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Terrie Williams' work with big animals has had a lasting impact on conservation efforts.

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"APS meetings [...] are the best way to keep up with what is going on in my field."

—Eleanor Lederer, MD, APS Member
University of Louisville

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CONNECTIONS

American Physiological Society (APS) conferences bring together researchers, educators and students from around the world to share the most recent advances and breakthroughs in physiology and related disciplines. APS members enjoy discounted registration rates. Explore our 2020 lineup at the-aps.org/meetings and take advantage of your benefits at the-aps.org/benefits.

the-aps.org

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On the Cover: The scapula and ribs of a gray whale calf dwarf Terrie Williams, PhD. The whale bones are mounted near her lab. Photograph by Eric Millette.

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Our New Learning Series

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Institute on Teaching and Learning

June 22–26, 2020
Minneapolis
the-aps.org/ITL

Heme Oxygenase and Related Enzymes: From Physiology to Therapeutics

June 28–July 1, 2020
Los Angeles
the-aps.org/hemeox

Integrative Physiology of Exercise

November 11–13, 2020
Austin
the-aps.org/IPE2020

Webinar dates and topics coming soon!

How Open Access May Change the Way We (and You) Publish

BY SCOTT STEEN, CAE, FASAE

As I write this column, the scientific scholarly publishing landscape is in the midst of significant upheaval. There is an intense discussion centering around open access publishing and how a large-scale shift to this publishing model might affect scientific research in the short and long term.

These discussions are not new. Early adoption of open access journals began nearly 20 years ago. But in 2020, the White House Office of Science and Technology Policy, along with key U.S. government agencies such as the National Institutes of Health (NIH), are considering widespread changes to their funding requirements that could introduce immediate and free access to full research data and findings within their funding streams. This would represent a major change to the way science is disseminated.

"Two of our top priorities are to support the dissemination of scientific research and to understand and lessen the potential negative impacts of changes to scholarly publishing for our members."

APS has been fully engaged in these discussions with the administration, NIH, the National Academy of Sciences and others to ensure the best outcome for both researchers and the Society.

Two of our top priorities are to support the dissemination of scientific research and to understand and lessen the potential negative impacts of changes to scholarly publishing for our members.

As a scientific publisher, we are also acutely aware of the impact a move to a fully open access model would have on the APS publishing program, as well as on our ability to support and serve our members and the broader physiology community.

Fortunately, we are not caught flat-footed. APS has been experimenting for years with options such as AuthorChoice (**www.physiology.org/AuthorChoice**) and Read, Publish and Join (**www.the-aps.org/readpublishjoin**) that offer researchers and institutional librarians innovative opportunities to publish open access across the APS journal portfolio. Our new high-profile journal *Function*—which launches later this year—will be fully open access, as is *Physiological Reports*, which APS jointly publishes with The Physiological Society. All articles published on APS journal websites are free within 12 months, in accordance with NIH policy.

While we still have work to do, I believe these offerings create a foundation that will allow APS to thrive despite changes in the publishing industry and reposition ourselves for a mostly open access future. There are no easy answers. Open access has its strengths, but it also has drawbacks and consequences. Our preference is to preserve choice, allowing researchers as much flexibility as possible.

We are creating resources to help educate you on these potential changes and how they might affect the way you disseminate your work. The first of these is a March 4 webinar, "Open Access: What Researchers Need to Know Now." Our panelists will discuss the various open access models; author copyrights, benefits and repositories; article fees; and other critical information that authors need to understand to fully engage in the open access discussion. In case you miss the webinar, the replay will be available at **www.the-aps.org/webinars**.

APS will continue to monitor these changes and keep you informed on what's happening in the broader field of publishing as we move toward more open scholarship.

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

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PHYSIOLOGY IN FOCUS

Heme Oxygenase and Related Enzymes: From Physiology to Therapeutics

June 28–July 1, 2020
Los Angeles
Learn more at the-aps.org/hemeox.

Be Part of this International Conference's 20-year History

This conference will bring together basic, clinical and translational scientists to present cutting-edge research in the area of heme oxygenase (HO), related enzymes and oxidative stress biology. In particular, the axis represented by transcription factor Nrf2 and its target Heme Oxygenase 1 (HO-1) is a major pathway orchestrator of antioxidant responses, playing a major role in cardiovascular and metabolic diseases, inflammatory diseases, cancer biology and immunology, as well as many other systems.

Researchers in the field will have the opportunity to interact with each other and present their most recent findings on the roles of Nrf2, heme oxygenase and related enzymes in the redox biology underlying each of those specific disorders.

Connect with peers to present and discuss the latest cutting-edge research in the field, outline future directions, explore areas of common interest, and establish new collaborations to move the field forward.

Program Highlights

PRELIMINARY SYMPOSIA

- Molecular Regulation of HO-1
- HO, Inflammation, Immunity and Cancer
- HO, Cardiovascular and Metabolic Disorders
- Young Investigator Symposia
- Heme and Iron Transport in Biology
- Heme Toxicity and the Vasculature
- Carbon Monoxide as a Novel Therapeutic in Inflammation and Metabolic Disorders
- Novel Functions of Biliverdin Reductase inMetabolism and Inflammation
- New Developments in the Biology of Bilirubin
- Nrf2/HO1, Toxicology and Gene Environment Interactions

Speakers and more information to be announced.

Deadlines

- Abstract Submission and Award Applications: April 1
- Advance Registration: May 4
- Final Registration: June 1

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Please recycle.

The American Physiological Society (APS) Local Undergraduate Research Award in Physiology (LURAP) allows APS members to recognize undergraduate excellence in physiology research at their home institution. The award fosters interest in physiological research for undergraduates and encourages them to continue with physiological studies. Additionally, the award encourages undergraduates to connect with members at their home institutions.

Applications are accepted year-round on an ongoing basis. Any member with an undergraduate research showcase event at their institution may apply.

Learn more at **the-aps.org/LURAP**.

"I have been very impressed with [APS] because of their commitment to education. I've met some incredible scientists and just as many incredible educators through my involvement with APS."

Ed Merritt, PhD
Southwestern University

Function founding Editor-in-Chief Ole Petersen, CBE, FRS, welcomed dozens of attendees to the inaugural *Function* symposium at the Duke University Molecular Physiology Institute. In addition to research presentations by members of the journal's editorial team, the symposium included two panel discussions: one on the physiology community's hopes for the new high-profile journal and a second on societal grand challenges that the discipline can best help solve.

Photos, this page, by Chuck Fazio

Program advisory board members and research hosts for the Short-Term Research Education Program to Increase Diversity in Health-Related Research (STRIDE) Fellowship met at APS headquarters to hear evaluation findings and provide feedback on the program at the end of the six-year grant. A total of 120 Fellows participated in the program aimed at increasing diversity in heart, lung and blood research careers.

A capacity crowd of graduate students and postdocs received personalized advice and instruction in writing scientific manuscripts at the Writing and Reviewing for Scientific Journals professional skills training course in Orlando, Fla. Seven journal editors and highly published authors served as instructors, helping attendees improve their first-author draft manuscripts. Attendees also learned about the submission process and received feedback on their draft articles.

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PHYSIOLOGY IN FOCUS

Institute on Teaching and Learning

June 22–26, 2020
Minneapolis
Learn more at the-aps.org/ITL.

Build a Life Science Education Community of Practice

The American Physiological Society (APS) Institute on Teaching and Learning (ITL) will engage both new and experienced educators in interactive sessions on best practices in teaching, learning and assessment. This conference is for educators at community or four-year colleges through professional schools.

Attend the conference to:

- enhance your skills in designing and implementing educational research in your classroom, and
- discover avenues to share your findings with colleagues.

Speaker Spotlight

Keynote: Bloom's and Evidence-based Teaching
Invited Speaker: Mary Pat Wenderoth, PhD, University of Washington

PRELIMINARY PLENARY TALKS

Inclusive Teaching in the Physiology Classroom
Speaker: Jeff Schinske, Foothill College

Student Evaluation of Faculty/Courses
Speaker: Mari Hopper, PhD, Sam Houston State University

Course-based Undergraduate Research Experiences (CUREs)
Speaker: Erin Dolan, PhD, University of Georgia

Ineffable Learning Outcomes
Speaker: Raymond J. Shaw, PhD, Merrimack College

Trust, Growth Mindset and Student Commitment to Active Learning
Speaker: Mark Graham, PhD, Yale University

Teaching Data Visualization and Statistics to Physiologists: Tools, Strategies and Resources
Speakers: Tracey Weissgerber, PhD, and Stacey Winham, PhD, Mayo Clinic

More speakers to be announced.

Deadlines

- Abstract Submission and Award Applications: April 1
- Advance Registration and New Teacher Workshop Registration: May 4
- Final Registration: June 1

LAB NOTES

STATS & FACTS

21%

The proportion of opioid overdose deaths that might be prevented by high rates of naloxone distribution, according to statistical modeling

National Institute of Drug Abuse

RESEARCH FIZZ

Time-dependent regulation of postprandial muscle protein synthesis rates after milk protein ingestion in young men

This study shows that consuming milk protein boosts amino acids, which in turn stimulates the production of muscle proteins. Muscle protein synthesis is important for the repair and growth of muscle tissue.

***Journal of Applied Physiology*, December 2019**

https://doi.org/10.1152/japplphysiol.00608.2019

MENTORING Q&A | PHYSIOLOGY IN THE FIELD

Working Off-site

How to do great work outside the lab.

Each issue, we'll ask a trainee to pose their career questions to an established investigator and mentor. Here, Katherine Weiss, a third-year environmental life sciences doctoral student at Arizona State University, asks for tips to optimize experiments and time spent conducting field work. Comparative physiologist Karen Sweazea, PhD, associate professor in the College of Health Solutions and School of Life Sciences at Arizona State University, shares strategies for overcoming environmental challenges, handling specimens and building a skill set that will support scientists that plan to work across disciplines.

Above: Illustration by Kagan McLeod; far left: iStockphoto

Q: Are there any key environmental variables that you would recommend always measuring at a field site when conducting comparative physiological fieldwork? If not, what is the thought process you undergo when deciding which environmental variables should be measured for a given field study?
A: I would recommend measuring any variable that could potentially impact the physiology of your study organism. Dr. Hans Selye, credited as the father of stress research, defined stress as the "nonspecific response of the body to any demand." That being said, the specific environmental variables that I would recommend measuring depend on the type of field site you are using, such as desert, forest, urban, etc. In my own research, I care about how potential stressors such as temperature and diet impact physiology. This could include access to food and water resources, as well as the quality of those resources. In an urban environment, factors such as light, noise and air pollution may additionally alter the physiology of your research organisms. Another important consideration when planning field research is to decide on the time of day and season to conduct measurements as many physiological variables fluctuate depending on when they are measured.

Q: Do you have recommendations for how to easily preserve, store and transport samples from the field to the lab (e.g., fecal, blood or tissue samples)?
A: Methods for transporting samples depend on the stability of what you are interested in measuring as well as how far you need to travel. For example, if I am only transporting samples a short distance (e.g., one or two miles), I may choose to simply transport samples on ice. For longer distances or measuring factors that decay quickly, I would snap-freeze samples in either a transport vessel containing liquid nitrogen or in a cooler with dry ice. Transporting blood can be tricky as we typically need to separate the plasma from the formed elements prior to freezing. We do that in the field using a car adapter to run a small centrifuge, or we simply bring the samples back to the lab on ice for processing.

"Collaborating with a comparative physiologist will also help you to identify which physiological variables are meaningful in a way that could alter the health, reproductive success or longevity of the organism."

Q: As a wildlife ecologist interested in using comparative physiological methods to identify how environments shape ecological communities, what skills do you think are needed to properly answer questions across these two disciplines?
A: Good collaboration and reading skills! It will be important to read up on what other researchers have observed with respect to how specific environmental variables may impact physiological outcomes. Collaborating with a comparative physiologist will also help you to identify which physiological variables are meaningful in a way that could alter the health, reproductive success or longevity of the organism since different variables can trigger different physiological responses.

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

RESEARCH FIZZ

Islet macrophages are associated with islet vascular remodeling and compensatory hyperinsulinemia during diabetes

This study finds that islet resident macrophages—myeloid cells found in the pancreas—are associated with increased insulin secretion during diabetes.

***American Journal of Physiology–Endocrinology and Metabolism*, December 2019**

https://doi.org/10.1152/ajpendo.00248.2019

STATS & FACTS

One-third

The estimated portion of the U.S. population affected by chronic pain

National Institute of Drug Abuse

RESEARCH FIZZ

Capillary blood tests may overestimate ketosis: Triangulation between three different measures of beta-hydroxybutyrate

This paper looks at three methods used to detect changes in ketosis, highlighting the importance of considering each method when managing ketoacidosis, as some tests may overestimate symptoms.

***American Journal of Physiology–Endocrinology and Metabolism*, December 2019**

www.physiology.org/doi/abs/10.1152/ajpendo.00454.2019

POLICY IQ | SCIENCE FUNDING

Science Agencies See Increases in FY 2020 Budgets

On December 20, 2019, President Trump signed into law two packages of appropriations legislation to fund the federal government for the remainder of fiscal year (FY) 2020, which began on October 1, 2019. Congress rejected the Trump Administration's budget proposal to slash federal funding for scientific research. Instead, the legislation included additional resources for the federal research programs at the National Institutes of Health (NIH), National Science Foundation (NSF), the Medical and Prosthetic Research Program at Veterans Affairs (VA) and NASA.

iStockphoto

NIH

The NIH budget was increased by $2.6 billion (7 percent) in FY 2020, for a total budget of $41.7 billion. This was the fifth year in a row that NIH received an increase of at least $2 billion over the previous year. The total budget includes $492 million to fund programs initiated under the 21st Century Cures Act. Each institute and center will receive an increase of at least 3.3 percent over FY 2019.

The explanatory report accompanying the funding bill directed NIH to submit quarterly reports updating the status of investigations into foreign threats to U.S. research infrastructure. The report also encouraged NIH to improve the security of U.S. intellectual property, specifically by improving the security of peer review and systems for identifying investigators who receive foreign funding. With respect to efforts to combat sexual harassment in the sciences, the report directed NIH to require institutions to notify the agency when key personnel changes are made due to sexual harassment and called on the agency to implement measures that address harassment with the same level of attention given to research misconduct.

POLICY IQ | NOVEL TECHNOLOGY AND RESEARCH

NIH Launches Advisory Panel on Emerging Biotechnologies

To meet the needs of a rapidly evolving biomedical research landscape, the National Institutes of Health (NIH) has formed a new advisory panel called the Novel and Exceptional Technology and Research Advisory Committee (NExTRAC). The committee is charged with making recommendations to address scientific, safety, ethical and social concerns related to emerging biotechnologies such as gene editing, artificial intelligence, synthetic biology and gene-drive–modified organisms.

Beginning in 2018, NIH and the U.S. Food and Drug Administration undertook efforts to streamline the oversight of gene therapy. As part of that process, NIH revised its guidelines for research involving recombinant or synthetic nucleic acid molecules and refocused its Recombinant DNA Advisory Committee (RAC) to become what is now NExTRAC.

During the December 2019 inaugural meeting of NExTRAC, its members reviewed what could be learned from previous efforts to provide oversight of new technologies. They also discussed what factors should be used to identify emerging biotechnologies, how to anticipate new applications of those technologies and how to determine when a biotechnology has fully "emerged." In addition, they discussed ways to involve various stakeholders, including the public, in efforts to evaluate and provide oversight of these technologies.

NIH Director Francis S. Collins, MD, PhD, gave the

NSF
NSF's budget was increased by $203 million (2.5 percent) for a total budget of $8.28 billion. The research and related activities account, which includes the Biological Sciences Directorate, was increased by 3.4 percent. Of note is a directive given to the White House Office of Science and Technology Policy to "incorporate and apply" the findings of a recent study—conducted by the independent science advisory group JASON—on foreign threats to U.S. research. That study called for protecting the merit review system while helping institutions achieve an appropriate balance between security and openness in research.

VA
The VA budget for medical and prosthetic research was increased by $21 million (2.7 percent), for a total budget of $800 million. The accompanying report outlined a number of priorities, including longitudinal research on brain conditions. The report also called for the secretary of the VA to ensure adequate funding for research to help veterans who have experienced toxic exposures and for prosthetic research specifically for female veterans.

NASA
The overall NASA budget was increased by $1.1 billion (5.3 percent), for a total budget of $22.6 billion. Within the NASA budget, the exploration technology budget was increased by 18.7 percent, but funding for the Human Research Program to support safe and productive human space travel will hold steady at $140 million.

committee its initial charge and asked it to form two working groups. The first working group was charged with developing a framework to assess potential applications and research-associated issues with new biotechnologies. This working group is expected to make a report in the summer or fall of 2020.

The second working group will address how NIH should move forward with research involving gene-drive–modified organisms. The group will assess whether existing biosafety guidance for contained laboratory research is adequate. It will also consider under what conditions NIH might support research involving the field release of gene-drive–modified organisms. To support this working group, NIH will convene a workshop on gene drives in the summer or fall of 2020. This working group is expected to present its draft report in late 2020 or early 2021.

PUBLISH WITH POLISH | BUILD A BETTER RESEARCH PAPER

Reporting Research to Your Funder

Receiving research funding includes responsibilities beyond providing grant updates to your funder. One such important responsibility is the public availability of articles required by funding agencies such as the National Institutes of Health, the Wellcome Trust or the Howard Hughes Medical Institute. Many funders stipulate article deposit to PubMed Central (PMC). As an official PMC partner, APS delivers final published content on behalf of its authors, reducing their burden.

Within the text of your article, you should acknowledge the funding agency and grant number(s) that supported your research as well as the complete institutional affiliations of all authors. This allows us to recognize extra- and intramural funders that require some form of public access. For example, peer-reviewed research developed at the U.S. Centers for Disease Control and Prevention must be made publicly available. (Visit **www.bit.ly/FedPubAccessPlans** for a complete listing of U.S. government agencies' public access plans.) By including all funding and affiliation information in your article, you can be assured your article will be properly marked for delivery to PMC.

All articles on APS journal websites become freely available after 12 months. If your funder requires immediate access or an embargo shorter than 12 months, you can participate in APS' open access (AuthorChoice) program. Choosing AuthorChoice enables your article to be publicly accessible both on the journal site and in PMC immediately upon receipt of payment (see **www.physiology.org/authorchoice**). AuthorChoice provides a CC-BY 4.0 license (APS retains copyright), allowing reuse and distribution without requesting permission from APS as long as the original work is cited.

Finally, you will need to notify your funder that your article was deposited to PMC. Following article delivery to and processing by PMC, a PMCID reference number will be visible in the PubMed abstract view page, beneath the abstract. Use this number to report PMC deposit to your funder.

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

RESEARCH FIZZ

Sodium, hypertension and the gut: Does the gut microbiota go salty?

This review explores gut microbiota activity in hypertension and the influence of a high-sodium diet on the immune system, bacterial metabolites and the body's circadian clock.

***American Journal of Physiology–Heart and Circulatory Physiology*, December 2019**

https://doi.org/10.1152/ajpheart.00312.2019

STATS & FACTS

29,247

The number of R01-equivalent grants awarded by the National Institutes of Health in 2018

Federation of American Societies for Experimental Biology

STATS & FACTS

21.7%

The success rate for R01-equivalent grants awarded by the National Institutes of Health in 2018

Federation of American Societies for Experimental Biology

UNDER THE MICROSCOPE

Rapid Fire Q&A

Bill Yates, PhD, FAPS, shares what inspired him to become a scientist, what he loves about his job and the interesting model organism he would be.

Q: Ever had a "eureka" moment? Tell us about it in 10 words or less.
A: Finding a paper from Don Reis' group that changed my career.

Q: What inspired you to become a scientist?
A: I started college as a pre-med student and found my way to a laboratory as part of my premedical experience. I found I was truly comfortable there, and I have remained in science ever since.

Q: "Old school" technique you're most proud of mastering?
A: Learning how to record single-unit activity from brainstem neurons.

Yates sipping champagne in Santiago, Chile, over the December 2019 holidays.

Q: Items on your lab bench that you are/were most possessive of?
A: The lab computer. We record massive data files, and I am very particular about how they are archived.

Q: If you could meet any scientist (living or dead) who would it be and why?
A: Joseph Erlanger, the "father" of neurophysiology and the catalyst for the launch of the *Journal of Neurophysiology* in 1938.

Q: If you were a model organism, which model organism would you be?
A: A marmoset. Rodents (particularly mice) have been the mainstay, and unfortunately a focus on rodents may have led us down many wrong paths. Marmosets allow genetic manipulation (like mice) and have a nervous system much more like humans.

Q: Briefly, what do you wish the general public understood about science or research?
A: How slow it is to move forward—science takes time to do right.

Q: Favorite book about science (fiction or non-fiction)?
A: "A Brief History of Time" by Stephen Hawkins.

Q: Most influential scientist on your career?
A: Donald Reis. His work related to vestibulo-sympathetic interactions jump-started my career.

Q: Favorite science-related TV show (fictional or factual)?
A: "Star Trek," particularly "Star Trek: The Next Generation."

Top left: iStockphoto

Yates ready to explore Chile on his latest trip.

Q: Biggest misconception about physiologists ... in five words?
A: Most are not called physiologists.

Q: The scientific discovery or invention (made by someone else) that you wish you had made?
A: Unravelling synaptic transmission (Henry Dale's work).

Q: Biggest misconception about physiologists ... in five words?
A: Most are not called physiologists.

Q: Favorite way to spend a free hour?
A: I like to spend an hour at the end of the day reviewing the papers that have come in for the *Journal of Neurophysiology* to get a broad perspective on neuroscience.

Q: Most valuable quality in a colleague?
A: Loyalty and reliability.

Q: Favorite part of your job?
A: Teaching.

Q: Notable scientists you follow on Twitter?
A: I tend to follow groups more than people: @ncm_soc, @TrendsNeuro, @Brain_Facts_org, @SfNtweets are good ones.

Q: Title you'd use on your autobiography?
A: "Tenacious."

Q: One thing every researcher/scientist should try at least once in their life?
A: Every scientist needs to learn how to teach a full course and teach it well.

Q: Favorite TV show, movie series or podcast to binge-watch/listen?
A: One of my favorites is "The Crown" on Netflix.

Q: Go-to snacks that get you through long days in the lab or classroom?
A: My New Year's resolution was to avoid snacks!

Q: City, suburb, country?
A: I haven't found it yet. I have lived in Florida, New York City and Pittsburgh. All have strengths and weaknesses. I am looking for a perfect retirement spot and actually am thinking about South America!

Q: The question we didn't ask that we should have?
A: "What do you do all day?" I am fortunate to have a job that allows many activities, including teaching, administration and research. There is a push in academia to do one of these and not the others, but I think there is strength in an active researcher also engaging in administration and education. The insights from these activities are mutually beneficial.

Bill Yates, PhD, FAPS, is a professor of otolaryngology and neuroscience and clinical and translational science at the University of Pittsburgh, where he also serves as co-director of the Office of Research Protections and vice chair of the Medical School Curriculum Committee. He is the editor-in-chief of the *Journal of Neurophysiology*.

STATS & FACTS

303,000

The estimated number of people supported directly by the National Science Foundation in fiscal year 2019

National Science Foundation

STATS & FACTS

33%

The overall fiscal year 2019 funding rate for competitively reviewed grant applications to the National Science Foundation Directorate for Biological Sciences

National Science Foundation

RESEARCH FIZZ

Low-calorie sweeteners cause only limited metabolic effects in mice

Research in mice suggests that low-calorie sweeteners cause only modest changes in blood sugar, insulin levels, insulin sensitivity and weight gain, as compared to those induced by sugar.

***American Journal of Physiology–Regulatory, Integrative and Comparative Physiology*, January 2020**

https://doi.org/10.1152/ajpregu.00245.2019

Bottom right: iStockphoto

Race Against Extinction

Terrie Williams' work with big animals has had a lasting impact on conservation efforts.

BY STARRE VARTAN

Photograph by Eric Millette

Williams at the Long Marine Lab at UCSC

How do you get a polar bear to walk on a treadmill? That's a very real problem Terrie Williams, PhD, and her graduate student solved in 2018. Turns out turkey baby food is the trick—and it helps that bears are one of the easier animals to train: "They are so food-motivated," says Williams, who has studied a variety of apex predators, from circumspect wolves, to easily bored killer whales, to flighty dolphins. The toughest animals she's worked with? African lions. "They are the only animals we have had that have torn everything apart on the treadmill—ripped off the tread, created belt problems," she says. Because after all, "they're cats."

Williams works with Primo the dolphin at her lab at Long Marine Laboratory at UCSC. "Tail walks" like this are used in comparative studies of power production by swimmers, divers and running mammals at the lab.

Above: David Williams. NMFS permit 13602

Williams puts animals on treadmills (or in a swimming/aquatic version for marine mammals) because, despite the beloved status of most of these creatures, scientists don't know enough about how their bodies work. In many cases, she doesn't even have the basics: "I don't know the heart rates for 90 percent of the animals I work with," she says. "It's not that the science for these animals is wrong; it's that there is no science for us to base conservation plans on."

GETTING ANIMAL PHYSIOLOGY RIGHT

Getting that information is one part of her work as a professor of both animal physiology and exercise physiology at the University of California, Santa Cruz (UCSC). It's also integral to the work she does as head of the ICE (Integrative Carnivore EcoPhysiology) Lab at UCSC, which, according to the lab's website, investigates the "energetic, thermal, cardiovascular, neural and biomechanical biology of human athletes and apex predators, including African lions, pumas, tropical dolphins and seals, sea otters, and polar-living wolves, whales, bears and seals."

Understanding these animals' physiological differences is of life-and-death importance for their survival. For example, Williams points to the work she's done on understanding different animals' metabolic rates, which scientists like her are just beginning to map out. "For many wild carnivores, the resting metabolic rates are higher by two times what you'd predict off a Kleiber scale," she says, referring to the 1930s allometric regression that predicts metabolic rate based on body size.

Before they knew that there could be such variability, researchers often had to develop conservation models where little or no data—or worse, incorrect data—were available. "If you get the basic metabolism wrong and you then multiply that by the population of predatory animals, your predictive models for how much prey they need to eat to survive can be grossly underestimated—a problem if you are trying to reintroduce large carnivores into a new habitat."

These are the kinds of difficulties wildlife managers have to face all of the time. From lions in Africa to wolves and bears in the U.S., "we must get these numbers right to avoid human-animal conflicts. … We're trying to catch up on the science before the animals lose. And they are losing quickly," Williams says. "The only hope we have of preserving them will be to get the science right."

AN ANIMAL FOCUS

Williams' current work is an extension of her interests since childhood. As a kid, she spent hours traipsing through the oak forests near her parochial school in New Jersey. And, despite her teachers' admonishments, she kept returning to learn more about the animals she found there. Over time, her observations allowed her to "perceive the nearly invisible body and eye movements comprising animal language and predict an animal's next move," she writes in her 2012 book, "The Odyssey of

"If you get the basic metabolism wrong and you then multiply that by the population of predatory animals, your predictive models for how much prey they need to eat to survive can be grossly underestimated—a problem if you are trying to reintroduce large carnivores into a new habitat."

KP2: An Orphan Seal and a Marine Biologist's Fight to Save a Species."

Animals weren't her only inspiration. She says growing up in the 1970s during the rise of the women's liberation movement might be her "biggest influence of all. Suddenly, young girls were being taught that they could be anything they wanted to be growing up." Williams wanted to be a scientist and wildlife explorer, which propelled her to study science.

It was at Rutgers New Jersey Medical School that Williams decided to pursue physiology over her other passionate interest, medical illustration. She finished there with a PhD in exercise and environmental physiology. Then, she says, "I was the longest postdoc in the world, literally traveling the world for 15 years."

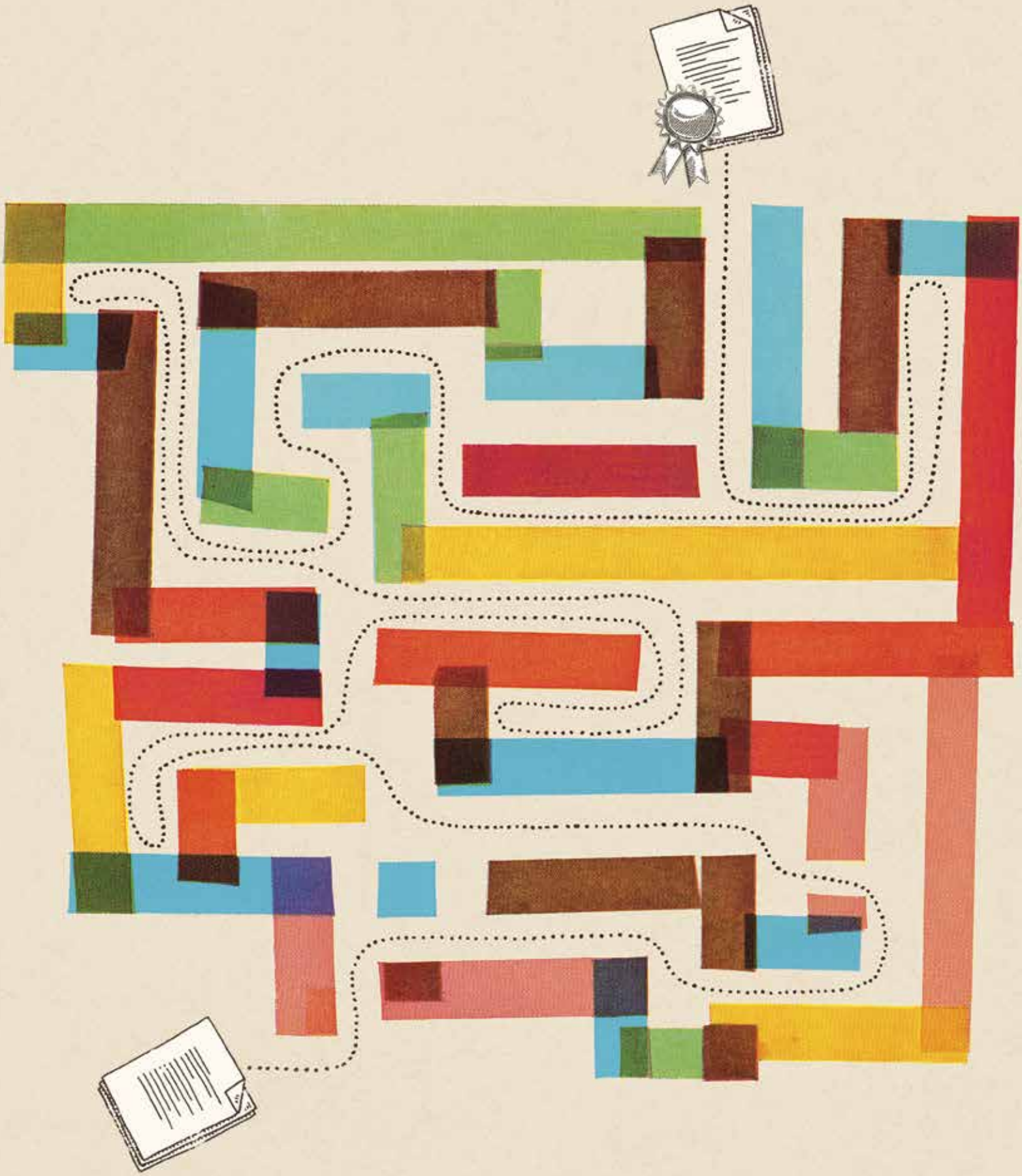
She studied seals in the Antarctic, then moved from San Diego to Alaska to work on the Exxon Valdez oil spill where she was in charge of the Valdez sea otter rehab program. She helped clean off oil-soaked otters but also "collected tissues and necropsy samples to put together a unique database on how crude oil affects these animals" that's still used today. From there, Williams was off to Hawaii to work for the U.S. Navy studying dolphin physiology, then to Washington, D.C., to the Office of Naval Research to help fund marine mammal research programs. Finally, she landed at UCSC, to teach and continue her research into large mammal physiology.

Williams says the winding road she took is one of the reasons she ended up where she is today. "People said I'd never get a job. But in the end I had so many stories to tell and experiences to share with students, it was actually easier than I thought to land an academic position," she says.

"We are in a race against extinction, especially for large animals, so I'm feeling under immense pressure to work quickly these days," she says. "The good news is if I can continue to convince people that funding this type of big science is worthwhile, then we will have total freedom and total imagination to use our science to solve these problems across the world. That is our simple goal."

Left: Williams—with Weddell seal 54 on the sea ice of McMurdo Sound, Antarctica—has studied the foraging and navigation capabilities of Weddell seals diving below the sea ice. Above: Williams with an adult African lion that was tagged in Kenya. During the lion's 20-minute sedation period, Williams and colleagues assess the health and measure the body mass and physical dimensions of the lion. The cat is fitted with a tracking collar that enables the team to monitor behavior and movements for over a year, providing data that is used to prevent human-lion conflicts.

Bottom left: A. Turner, NMFS permi 18691; right: courtesy of Terrie Williams, PhD



INSIDE GRANT FUNDING

Program officers and study section reviewers share their tips for securing research dollars.

BY ALLA KATSNELSON

For many researchers, obtaining grants from a federal research agency such as the National Institutes of Health (NIH) or the National Science Foundation (NSF) is a key step in establishing and sustaining their career. But whether you're trying to pin down which type of NIH grant from the agency's alphabet soup of funding streams to apply for, searching out the study group that best lines up with your research, or figuring out what exactly constitutes a specific aim, the process can be difficult to navigate.

"We really try to make the peer review process transparent, but there are so many aspects involved and so many nuances that it's difficult to communicate all the details," says Kristin Kramer, PhD, director of communications and outreach at NIH's Center for Scientific Review (CSR), which oversees grant reviewing at the agency.

Facing page: CSA Images

Knowing more about how the process works won't guarantee you the grant, but it will arm you with tools for strengthening your application. Here are some key points to keep in mind.

UNDERSTAND AGENCY DIFFERENCES

NIH and NSF, the agencies that most physiologists apply to for funding, differ slightly in the research they fund. NIH funds everything from basic to clinical projects that have a biomedical relevance. NSF's interests hit a different sweet spot. "We are interested in really mechanistic questions in physiology," says Kathryn Dickson, PhD, program director at NSF's Physiological Mechanisms and Biomechanics program, which funds many of that agency's physiology-related grants. "One thing we tell PIs (principal investigators) is if your research question is biomedically motivated, then it is really appropriate for NIH, not NSF."

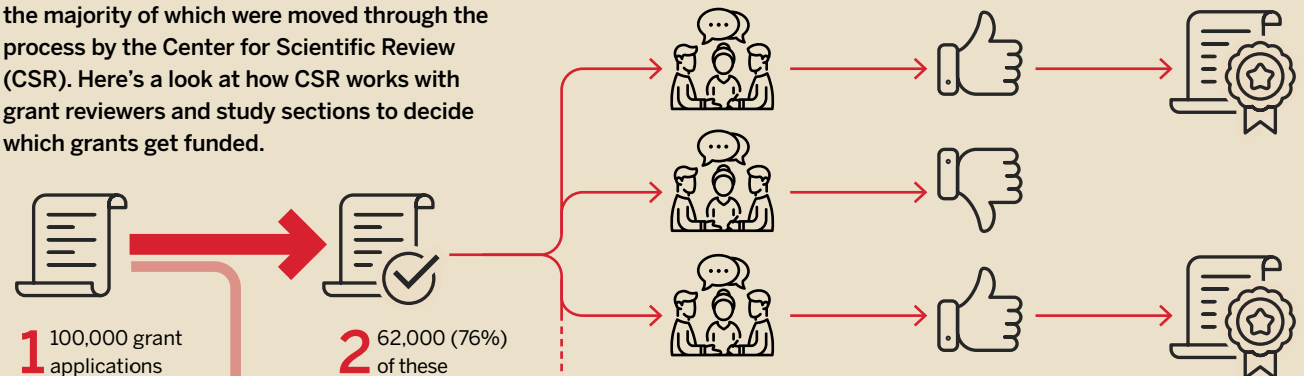
The two agencies might fund different aspects of a single project. "In part it's how researchers frame it," Dickson says. "A lot of medically related physiology can be framed as a basic biology question." For example, a project that uses an animal model to investigate a muscle disorder would be up NIH's alley, but one that probes how that work points to a needed revision in researchers' understanding of muscle physiology as a whole would be more aligned with NSF.

KNOW THE PROCESS

Most NIH grant applications begin their journey through the review process at CSR, which last year reviewed 62,000 grant applications—76 percent of all the applications NIH received. Each grant is assigned to a study section based on the topic, and three reviewers in the study section assess it and assign a preliminary score. Based on that score, about half the applications in each study section are selected for a discussion by the full set of the section's reviewers, which takes place over a couple days in a proverbial windowless room. After the application has been discussed and receives a score, and often a percentile ranking, the program officer at the relevant institute advises that institute—based on the institute's

The Journey of an NIH Grant Application

The National Institutes of Health (NIH) received more than 100,000 grant applications in 2019, the majority of which were moved through the process by the Center for Scientific Review (CSR). Here's a look at how CSR works with grant reviewers and study sections to decide which grants get funded.



1 100,000 grant applications in 2019 received by NIH.

24% of applications are reviewed outside the CSR system.

2 62,000 (76%) of these applications go to CSR.

3 CSR assigns the application to a study section at an NIH funding institute based on topic. Study sections assign each application a score based on five criteria:

1. Significance
2. Investigator
3. Innovation
4. Approach
5. Environment

4 Program officers at each institute then advise the institute on which projects should be funded.

5 Grant is awarded (or not).

"We are here to help. We realize it's complicated and confusing, and there are a lot of mechanisms and funding opportunities. The last thing you want to do is put all that time and effort into an application to find out that it doesn't even fit the institute's FOAs."

payline (the percentage cut-off for funding) and other criteria—on which projects should be funded.

Individual institutes within NIH also have their own divisions for grant review, which evaluate grants that are specific to the institute—for example, those submitted through a request for applications (RFA) on a narrow topic. Institutes also have the discretion to review some types of grants internally. For example, the Eunice Kennedy Shriver National Institute of Child Health and Human Development reviews a category of small grants, RO3s, as well as mentored grants for senior postdocs, called K99s, in-house, explains Stuart Moss, PhD, a program director at that institute who oversees male reproductive health.

Rebecca Roof, PhD, a program director in the Division of Translational Research at the National Institute of Neurological Disorders and Stroke (NINDS), explains that NINDS reviews applications for specialized programs, such as the translational program she manages, in this way. Just as CSR does, the institute assembles panels of peer reviewers to assess the applications. "Then, we will look closely at the peer review comments and make recommendations based on scientific and programmatic merit," she says.

NSF has a generally similar process—review by both external experts and a panel, followed by an internal decision—except that applications go through different agency programs rather than through different study sections. Dickson notes, though, that NSF doesn't use paylines, which gives program officers more influence in recommending whether a grant should be funded.

GET IN TOUCH

"When I was in academia, I was typically reluctant to call my program director—they were some mysterious person that sits at NIH," Moss says. Now, as a program officer, he strongly encourages such communication—early and often.

CSR's Kramer agrees: "If PIs reach out to program staff in advance, they can get some guidance to shape their proposal and to make sure it fits within the areas of interest for institutes that might fund them," she says.

Educate Yourself on the Grant Process

Early Career Reviewer Program
https://public.csr.nih.gov/ForReviewers/BecomeAReviewer/ECR

NIH RePORTER
Get a sense of similar projects and find program officers.
https://projectreporter.nih.gov/reporter.cfm

Grants.gov
Identify funding opportunities relevant to your work.

All About Grants podcast
Gain insight on the process.
https://grants.nih.gov/news/virtual-learning/podcasts.htm

Reviewer Guidelines and Training Videos
Learn how reviewers assess applications.
https://public.csr.nih.gov/ForReviewers/GuidelinesAndTemplates
https://public.csr.nih.gov/NewsAndPolicy/PeerReviewVideos
https://public.csr.nih.gov/ForReviewers/MeetingOverview/NewChairOrientation2019

CSR on Twitter
Ask questions and give your own feedback on the process.
www.twitter.com/CSRpeerreview

"When I was in academia, I was typically reluctant to call my program director—they were some mysterious person that sits at NIH," Moss says. Now, as a program officer, he strongly encourages such communication—early and often.

Moss often asks researchers who contact him to send a rough draft of their specific aims so he can offer suggestions on what—or what not—to emphasize and advise them on the most appropriate funding mechanism for their project.

"We are here to help. We realize it's complicated and confusing and there are a lot of mechanisms and funding opportunities," Roof says. "The last thing you want to do is put all that time and effort into an application to find out that it doesn't even fit the institute's FOAs (funding opportunity announcements)."

One way to find an NIH program officer by topic is to paste an abstract or other descriptive text from your work into the "matchmaker" tab at NIH RePORTER, an online database of the agency's published grants. Or, ask NIH-funded colleagues who do similar work for a name. If the first program officer you get to isn't quite right, that officer will usually pass you on to someone better aligned.

The same advice holds true for NSF: Search the agency's website for the program officer in the division that sounds most appropriate and get in touch. Researchers often think they fit the description for one division, but talking through their project reveals a better path, Dickson says. "Matching the project to the program is a big first step."

HELP YOUR APPLICATION SPEAK FOR ITSELF

An NIH study section might consist of about 30 reviewers, each of whom individually assesses up to a dozen applications. Only about half—those with the highest initial scores—get an airing at the meeting, and those that do will be discussed for perhaps 15 minutes, says Laura McCabe, PhD, a physiologist studying bone health at Michigan State University who serves as a reviewer for NIH. Clear descriptions of your approach, your reasoning and how you are addressing biological variables help reviewers highlight the grant's strengths and argue for your project, she says. She also suggests, where appropriate, including a graphical model that depicts your hypothesis and how you plan to test it. "It's another way to lay your ideas out," she says.

"Reviewers will have expertise in your area, but they don't think about that particular topic 24/7," Moss says. "They want to be taken by the hand

Grant Funding Tips from APS' Lead Scientist

APS Chief Science Officer Dennis Brown, PhD, FAPS, has secured dozens of grants during his career. Here, he shares his top tips for getting your research funded.

1. Shoot for an NIH RO1. R21s take the same amount of effort to obtain but only last for two years.
2. Explain *why* your research is worth doing in the Specific Aims section. Details of methods can come later. Clearly state the knowledge gap(s) that your work will fill in this important section.
3. Write a long two- to three-page section highlighting the Significance and Innovation of your work (this should be intermingled with "Background" information), even at the expense of a shorter Approach section; these are major scoring parameters. Use phrases that can be cut and pasted by reviewers in their comments.
4. Enumerate expected results, address alternative approaches and discuss caveats in a paragraph at the end of each major Approach section of the application.
5. Write a grant *after* you have published an important paper in the same area so the reviewers can appreciate your expertise.

and led down the path on which the PI wants to go." In that respect, the Specific Aims page, where researchers lay out the reasoning behind their project, "is absolutely critical," Moss says. "If you've lost the reviewers in the Specific Aims page, you've lost them for the next 12 pages."

Achieving the clarity and the right level of detail that doesn't get into the weeds isn't easy. McCabe recommends making sure to build in time to ask colleagues who have successfully navigated the process to provide feedback on your application. And, of course, think about format as well as content, McCabe says. Break up the page with figures and white space so that reviewers don't have to wade through a solid page of tiny text.

One common problem in grant applications is what reviewers call a "house of cards," Kramer says. Of course, your project's aims should follow logically from one to the next, but one generally shouldn't be entirely dependent on the results of another because if one aim fails, the entire grant falls apart. Along the same lines, Kramer adds, "some truly thoughtful consideration of alternative outcomes and potential pitfalls" strengthens the application.

In their training, Kramer says, NIH reviewers are sometimes encouraged to think about the five review criteria (significance, investigator, innovation, approach, environment) by considering two questions: Should a researcher do a particular project? Can they do it? The first question addresses the significance and innovation of the research and what it would bring to the field or beyond, and the second addresses whether the approach is rigorous and if the researcher has the expertise and resources for the project to be a success. The application should answer both questions, she says.

THINK LIKE A REVIEWER

NIH posts extensive materials, such as videos and guideline documents, that are used for training reviewers. Exploring exactly how reviewers are asked to assess projects can help you focus your own applications, Kramer says.

NIH also invites early-career investigators to apply to the Early Career Reviewer Program, which allows them to serve as reviewers and get a taste of the process from the inside. "The feedback we've gotten is that people find it invaluable in crafting their own grant," Kramer says.

Cravings, Control and Consequences

Research on addiction is unearthing startling revelations.

BY MAUREEN SALAMON

Addiction researchers have been eyeing the snowballing trend of declining American life expectancy—driven largely by drug overdoses and alcoholism—long enough to share terminology for the phenomenon.

"We call it 'deaths of despair,' with the idea that it's mostly due to underlying sociological factors related to the despair younger populations are feeling and coinciding with the availability of drugs to such an extent that they accidently or otherwise end up overdosing," says Elyssa Margolis, PhD, who holds an endowed chair in genetics of addiction in neurology at University of California-San Francisco (UCSF) Weill Institute for Neurosciences.

The statistics are sobering. A November 2019 study in *JAMA* found the chances of dying of any cause before age 65 have climbed, with overall life expectancy dropping over the past three years after six decades of only gains. Leading contributors include a rise in deaths among working-age adults ages 25 to 64 due to overdoses and alcohol abuse, among other causes. Meanwhile, a January 2020 study in *Alcoholism: Clinical & Experimental Research* showed alcohol-related deaths in the U.S. are at an all-time high, doubling since 1999.

Photo illustration by Brad Latham

The chances of dying of any cause before age 65 have climbed, with overall life expectancy dropping over the past three years after six decades of only gains. Leading contributors include a rise in deaths among working-age adults ages 25 to 64 due to overdoses and alcohol abuse.

These alarming developments also underscore the vital need for physiology research into how and why the brain and body react as they do to addictive substances such as drugs, alcohol or even food. But the disconnect between lab science and actual individuals struggling with addiction can be "a tough nut to crack," Margolis notes. "Some of those disconnects can't be surmounted, but it's important for us who are bench researchers to keep that human condition in mind."

Derived from the Latin term for "bound to" or "enslaved by," addiction wraps in three key components: compulsive cravings for a substance, loss of control over its use and continued use despite damaging consequences. The causes of addictive behavior first came to scientists' attention in the 1930s, with researchers typically splitting that focus into a logical timeline of "before"—how cells respond to substances, influencing the development of addiction—and "after"—observing the physiological ramifications of substance abuse on human health. Ideally, experts say, both vantage points will point toward proactive or preventive measures that can help individuals and society avert worst-case scenarios akin to the latest U.S. longevity statistics.

"Both arms of the equation are very important," says Patricia Molina, MD, PhD, FAPS, the Richard Ashman Professor and Chair of the Department of Physiology and director of the Alcohol and Drug Abuse Center of Excellence at Louisiana State University. "One is trying to understand what makes the brain addicted to a drug, and a slew of investigators are focused on that.

"My work focuses on, if someone is using a substance, how that substance interferes with the biological processes critical for health," says Molina, past president of the American Physiological Society. "My focus is understanding what happens beyond the brain."

EVOLVING BELIEFS

Margolis, who studies neural circuits involved in drug reinforcement and seeking, falls squarely into the "before" camp, and her work has generated controversial results. For example, her September 2017 paper in the journal *Neuropharmacology* used a variety of techniques—including animal models, electrophysiology and single gene expression assays—to examine mu and delta opioid brain receptor response to two opiates that supposedly activate the same receptor.

What she found "verged on heretical for the field," Margolis says. "There was no relationship between the neural responses to the two compounds, even though in theory the two compounds were working on the same receptor. If you're doing exactly the same thing and using the same receptors, cells should respond the same way to both drugs.

"This matches up really nicely with behavioral results because this means patients won't develop cross-tolerance," Margolis explains. "I've gotten a lot of pushback in the field because it makes things a lot more complicated. … On the other hand, a lot of effort is now going into designing molecules or doing screens for molecules that have this other property people are referring to as functional selectivity."

Howard Fields, MD, PhD, UCSF professor emeritus of neurology and physiology, also explores the "before" side of addiction research. His more recent research zeroed in on reward pathways in the brain and how the neurotransmitter dopamine—key to the reinforcement of rewarding behaviors—influences motivation and choice.

In a 2014 study in the *Journal of Neuroscience*, Fields, Margolis and colleagues upended the dogma surrounding how dopamine works in the ventral tegmental section of the brain. Much research had established this region as essential to the rewarding and motivational action of opioids.

"What was new about this study was, yes, opioids work on this part of the brain, but they don't work by the disinhibition mechanism everyone believed was true, i.e., that the direct effect of opioids was to inhibit inhibitory neurons and indirectly excite dopamine neurons," Fields says. "We demonstrated that opioids can activate dopamine neurons directly. A lot of people still don't believe it because the dogma was that the mechanism was indirect."

While the study may not have produced concrete steps individuals can take to protect themselves against addiction, Fields is taking a longer view. "Hopefully, the major impact of our work will be to develop a safer opioid people can use for pain management and figure out better treatments for those who are already addicted," he says.

REAL-LIFE RELEVANCE

For some scientists, the decision to devote their careers to addiction research is—at least partially—personal. For Fields, a U.S. Army stint during the Vietnam War exposed him to wounded soldiers with painful nerve injuries, whom he felt compelled to help. For Ole Petersen, CBE, FRS, a professor in the School of Biosciences at Cardiff University in Wales, a hard-drinking father colored his impressions of alcohol and its power.

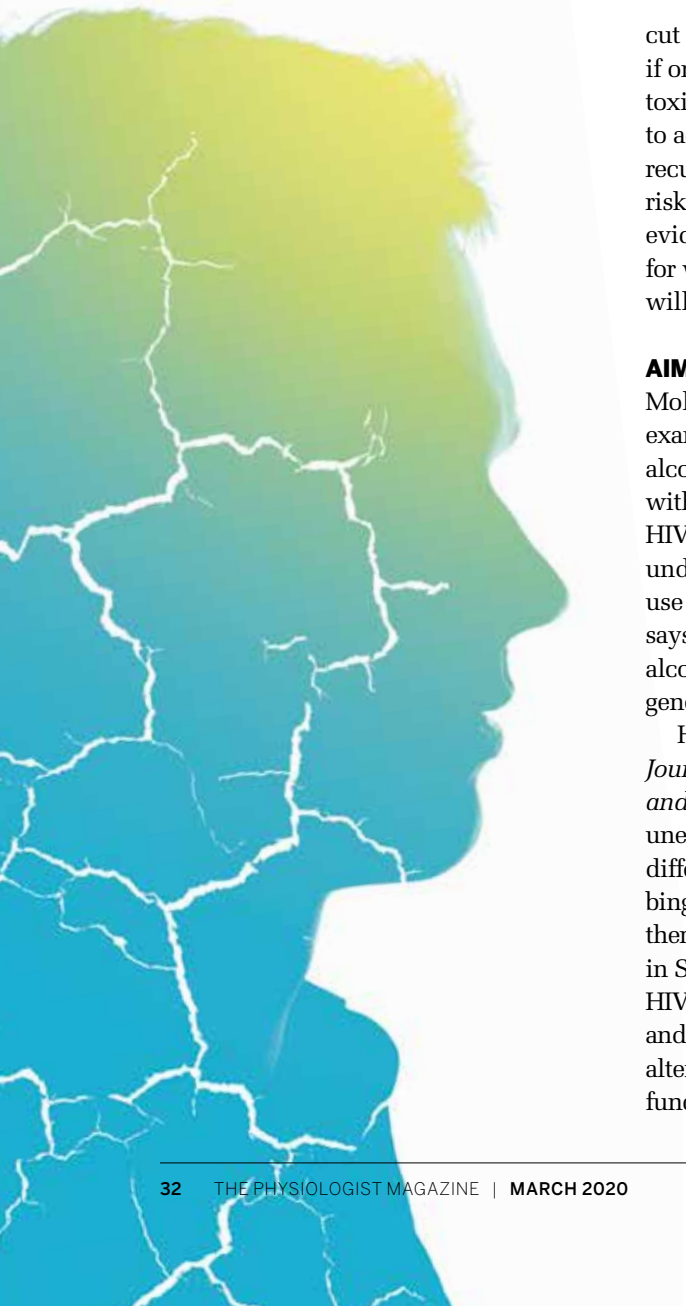
"I decided early on I wasn't going to drink because I didn't want to be like that," says Petersen, also founding editor-in-chief of APS' new journal, *Function*, launching this year. His research concentrates on the function of the exocrine pancreas and pathophysiology of acute pancreatitis, a condition in many cases caused by excess alcohol. To that end, Petersen's body of work veers toward the "after" of substance abuse, though he doesn't strictly consider himself an addiction researcher. "My impression is that the effects of alcohol on the brain may be somewhat less understood than in a relatively simple organ like the pancreas, where we now have a very detailed molecular understanding of how alcohol, in combination with fatty acids, damage the cells," he says.

Lab work may often seem like it takes place far away from those touched by substance abuse, but Petersen contends that understanding the mechanisms of the toxic actions of alcohol on various organs is crucial to both clinicians and the public.

"For physicians, our research helps them speak to patients with more authority, which increases enormously if it's very clearly seen and felt that they understand what's happening," he says. "There are multiple levels of influence outside finding a cure or effective treatment in disease. It's very important to always understand why something works.

Derived from the Latin term for "bound to" or "enslaved by," addiction wraps in three key components: compulsive cravings for a substance, loss of control over its use and continued use despite damaging consequences.

Petersen and Molina agree that society still largely considers heavy drinking acceptable—a notion they say needs to be stamped out as firmly as tobacco use. Here, too, physiology research might prove pivotal.



"When for example, advising to cut alcohol consumption, it helps if one can explain exactly why it's toxic," Petersen adds. "With regard to acute pancreatitis—which, if recurrent, dramatically increases the risk for developing pancreatic cancer—evidence-based preventive measures for what is effectively a lifestyle disease will become increasingly important."

AIMING AT ALCOHOL ABUSE

Molina's body of research, which examines the interaction between alcohol and other drugs of abuse with chronic disease—particularly HIV infection—will ideally lead to understandings that can cut alcohol use in this "very fragile" group, she says. Those with HIV experience alcoholism rates double that of the general population.

Her July 2018 study in the *American Journal of Physiology—Endocrinology and Metabolism* also produced unexpected insights. Examining the differential contribution of chronic binge drinking and antiretroviral therapy to metabolic dysfunction in SIV-infected (a model for human HIV) macaque monkeys, Molina and colleagues observed "significant alterations in muscle and mitochondrial function—the most fundamental energy source for the body"—despite rigorous infection control.

"What was really surprising was the fact that even when you control viral load, drinking has a significant impact on physiology," Molina says. "You would not think that. You would think if the infection were controlled, everything else is going to be OK."

Similarly, she says, someone with a more typical chronic condition such as high blood pressure, diabetes or cardiovascular disease might consider that their alcohol consumption is completely unrelated to their ailment "when that's clearly not the case." Molina hopes future research might reveal the intimate connections between heavy drinking and a host of downstream health effects.

"Alcohol and many other drugs of abuse can impact so many systems that will affect not only the progression of chronic diseases but can also affect responsiveness to treatment or delay how fast you will recover," she says. "Alcohol will impair the way your bone heals after a fracture. Alcohol will maybe aggravate or accelerate the development of diabetes if you have prediabetic syndrome. So I feel that understanding what might be an OK amount of drinking for a healthy individual may not necessarily be an OK amount for someone with a chronic disease."

Petersen and Molina agree that society still largely considers heavy drinking acceptable—a notion they say needs to be stamped out as firmly as tobacco use. Here, too, physiology research might prove pivotal.

"In campaigning against excessive intake of dangerous substances, including alcohol, it may be helpful if you can explain why it's dangerous," Petersen says. "If you know there's a mechanism and you can explain exactly why, I think it helps people understand it's a real phenomenon."

DON'T MISS OUT ON YOUR CHANCE TO ATTEND

American Physiological Society (APS) members receive discounts on meeting registration for the Society's annual meeting at Experimental Biology (EB). Register today at **apsebmeeting.org**. Advance registration rates available until **March 13**.

The APS annual meeting is the place to explore the latest cutting-edge science and welcomes everyone with an interest in advancing the latest research. This multidisciplinary meeting features plenary lectures, workshops, symposia, poster presentations, on-site career services and exhibits spotlighting products and services integral to our professional community.

american physiological society

EB Experimental Biology

american physiological society

EB Experimental Biology

SPEAKER SPOTLIGHT

Tang Prize Award — Tony Hunter, PhD

Tony Hunter, from the Salk Institute for Biological Studies, is the British American scientist who discovered tyrosine phosphorylation and that the oncogene Src is a tyrosine kinase. With this discovery, Hunter gave birth to the field of tyrosine kinase inhibitors, which are prototypes of targeted cancer therapies. Its emergence made a milestone of cancer therapy.

APS Nobel Prize Award Lecture — Randy W. Schekman, PhD

During the 1970s, Randy Schekman studied yeast cells with malfunctions in the vesicle transport system. He demonstrated that the malfunctions were due to genetic defects and explained how different genes regulate different aspects of the transports.

APS/ASPET Joint Presidential Symposium Series on Inflammation and Oxidative Stress

Topics include:

- Workshop on CRISPR-Cas and miRNAs in the Study of Drug Metabolism, Cancer and Other Diseases
- Cardiovascular and Renal Inflammation in Health and Disease
- Inflammation and Drug Disposition
- Central Nervous System Inflammation: Pain and Cognition

April 4–7, 2020
San Diego
View more speaker announcements at apsebmeeting.org.

American Physiological Society Annual Meeting at Experimental Biology Product Workshops

Discover the latest technology and lab-enhancing products at APS' annual meeting. Learn more at apsebmeeting.org.

FUJIFILM VisualSonics presents: From "A"rtificial Intelligence, to "Z"ebrafish: A 3-Part Series Exploring the Latest Innovations and Discoveries in Imaging

Sponsored by: FujiFilm VisualSonics
Sunday, April 5, 11:30 a.m.–1 p.m.

Join FUJIFILM VisualSonics for a series of three 20-minute talks and hands-on sessions where we show you how our Vevo Imaging Systems are used in high-impact studies to track stem cells in the myocardium, monitor oxygenation in the brain during stroke and follow the biodistribution of cancer-fighting drugs throughout the body. Learn how AI can be used to analyze your data up to 48 times faster. Come for one session or stay for all three to triple your chances of winning one of three FUJIFILM Instax Cameras.

Understanding the Dynamics of Cellular Activity and the Culture Oxygen Environment

Sponsored by: Baker Ruskinn
Sunday, April 5, 11:30 a.m.–1 p.m.

The Baker Ruskinn and Lucid Scientific lunch and learn is an opportunity to understand the benefits of "physoxic" cell culture and the importance of regulating and monitoring oxygen in cell culture environments. During lunch, we will present our companies' visions for mimicked *in vivo* cell culture solutions, the advantages of cell culture using continuous physiological oxygen, and how to measure oxygen consumption in real time.

Quantitative analysis of neuronal and vascular networks

Sponsored by: MBF Bioscience
Monday, April 6, 11:30 a.m.–1 p.m.

Discover the benefits of using FAIR (finable, accessible, interoperable and reusable) techniques when quantifying scientific image data. Our presenters will introduce MBF Bioscience's suite of software tools for viewing, presenting and analyzing experimental data in diverse anatomical regions. We will provide a practical demonstration of how to use automated image segmentation tools in Neurolucida 360 for qualitative and quantitative analysis by addressing real experimental questions using confocal, light sheet or micro-CT images.

Diverse applications of nanopore technology: protein detection, microRNA screening, and beyond …

Sponsored by: elements SRL
Monday, April 6, 11:30 a.m.–1 p.m.

Nanopores are nanometer-scale apertures through which individual molecules can be translocated and probed electrically. Such sensors have proven to be versatile tools for detection and analysis, with the most prominent example being direct-read nucleic acid sequencing in the Oxford Nanopore platform. However, the value of the approach extends to diverse applications beyond sequencing. In this presentation, we will give a brief introduction to both protein and solid-state nanopores and the factors that are most critical to measurements with them. We will then describe a number of emerging applications that employ the platform and are currently being developed for translational use.

APS Members Elected to the Class of 2019 AAAS Fellows

A tradition since 1874, American Association for the Advancement of Science (AAAS) Fellows are elected by their peers serving on the Council of AAAS and include distinguished scientists and Nobel laureates. The following APS members were elected 2019 Fellows of AAAS. They were recognized for their invaluable contributions to science on February 15.


Biewener


Farber


Moenter


Samuelson


Schultz


Shipley


Yuan

- **Andrew Biewener, PhD**, Charles P. Lyman Professor of Biology, Department of Organismic and Evolutionary Biology, Harvard University Concord Field Station, Bedford, Mass.
- **Steven A. Farber, PhD**, faculty, Department of Embryology, Carnegie Institution for Science, Baltimore
- **Suzanne M. Moenter, PhD**, Fred J. Karsch Collegiate Professor of Physiology and professor of molecular and integrative physiology, obstetrics and gynecology, and internal medicine, University of Michigan
- **Linda C. Samuelson, PhD, FAPS**, APS president-elect; John A. Willams Collegiate Professor of Gastrointestinal Physiology; professor of molecular and integrative physiology, and internal medicine; and interim director, Center for Organogenesis, University of Michigan
- **David J. Schulz, PhD**, professor, Division of Biological Sciences, University of Missouri-Columbia
- **Michael Shipley, PhD**, Donald E. Wilson, MD, MACP Distinguished Professor, Department of Anatomy and Neurobiology, University of Maryland School of Medicine
- **Sarah Y. Yuan, MD, PhD**, professor and chair, Department of Molecular Pharmacology and Physiology, and Deriso Endowed Chair in Cardiovascular Disease, University of South Florida Morsani College of Medicine


Bidwell


Chade

APS Members Recognized for Inventions

The following APS members from the University of Mississippi Medical Center were recognized in November 2019 for inventions and patents developed between January 2018 and June 2019. The innovations represent biomedical applications, including diagnostic techniques for neurodegenerative diseases, heart failure and potential therapies for diabetes and addiction.


Gomez-Sanchez


Gomez-Sanchez


George


Hester

- **Gene L. Bidwell III, PhD**, associate professor, Department of Neurology
- **Alejandro R. Chade, MD, FAHA**, professor, Departments of Physiology and Biophysics, Medicine, and Radiology
- **Celso Gomez-Sanchez, MD**, professor, Department of Pharmacology and Toxicology
- **Elise Gomez-Sanchez, DVM, PhD**, professor, Department of Pharmacology and Toxicology
- **Eric George, PhD**, associate professor, Department of Physiology and Biophysics
- **Robert Hester, PhD, FAPS**, Billy S. Guyton Distinguished Professor and professor of physiology and orthopedic surgery and interim chair, Department of Data Science

Nobel Laureates Named Consulting Editors of *Function*

Nobel laureates **Erwin Neher, FRS**; **Sir Peter Ratcliffe, FRS**; and **Thomas Südhof, FRS**, have been named consulting editors of *Function* (**www.physiology.org/function**), the newest publication in the APS family of journals. "We are delighted that these three esteemed researchers have signed on as *Function* consulting editors. We value their opinions and their intentions to promote and support the journal, as well as advise the editorial team," explained *Function* Editor-in-Chief Ole Petersen, FRS, CBE.

Neher was awarded the Nobel Prize in Physiology or Medicine in 1991. The patch clamp technique he invented can directly record the tiny current that flows through a single ion channel in the cell membrane. Neher's work initiated a new field in the study of cellular and membrane biology, leading to ion channel research across a range of conditions, including diabetes, cardiovascular disease and anxiety disorders. He is a member of the National Academy of Sciences (NAS) and is a director and scientific member at the Max Planck Institute for Biophysical Chemistry in Germany.

Ratcliffe, who has frequently published in APS journals, received the Nobel Prize in Physiology or Medicine in 2019 for discoveries of how cells sense and adapt to oxygen availability. His work may lead to potential new routes to treat a range of diseases, from cancer to chronic anemia. Ratcliffe is director of the Target Discovery Institute at the University of Oxford in the U.K. and is director of clinical research at the Francis Crick Institute in London.

Südhof, a member of NAS, was awarded the Nobel Prize in Physiology or Medicine in 2013 for his discovery of the machinery that regulates vesicle traffic, a major transport system of the cells. Südhof's research on synapses explores their properties,

formation in the brain and their precise signaling as the basis for all information processing by the brain. He is the Avram Goldstein Chair and Professor of Molecular and Cellular Physiology at Stanford University School of Medicine in California.

All three laureates have published in APS journals. To read their research, visit the APS Nobel Laureate collection at **www.physiology.org/nobel-laureates**.

Function Team Member Newgard Named on Web of Science List

Christopher Newgard, PhD, has been named a 2019 highly cited researcher by the Web of Science Group, an information and technology provider for the global scientific research community. Newgard is the W. David and Sarah W. Stedman Distinguished Professor at Duke University in North Carolina and director of the Duke Molecular Physiology Institute and the Sarah W. Stedman Nutrition and Metabolism Center. He is part of the editorial team for *Function*, APS' newest journal, and hosted the inaugural *Function* symposium in January.

Barrett Appointed to National Science Foundation Post

Kim Barrett, PhD, FAPS, has been appointed division director for the Division of Graduate Education in the Directorate for Education and Human Resources at the National Science Foundation. Barrett, a distinguished professor of medicine at the University of California, San Diego, was president of APS in 2013–2014 and is a current member of the APS Women in Physiology Committee.

Thornell Wins Prestigious Cystic Fibrosis Award

Ian Thornell, PhD, a research assistant professor in the Department of Internal Medicine at the University of Iowa, has been named to the Gilead Sciences Research Scholars Program in Cystic Fibrosis. This two-year program supports innovative scientific research that will advance knowledge in the fields of pediatric and adult cystic fibrosis. Thornell's work examines chloride secretion in cells that are directly and indirectly affected by cystic fibrosis.

OPPORTUNITY KNOCKS

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

POSTDOCTORAL FELLOWSHIP
UNIVERSITY OF ILLINOIS COLLEGE OF MEDICINE
The University of Illinois College of Medicine in Chicago invites applications for highly motivated graduating PhD students or postdoctoral fellows with experience in vascular biology, cell signaling and lung biology to apply to our T32 Postdoctoral Training Program.
Read more at www.the-aps.org/uicom.

Kambis and Kar Win Fund It Forward Video Contest

University of Nebraska Medical Center graduate students **Tyler Kambis** and **Sumit Kar** were awarded first place in the graduate division of The Science Coalition's (TSC) inaugural Fund It Forward Student Video Challenge. Winning entries show how "students help advance groundbreaking research at America's universities and are passionate about protecting the essential work happening on their campuses," says TSC President Heather Bené. Kambis and Kar's video highlights how funding from the National Institutes of Health helps scientists develop heart disease treatments for people with type 1 diabetes.

DATES & DEADLINES

AWARDS

Environmental & Exercise Physiology Section Edward F. Adolph Distinguished Lectureship (Deadline: March 1, 2020)
Environmental & Exercise Physiology Section Honor Award (Deadline: March 1, 2020)
Environmental & Exercise Physiology Section Impact Award (Deadline: March 1, 2020)
Julius H. Comroe Jr. Distinguished Lectureship of the Respiration Section (Deadline: March 15, 2020)
Carl Ludwig Distinguished Lecture of the APS Neural Control & Autonomic Regulation Section (Deadline: March 19, 2020)
John F. Perkins Jr. Memorial Award for International Physiologists (Deadline: April 15, 2020)
Solomon A. Berson Distinguished Lectureship of the APS Endocrinology & Metabolism Section (Deadline: May 15, 2020)

More details: www.the-aps.org/awards

CALLS FOR PAPERS

American Journal of Physiology—Endocrinology and Metabolism (March 31, 2020)

- Browning and Beiging of Adipose Tissue—Its Role in the Regulation of Energy Homeostasis and as a Potential Target for Alleviating Metabolic Diseases
- Immunometabolic Cross-talk and Regulation of Endocrine and Metabolic Functions
- Mitochondria Dysfunction in Aging and Metabolic Diseases
- Role of Gut Microbiota, Gut-brain and Gut Liver Axes in Physiological Regulation of Inflammation, Energy Balance and Metabolism

Physiological Genomics (March 31, 2020)

- The Microbiome-human Host Interactions Contributing to Cardiovascular and Inflammatory Disease
- Big Data Integration to Understand Complex Disease
- The Microbiome and Metabolic Health

Physiological Genomics (April 30, 2020)

- Physiological Genomics of Cell States and Their Regulation and Single Cell Genomics

More details: www.physiology.org/calls

CONFERENCES

APS Annual Meeting at Experimental Biology

- Housing deadline: March 6, 2020
- Advance registration deadline: March 13, 2020

More details: http://apsebmeeting.org/eb2020

APS PHYSIOLOGY IN FOCUS CONFERENCES

Institute on Teaching and Learning

- Abstract submission deadline: April 17, 2020
- Award application deadline: April 17, 2020
- Advance registration deadline: May 4, 2020
- New Teacher Workshop registration deadline: May 4, 2020

More details: www.the-aps.org/itl

Heme Oxygenase and Related Enzymes: From Physiology to Therapeutics

- Abstract submission deadline: April 17, 2020
- Award application deadline: April 17, 2020
- Advance registration deadline: May 4, 2020
- Housing deadline: May 28, 2020

More details: www.the-aps.org/hemeox

Integrative Physiology of Exercise

- Abstract submission deadline: August 3, 2020
- Award application deadline: August 3, 2020
- Advance registration deadline: September 30, 2020
- Housing deadline: October 18, 2020

More details: www.the-aps.org/ipe2020

APS PUBLICATIONS

APS Journals Welcome New Editors

THREE NEW EDITORS-IN-CHIEF TAKE THE HELM OF APS JOURNALS IN JULY 2020. HERE'S MORE ABOUT THEM:

Heddwen Brooks, PhD, Incoming Editor-in-Chief of the *American Journal of Physiology—Renal Physiology*

Heddwen Brooks, PhD, is a professor of physiology and past chair of the Graduate Interdisciplinary Program in Physiological Sciences at the University of Arizona. She earned her PhD from Imperial College in London in 1997 and worked as a postdoctoral fellow with Mark Knepper, MD, PhD, at the National Heart, Lung and Blood Institute's Laboratory of Kidney and Electrolyte Metabolism. Brooks is an active APS member, having served on the Joint Program and Education committees, as chair of the Renal Section and as an associate editor for *American Journal of Physiology—Regulatory, Integrative and Comparative Physiology* from 2013 to 2019. She is also a mentor to trainees as part of the APS Writing and Reviewing for Scientific Journals professional skills training course.

Jan-Marino (Nino) Ramirez, PhD, Incoming Editor-in-Chief of the *Journal of Neurophysiology*

Nino Ramirez, PhD, is a professor of neurological surgery, joint professor of pediatrics and adjunct professor in the Department of Pathology and the Department of Physiology and Biophysics at the University of Washington School of Medicine. He is the director of the Center for Integrative Brain Research at the Seattle Children's Research Instititue. Ramirez served as the chair of the APS Hypoxia Interest Group and was awarded the APS Central Nervous System Section's Joseph Erlanger Distinguished Lectureship in 2020. He has been an associate editor for the *Journal of Neurophysiology* since 2014 and was reviewing editor for *eLife* from 2015 to 2019.

Gina L. C. Yosten, PhD, Incoming Editor-in-Chief of the *American Journal of Physiology—Regulatory, Integrative and Comparative Physiology*

Gina Yosten, PhD, received her doctorate in pharmacology and physiology from Saint Louis University (SLU) in 2010, working with her mentor, Willis K. Samson, PhD, FAPS. Following a postdoctoral fellowship at SLU and an APS-sponsored Research Career Enhancement Fellowship at the University of Mississippi with Jane Reckelhoff, PhD, FAPS, Yosten joined the faculty at SLU in 2015. She has been actively involved in APS since she was a graduate student, serving on the Science Policy and Joint Program committees and currently as an associate editor for the *American Journal of Physiology—Regulatory, Integrative and Comparative Physiology*. Yosten is the outgoing chair of the Endocrinology & Metabolism Section and a member of the Section Advisory Committee.

SCIENCE POLICY COMMITTEE

Early Career Advocacy Fellows Announced

The Science Policy Committee is pleased to announce the selection of the 2020 APS Early Career Advocacy Fellows. Congratulations to **Erica Littlejohn, PhD**, a postdoctoral fellow at the University of Texas Health Science Center at San Antonio, and **Cornelia Fanter, PhD**, a postdoctoral fellow at the University of Nevada, Las Vegas. Littlejohn and Fanter join second-year fellows Steven Brooks, PhD, a postdoctoral fellow at the National Institute of Allergy and Infectious Diseases, and Alicia Pate, PhD, an assistant professor at the Saint Louis College of Pharmacy. Fellows work closely with the Committee as they engage in advocacy, building the skills they need to become long-term advocates for scientific research.

SECTION AND CHAPTER NEWS

Schultz Announced as New Chapter Advisory Committee Chair

Harold Schultz, PhD, FAPS, a professor in the Department of Cellular and Integrative Physiology at the University of Nebraska Medical Center in Omaha and a long-time member of APS, was elected as chair of the Chapter Advisory Committee. He began his three-year term on January 1, 2020. In this leadership role, Schultz is responsible for ensuring strong, positive relationships between the Society and its chapters.

An Inclusive View of Health:

Why NSF Matters

BY HANNAH V. CAREY, PHD, FAPS

"Bench to bedside" refers to fundamental research that has the potential to directly benefit human health. It's the ultimate goal of the basic research supported by the National Institutes of Health (NIH) that many APS members conduct. Other APS members and their trainees—including our active community of comparative and evolutionary physiologists—engage in physiological research that is similarly broad in scope, but with less obvious translational implications for human health. This research examines how and why the physiology of various animals functions the way it does, and that allows an animal to thrive in a particular environment. Yet, new knowledge derived from this research can also contribute to better health outcomes.

"NSF plays a crucial role in generating discoveries about our planet and its inhabitants, producing technologies that boost the economy and improving general health and well-being."

Healthy humans require healthy environments, so considerations like the quality of air, water, soil and climate are important. So too are the dynamics of living systems, from organisms to ecosystems. This is because environmental change—especially when it is rapid and unpredictable—can negatively affect an animal's health and fitness, reducing biodiversity and ecosystem services that provide life-sustaining benefits to humans and other organisms. The National Science Foundation (NSF) is the major source of support for research on physiological mechanisms underlying organismal responses to both benign and stressful environments.

NSF plays a crucial role in generating discoveries about our planet and its inhabitants, producing technologies that boost the economy and improving general health and well-being.

However, NSF's budget has not grown in real terms in nearly 20 years. Its fiscal year 2020 budget of $8.28 billion is just 20 percent of the NIH budget. This allocation is insufficient to adequately support NSF's broad portfolio, which includes the physical, geological, social, non-medical biological and computer sciences, engineering, mathematics and STEM education.

Working in concert with scientific societies is one of the most powerful ways for us to speak with a louder voice to help ensure that the agency is funded, at a minimum, to a level that keeps up with inflation.

The APS community is fortunate to have excellent staff in our Government Relations and Science Policy Office who are ready to guide you in advocacy efforts locally and on Capitol Hill (see p. 12 of the January issue of *The Physiologist Magazine*). APS and the Federation of American Societies for Experimental Biology (FASEB) have recently ramped up their advocacy for NSF, including APS' successful NSF-focused Capitol Hill Day in May 2019. FASEB provided new fact sheets that show the value of NSF-funded research for every state. These and other tools for NSF advocacy are available on FASEB's new NSF Matters website at **http://bit.ly/NSFMatters**.

NSF-funded research generates new knowledge that benefits human societies and our planet. Whether researchers target human health directly or indirectly, we all must step up and be strong advocates for NSF's indispensable role in our nation's scientific enterprise.

Hannah V. Carey, PhD, FAPS, is a professor of comparative biosciences and director of the Biotron Laboratory Controlled Environmental Research Center at the University of Wisconsin–Madison. She is a past president of APS and the current president of FASEB.

Illustration by Brett Affrunti

We're spotting physiology in everyday life on the I Spy Physiology blog!

APS member-contributors use physiology to explain how humans and animals function and stay healthy in this public-facing, translational blog. Interested in contributing? Email communications@the-aps.org.

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