications accepted on an ongoing, year-round basis)



More details: www.physiology.org/awards

CALLS FOR PAPERS

- American Journal of Physiology-Gastrointestinal and Liver Physiology** (January 31, 2024)
 - Cell and Animal Models of Gastrointestinal Disease
 - Epithelial Cell Metabolism
 - The Microbiota-Gut-Brain Axis
- American Journal of Physiology-Heart and Circulatory Physiology** (February 1, 2024)
 - Hypertension
- Journal of Applied Physiology** (February 1, 2024)
 - Impact of Climate Change on Health and Performance
- Journal of Neurophysiology**
 - Sleep Disorders (January 31, 2024)
 - Neuroimaging Meets Neurophysiology (March 31, 2024)
- Physiological Genomics** (January 31, 2024)
 - Cancer 'Omics
 - Integrative Physiology and Translational -Omics of Exercise and Physical Activity
 - Methods and Approaches in 'Omics Research
 - The Microbiome in Health and Disease
 - The Physiology of Obesity



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

MEETINGS & EVENTS

- American Physiology Summit**
April 4–7, 2024
Long Beach, California
 - Late-breaking abstract submissions: January 2–31
 - Early registration deadline: January 17
 - Housing deadline: March 11
 - Regular registration deadline: March 11



More details: www.physiology.org/APS2024

WEBINARS

- WEBINAR SERIES—NEUROPHYSIOLOGY: EXPLORING BASIC RESEARCH AND CLINICAL CONSEQUENCES SERIES**
- Compensatory Mechanisms in Parkinson's Disease**
January 17, 2024
- APS-Harvard Bioscience Tech Methods Webinar** January 24, 2024
- Trauma Pathophysiology Webinar** January 31, 2024



More details: www.physiology.org/webinars

Share Your Discoveries

Present your work at the 2024 American Physiology Summit to gain valuable feedback and make vital connections.

Participate in our lively poster receptions, where your peers are sharing discoveries on the cutting edge of bioscience.

We begin accepting late-breaking abstracts January 2, 2024. Submit your research at physiology.org/APS2024.

**Late-breaking Abstract Submission
Deadline: January 31, 2024**

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**APRIL 4–7, 2024
LONG BEACH**

Reframing Failure as a Stepping Stone to Success

BY MEENA S. MADHUR, MD, PHD

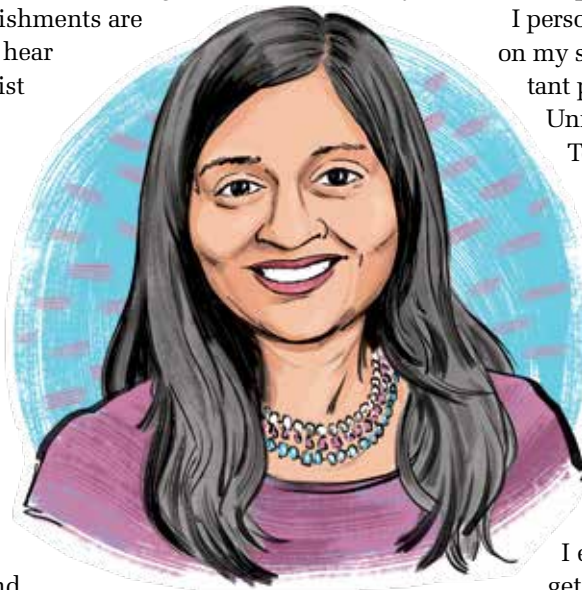
We have all been at that conference where the keynote speaker is introduced and a long list of accolades and accomplishments are described. What we don't hear is the undeniably longer list of failures—failed experiments, rejected papers, not-discussed grant proposals and awards not won. This bias in reporting leads to false expectations and feelings of insecurity among trainees and junior faculty. I have recently seen far too many posts on social media and heard many stories of young scientists who receive a paper or grant rejection and say that they don't know how they can do this much longer. They say they want to scream, cry or quit academia. While it might

seem easier said than done, it is important to reframe these failures as part of the “game” and opportunities for growth.

Each failed experiment is a chance to realize how to do it better and know what doesn't work. Each

rejected paper or grant is an opportunity to improve it or shop it around to a more suitable journal or funding mechanism. Even an award not won provides visibility to you and your work and networking opportunities.

“Instituting an event like FailFest can be cathartic. Normalizing these failures ... can provide important perspective and promote resilience.”



I recently attended an event at my institution called FailFest in which women faculty and trainees went around the table and described our funniest and biggest personal and professional failures over pizza. Instituting an event like this, even if informal, can be cathartic. Most importantly, normalizing these failures and understanding truly how commonplace they are, can provide important perspective and promote resilience.

It's important to remember that luck plays a big role too, so being able to see certain wins or losses as good luck and bad luck, respectively, can help detract from those feelings of insecurity and utter despair.

I personally had a bit of luck on my side when I was an assistant professor at Vanderbilt University in Nashville, Tennessee. I got my first career development grant, a National Institutes of Health (NIH) K08 award, and my first R01 equivalent grant, an NIH DP2 New Innovator Award, on my first try.

Filled with confidence that grant writing must be easy, I embarked on trying to get my second R01 equivalent grant only to be hit with the dreaded not-discussed result. Multiple attempts later, my R01 was funded with a sixth percentile. Of course, that was the screenshot that made it to Twitter!

Along the way I had other successes and an equal number of failures. But without these successes (and failures), I wouldn't be where I am today or who I am today. So, if you remember one thing, let it be this: Success is defined not by the number of times you win, but by the number of times you get back up after losing. ☺

Meena S. Madhur, MD, PhD, is the division director of clinical pharmacology at Indiana University. She studies immune mechanisms of cardiovascular disease. You can follow her at www.twitter.com/CVimmunology.



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

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Interested in contributing? Email **communications@physiology.org**.

#ISpyPhysiology



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Don't miss the opportunity to make vital connections and expand your network at the 2024 American Physiology Summit.

Come together with leaders in your field to share the most recent advances and breakthroughs impacting the research community and the world around us.

APS members who register early receive the best rate. Explore the schedule and register today at physiology.org/APS2024.

Early Registration Deadline:
January 17, 2024

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