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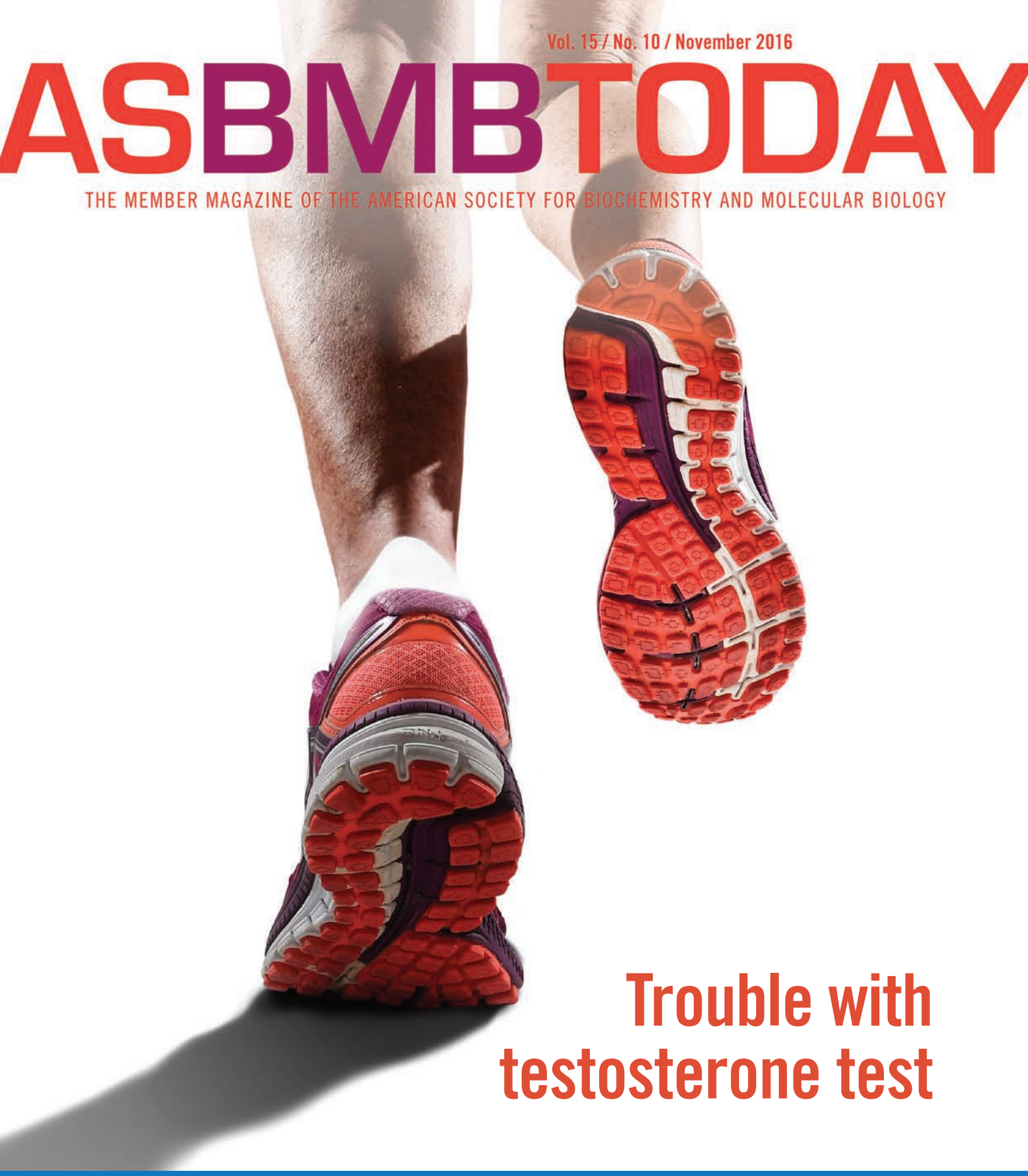
ASBMB TODAY

THE MEMBER MAGAZINE OF THE AMERICAN SOCIETY FOR BIOCHEMISTRY AND MOLECULAR BIOLOGY



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ASBMB '17
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CHICAGO | APRIL 22 – 26

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E1 Melibionic Acid	E2 D-Melibiose	E3 D-Galactose	E4 α-Meth Glactos								
F1 Adonitol	F2 L- Arabinose	F3 D-Arabinose	F4 β-Meth Xylopyra								
G1 Tricarballylic Acid	G2 D,L-Lactic Acid	G3 Methyl D-lactate	G4 Methyl pyruvat								
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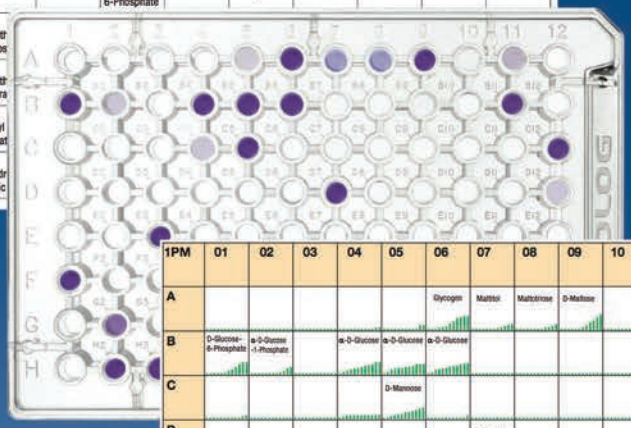

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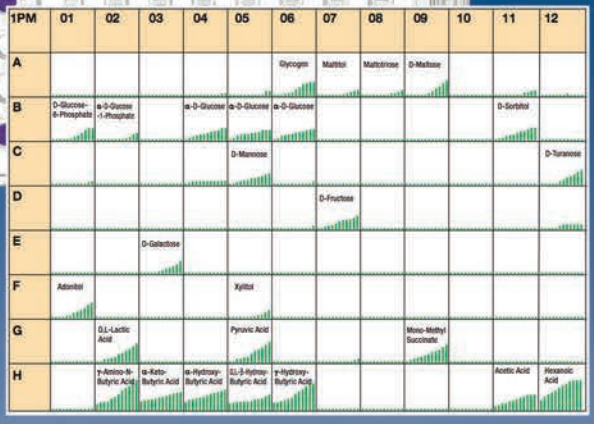

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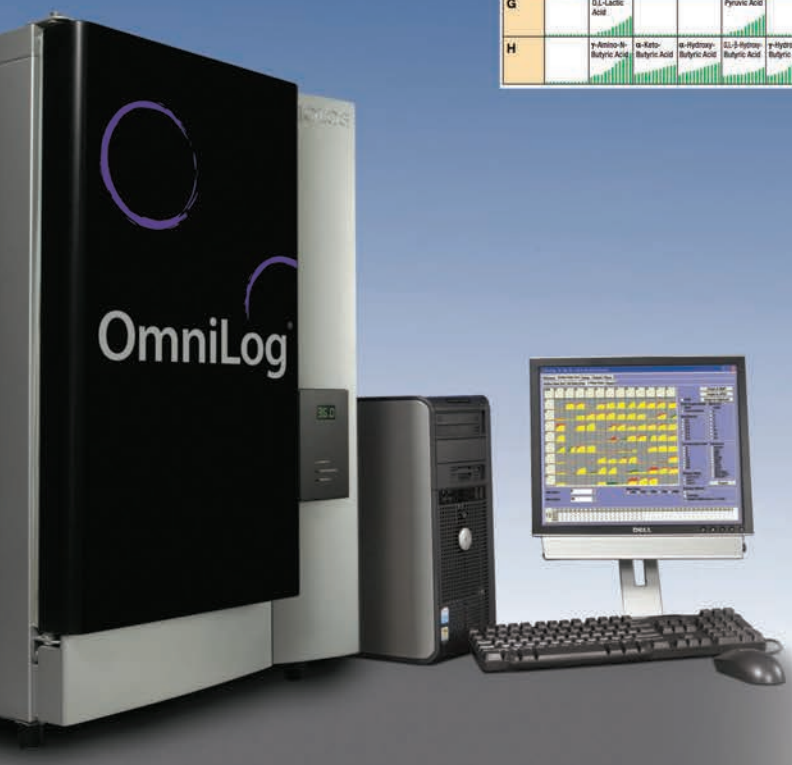

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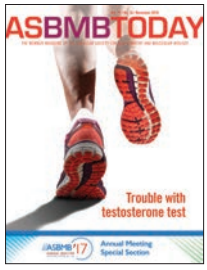

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ASBMBTODAY
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It's time

By Angela Hopp

I recently saw a documentary on Netflix about uncontacted tribes in the rainforest on the border of Brazil and Peru. Several factors — including hunger, drug trafficking and logging — are forcing some tribespeople out of their sanctuary. Leaving the forest is fraught with danger, as each new contact could result in illness or deadly misunderstanding.

The film shows how those tribespeople who requested assistance (by law, they must make the first contact) are adapting to their new circumstances. Though they still live in the forest, they get resources and care from a protective agency. The men said they are glad to have clothes and medicine. Pots and pans, the women agree, are handy.

But what I've been thinking about, possibly because I'm just not completely buying it, was the suggestion by an anthropologist that the tribespeople are terrible at keeping time. They use the sun, he said, but don't know their ages. I won't quibble with any of that here. I'm no expert.

However, this idea — of not living by the clock — is on my mind. Perhaps that is why, as I flipped through this issue of ASBMB Today, I saw the significance of time everywhere.

In her column, Natalie Ahn, the president of the American Society for Biochemistry and Molecular Biology, writes about serendipity. If something happens at the right time, it's serendipitous. If it happens at the wrong time, it's usually a real bummer. (Cue: Alanis Morissette.)

ASBMB Public Affairs Director Ben Corb, in his "News from the Hill" column, writes about the countdown to a new American presidency. I know that my blood pressure rises every time I think about how close Election Day is. Tick tock. Tick tock.

The "Retrospective" articles we publish almost every month are always a good reminder that our time here is limited. We have one about Roscoe Brady and one about Roger Tsien in this issue.

The cover story is about the test used to measure testosterone in women athletes. How much testosterone does a sprinter need to trim a few seconds off her race? The answer, as the story explains, isn't simple.

You'll also see a lot of information about the ASBMB annual meeting. Though the meeting is months away, the abstract-submission deadline is close: Nov. 17. On top of that, unlike in past years, there will be no extensions. Do not be late!

Meanwhile, time plays a big role in an essay by Zachary A. Kemmerer, a graduate student who is competing on NBC's "American Ninja Warrior." He wrote: "A clash of wills played out in those 1,800 seconds as we tried to break each other down."

I hope that you will be blessed with a bit of uninterrupted peace to read the issue. (But do not put off submitting your meeting abstract!)

Angela Hopp (ahopp@asbmb.org) is the communications director for the ASBMB and executive editor of ASBMB Today. Follow her on Twitter at twitter.com/angelahopp.

Celebrating serendipity

By Natalie Ahn

In September, the Lasker Foundation awarded the 2016 Albert Lasker Basic Medical Research Award to Gregg L. Semenza, Peter J. Ratcliffe and William G. Kaelin Jr. for the discovery of the HIF1 transcription factor and the mechanistic steps in the universal pathway explaining the cellular response to hypoxia. The 2016 Lasker–DeBakey Clinical Medical Research Award went to Charles M. Rice, Ralf F.W. Bartenschlager and Michael J. Sofia for research characterizing the molecular biology of the hepatitis C virus, the development of in vitro systems for HCV replication, and the development of therapeutics to treat and in some cases cure chronic HCV infection and liver disease. And the 2016 Lasker–Koshland Special Achievement Award in Medical Science went to Bruce Alberts for his fundamental discoveries of the protein components and mechanism of DNA replication and for his leadership in science education and international collaborations in science teaching and learning. The American Society for Biochemistry and Molecular Biology, which proudly counts four of the winners as members, heartily congratulates all recipients.

Importantly, serendipity and the ability to glean deep insights from hints and unexpected findings played major roles of every breakthrough.

For example, Semenza's detection of a faint hypoxia-induced band on an EMSA autoradiograph enabled the biochemical purification of HIF1, which launched the molecular mechanism for hypoxia signaling. Rice's chance discovery of a 3' segment missing in the HCV genome and the invention of HCV minigenome replicons by Bartenschalger were critical to the development of a cellular model of HCV infection. And it was Alberts' accidental discovery that DNA binds tightly to cellulose that enabled him to purify and reconstitute DNA replication proteins and realize that the replisome is a macromolecular machine capable of simultaneous leading and lagging strand synthesis.

The perspicacity to pursue initial leads, often murky and obscure, and the tenacity to follow the science to discover their full meaning are key to creating new knowledge.

Also essential to their success were the investigators' interdisciplinary strategies, with chemistry, biochemistry and molecular biology at their core. Essential as well were collaboration and information sharing between many labs, including the knowledge flow in both directions between basic research and private sector R&D labs that was critical for successful therapeutics for HCV. Diverse individuals from many countries and of many races and ethnicities, in both academic and private settings, made key contributions in each scientific team.

Recognition for Alberts especially is appreciated by the ASBMB, given the special regard that our society has for science education. Throughout his career, Alberts has led the way as an advocate for teaching critical-thinking skills to students, from his landmark textbook "Molecular Biology of the Cell" to his achievements as president of the National Academy of Sciences in promoting curiosity and inquiry-based methods for STEM undergraduate and K–12 education.

This advocacy impacts everyone, at all levels — here in Colorado, my colleague Amy Palmer has overhauled freshman chemistry to emphasize concepts-based learning with transformative results.

No matter what we do as scientists, part of our mandate certainly must include instilling students with the curiosity, self-confidence and passion for scientific inquiry that will prepare them for their own serendipitous moments to come.

Natalie Ahn (natalie.ahn@colorado.edu) of the University of Colorado, Boulder, is president of the ASBMB.

A lot at stake

By Benjamin Corb

With Election Day just a few days away, here are my suggestions for what to watch for in the outcomes and their possible impact on the scientific community.

Obviously, the big headline grabber is going to be who will be the 45th president of the United States. In previous columns and in numerous postings on our science policy blog (policy.asbmb.org), we have shared what a Donald Trump or Hillary Clinton presidency might look like. The president will help to shape some of the scientific priorities of the country. Will the next president take as warmly to science as President Barack Obama has, or will science, and advisers like those in the Office of Science and Technology Policy, find a diminished role in the next administration? Key cabinet-level and agency-head appointments to watch will be the nominees for directing the National Institutes of Health, the National Science Foundation and the OSTP.

The president can set the country's agenda. Vice President Joe Biden famously has said, "Don't tell me what you value. Show me your budget, and I'll tell you what you value." It's the U.S. Congress that controls the purse strings. The political makeup of the 115th Congress really will influence research budgets. A Republican majority in the House following the election, for sure, will keep the House focused on cuts in spending. However, the previous Congress was supportive to the research community (particularly the NIH) and made important attempts to support biomedical research. Unfortunately, proposed increases to the NIH budget remained tangled in conservative fiscal policies, making increases possible but difficult. A Democratic majority in the House likely would lead to drastic changes in fiscal policy, which could benefit the research community. A Democratic majority in the House is also not particularly likely.

Should Democrats take back control of the Senate, which they lost in 2015, it's likely that we'll see more support for research budgets. However, the gridlock isn't likely to be unraveled. Thanks to senatorial rules and our hyperpartisan politics these days, a simple majority in the Senate isn't likely to influence policy all that much. In order to move from debate to voting on legislation, in most cases, a supermajority of 60 senators must vote to end debate. It is not likely that we will see a supermajority for any party after the election.

With research agency budgets on the line and mandatory spending caps set to drop again, thanks to the 2011 Budget Control Act, there is a lot of work to do. There is a lot at stake for the research community. The election night results will give us our first glimpse into how some key policy debates may play out in Washington in the next two years until the midterm elections.

Benjamin Corb (bcorb@asbmb.org) is the director of public affairs at the ASBMB. Follow him on Twitter at twitter.com/bcorb.

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ASBMB members win Lasker awards


RICE


BARTENSCHLAGER


SEMENZA


ALBERTS

In September, the Albert and Mary Lasker Foundation announced the recipients of the 2016 Lasker Awards. This year's awards recognize six researchers who made outstanding contributions to physiology and virology, as well as one scientist who helped pioneer the fields of DNA replication and science education. Among the recipients for the awards were four members of the American Society for Biochemistry and Molecular Biology.

ASBMB members Charles M. Rice of Rockefeller University and Ralf F. W. Bartenschlager of Heidelberg University received with The Lasker–DeBakey Clinical Medical Research Award for growing the hepatitis C virus in cultured cells. Michael K. Sofia of Arbutus Biopharma shared the prize with Rice and Bartenschlager for utilizing this system to test and invent candidate drugs, which culminated in the development of the hepatitis-C drug Sovaldi.

Gregg L. Semenza of the Johns Hopkins University School of Medicine, an ASBMB member, was one of the recipients of the Albert Lasker Basic Medical Research Award. Semenza won the award along with William G. Kaelin Jr. of the Dana–Farber Cancer Institute and Harvard Medical School and Peter J. Ratcliffe from the University of Oxford and Francis Crick Institute. The three physician-scientists received the award for their role in discovering the pathway that eukaryotic cells use to adapt to and sense changes in oxygen availability. Kaelin is organizing a scientific symposium about the pathway at the annual meeting in April at which Ratcliffe will speak.

ASBMB member Bruce M. Alberts at the University of California, San Francisco, received the Lasker–Koshland Special Achievement Award in Medical Science. In addition to devising tools for understanding the mechanisms cells use to copy DNA, Alberts has used his clout as a scientist and a president of the U.S. National Academy of Sciences to improve science education.

Written by John Arnst

Bassler wins research award


BASSLER

The Alexander von Humboldt Foundation and the Max Planck Society have named Bonnie Bassler, a Howard Hughes Medical Institute investigator at Princeton University, one of two recipients of the Max Planck Research Award.

Bassler is being honored for her role in discovering that bacteria communicate with one another through chemical signaling molecules, a process known as quorum sensing. Her discovery shows the potential for application to a wide variety of fields including medicine, agriculture and industry.

Since 2004, the Max Planck Research Award has recognized two internationally renowned scientists, one who works in Germany and another who works abroad, who contribute groundbreaking research. The award, presented annually on an alternating basis within the areas of natural sciences, engineering, life sciences and the humanities, carries a prize of about $840,000 to support future research.

Harrison wins Vallee Foundation award


HARRISON

Melissa Harrison, an assistant professor in the department of biomolecular chemistry at the University of Wisconsin–Madison, is one of the recipients of the 2016 Young Investigator Awards from the Vallee Foundation.

Harrison's research explores the factors that drive transcriptional activation of the zygotic genome. Her work focuses on exploring the fundamental molecular mechanisms by which the embryonic genome is remodeled rapidly to create the pluripotent state.

Awarded by the Vallee Foundation, the Young Investigator Awards recognize independent investigators who have conducted significant research early in their scientific careers. The award provides recipients with $250,000 in discretionary funding to be used for biomedical research.

Written by Erik Chaulk

Schepartz is new chief editor of Biochemistry


SCHEPARTZ

Alanna Schepartz, a professor of chemistry and molecular, cellular and developmental biology at Yale University, is the new editor-in-chief of Biochemistry, a peer-reviewed journal published by the American Chemical Society. She

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took the helm in August. Schepartz's research covers biochemistry, cell biology and chemical biology with a focus on macromolecular interactions. "With her broad knowledge of biochemical research, extensive relationships in the community, and outstanding editorial experience, I am confident that the journal will excel under her leadership and remain one of the most-cited titles in the field," said James Milne, senior vice president of ACS Journals Publishing Group in a press release that announced Schepartz's appointment.

Written by Kamalika Saha

Forsdyke releases third edition of textbook

FORSDYKE

The third edition of Donald Forsdyke's book "Evolutionary Bioinformatics" is available. Originally published in 2006, the book has been supplemented with more online material in this third edition.

Books on bioinformatics traditionally deal with topics such as gene discovery and database searching. In "Evolutionary Bioinformatics," Forsdyke explores "new bioinformatics," considering genomes as information channels through which multiple forms of information have passed through the generations.

Forsdyke is professor emeritus of biochemistry at Queen's University in Canada. He has published more than 200 papers as well as several books.

In memoriam: Ines Mandl

MANDL

Ines Mandl, professor of biochemistry at Columbia University, passed away Aug 5. She was 99.

Born Ines Hochmuth in Vienna on April 19, 1917, she married Hans Mandl at the age of 19. When Germany invaded Austria in 1938, the two fled and eventually settled in Cork, Ireland, for the duration of World War II. While in Ireland, Ines Mandl became interested in science, studying chemistry at the University of Cork.

After the war, Mandl and her husband moved to America, where she obtained her master's degree in 1947 and her Ph.D. in chemistry in 1949 from the Polytechnic Institute of Brooklyn. Mandl subsequently joined Columbia University as a chemist and research associate before becoming a full professor.

In 1972, she founded the journal Connective Tissue Research, for which she served as editor-in-chief until her retirement in 1986.

Regarded as a leading expert in the study of enzymes and elastic tissue, Mandl received numerous honors throughout her career, including the Carl Neuberg Medal and the Garvan Medal.

In 2000, Mandl helped establish the Ines Mandl Research Foundation as a means of supporting students studying chemical engineering or biomedical or biological sciences. The foundation serves as a legacy of Mandl's profound impact on the scientific industry.

Written by Erik Chaulk

Roscoe Owen Brady (1923–2016)

By Sarah Spiegel & Richard L. Proia

It is with sadness, honor and deep respect that we note the passing of Roscoe Owen Brady, a pioneer in biomedical research, on June 13. He was a world-renowned scientist whose efforts have benefited many patients suffering from inherited disorders of lipid metabolism. Brady's early scientific work helped form the basis of the biochemistry of fatty acid, lipid and sphingolipid metabolism. As a quintessential physician-scientist, he expanded this research into the biomedical arena and developed diagnostic tools for patients and carriers as well as treatments for a devastating class of lysosomal storage diseases known as the sphingolipidoses. These are severe, often fatal, disorders caused by genetic defects in lysosomal sphingolipid catabolism. His pioneering therapy still is being used clinically today, and the approach now has been extended for the treatment of several other lysosomal storage diseases.

Brady's more than six decades of work was admired widely throughout the world as evidenced by the numerous honors he received, including the Lasker Award, the National Medal of Technology and Innovation from President George W. Bush, and membership in both the U.S. National Academy of Sciences and the National Academy of Medicine.

Born in Philadelphia in 1923, Brady received his bachelor's degree from Pennsylvania State University and his M.D. from Harvard Medical School in 1947. He then returned to Philadelphia, where he interned at the University of Pennsylvania Hospital. Over the next four years

Roscoe Brady

at the University of Pennsylvania School of Medicine, he was a fellow in the department of medicine and a postdoctoral fellow in the department of physiological chemistry, where he collaborated with Samuel Gurin to study the metabolism of long-chain fatty acids, lipids and sterols using radiolabeled precursors. In addition to helping elucidate various metabolic pathways, precursors and enzymes involved, these studies formed the foundation for Brady's later seminal work in uncovering the metabolic defects and the enzymes involved in sphingolipidoses.

In 1953, Brady was called to active duty and served in the U.S. Navy Medical Corps. He then was recruited to the U.S. National Institute of Neurological Disorders and Blindness (later renamed the National Institute of Neurological Disorders and Stroke) in Bethesda, Maryland, as a section chief in the laboratory of neurochemistry. For more than 50 years, he remained at the intramural program of the National Institutes of Health, rising to the rank of chief of the developmental and metabolic neurology branch. It was here that he developed a team of scientists and clinicians to investigate the causes and treatment of the sphingolipidoses, most of which have profound neurological manifestations.

At that time, these disorders, affecting primarily children, were not well studied, and their causes were unknown. After initiating studies to increase the basic understanding of sphingolipid metabolism, Brady and his team set out to find the underlying defects in several sphingolipidoses, a line of research that ultimately led to the development of targeted therapies. Their pioneering research elucidated the biochemistry, the enzymatic basis for the metabolic defects of sphingolipidoses such as Gaucher disease, Niemann–Pick disease, Fabry disease and Tay–Sachs disease.

In their most well-known work, Brady and his team discovered that Gaucher disease, the most common LSD, is caused by the accumulation of the sphingolipid glucosylceramide. Brady's team developed in vitro assays that they used to demonstrate that patients with Gaucher disease have a deficiency in glucocerebrosidase, the enzyme that breaks down glucosylceramide. They found a similar motif underlying the other sphingolipidoses, an inherited deficiency in a lysosomal enzyme that, when absent, results in the accumulation of its sphingo-

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lipid substrate. These included Fabry disease, an alpha-galactosidase A deficiency leading to the accumulation of the sphingolipid Gb3, and Niemann–Pick type A and B, caused by acid sphingomyelinase deficiency and the accumulation of sphingomyelin. This work inspired numerous scientists throughout the world to unravel the biochemical causes of other related disorders.

In the late 1960s, Brady's group developed additional diagnostic tests to determine whether individuals were asymptomatic carriers of the autosomal recessive sphingolipidosis genes as well as for prenatal testing. These breakthroughs helped introduce the modern era of genetic counseling, in which Brady actively and insightfully participated. These issues were all the more important in the case of the sphingolipidoses because of the devastating, and often lethal, consequences of these incurable diseases.

After determining the enzymatic deficiency in Gaucher disease, in 1966, Brady recognized and then began pursuing a novel treatment option: enzyme replacement therapy. In 1973, he and his team isolated a few milligrams of glucocerebrosidase from human placenta and showed that administration of the purified enzyme into two Gaucher patients reduced the level of glucosylceramide storage in liver and plasma. Although it took decades with many experimental twists and turns to develop, in 1991 they received approval from the U.S. Food and Drug Administration for the use of their purified glucocerebrosidase as a Gaucher disease treatment. With the advent of molecular cloning technology, the therapeutic enzyme subsequently was produced by recombinant methods. Brady's tenacious efforts, which culminated in the development of the first effective treatment for a lysosomal storage disease, have improved markedly the lives of thousands of Gaucher disease patients and paved the way for similar treatment designs for a growing list of other lysosomal storage diseases, benefiting even more patients and giving hope to families affected by these formerly untreatable disorders.

Brady was a groundbreaking lipid biochemist as well as a committed clinician working to improve the lives of patients with lysosomal storage diseases. Though his shining example lives on, his presence will be missed sorely by his friends and colleagues.

Sarah Spiegel (sarah.spiegel@vcuhealth.org) at the Virginia Commonwealth University School of Medicine and Richard L. Proia (proia@nih.gov) at the National Institute of Diabetes and Digestive and Kidney Diseases wrote this retrospective. It first appeared in the Journal of Lipid Research.

The Do-Over

If you could erase a part of your life and do it over again, which part of your life would that be? What would you do differently?

For an essay series in 2017, ASBMB Today is asking its readers to send in essays about do-overs. Maybe you regretted your choice of college. Maybe you trusted someone who let you down. Perhaps you wonder what would have happened if you had picked that other research project. Whatever it is, be honest and true.

Essays must be unpublished and between 500 to 1,000 words. Submissions can be sent to **http://asbmbtoday.submittable.com/**. Submit under "The Do-Over." **Deadline: Dec. 1**. Please include in your essay a title, complete contact information and an author bio of no more than 50 words.

Roger Tsien (1952–2016)

By Scott LaFee & Heather Buschman

Roger Tsien, co-winner of the 2008 Nobel Prize in chemistry and professor of pharmacology, chemistry and biochemistry at University of California, San Diego, School of Medicine for 27 years, died Aug 24 in Eugene, Oregon. He was 64.

Tsien's work literally illuminated science. With Osamu Shimomura, an emeritus professor at the Marine Biological Laboratory in Woods Hole, Massachusetts, and Martin Chalfie, a professor of biological sciences at Columbia University, Tsien helped scientists peer within living cells and organisms as never before, earning not just the 2008 Nobel Prize but scores of subsequent awards and accolades.

Tsien, Shimomura and Chalfie collaborated to discover and develop green fluorescent protein, derived from the jellyfish Aequorea victoria, as a new and soon-indispensable tool.

Shimomura identified the crucial jellyfish protein and revealed that it glowed bright green under ultraviolet light. Chalfie showed how it could be used as a biological marker. Combining his deep skills in chemistry and biology, Tsien found ways to make GFP glow more brightly and consistently; then he created a full palette of fluorescent proteins that scientists could use to track different cellular processes at the same time.

"I've always been attracted to colors," Tsien told the San Diego Union–Tribune in 2008. "Color helps make the work more interesting and endurable. It helps when things aren't going well. If I had been born colorblind, I probably never would have gone into this."

PHOTO COURTESY OF UC, SAN DIEGO

Roger Tsien

GFPs have become a fundamental fixture in life-sciences labs around the world, allowing researchers to look into cells or whole animals, to watch molecules interact in real-time and ask questions once thought impossible.

Tsien was never content to rest upon his Nobel laurels. He wanted his research to be clinically relevant. As a distinguished Howard Hughes Medical Institute investigator, Tsien sought better to visualize cancer in other ways — or maybe treat it. He and colleagues have designed U-shaped peptides able to carry either imaging molecules or chemotherapy drugs to targeted cancer cells.

His lab created a new generation of fast-acting fluorescent dyes that optically highlight electrical activity in neuronal membranes, deciphering how brain cells function and interact. And using a modified plant protein, he and colleagues created a new type of genetic tag visible under an electron microscope, allowing researchers to see life in unprecedented detail.

"He was ahead of us all," said Tsien's wife, Wendy. "He was ever the adventurer, the pathfinder, the free and soaring spirit. Courage, determination, creativity and resourcefulness were hallmarks of his character. He accomplished much. He will not be forgotten."

Roger Yonchien Tsien was born Feb 1, 1952 in New York City, the third son of immigrant parents. He was a scientist from early childhood, sketching out chemistry experiments as an 8-year-old in a notebook now kept in the Nobel Museum in Stockholm, Sweden. His first Boy Scout merit badge was in chemistry.

In 1968, at the age of 16, he took first prize in the prestigious Westinghouse Science Talent Search for high school seniors. He attended Harvard College, graduating summa cum laude in chemistry and physics in 1972, and then earned his doctorate in physiology in 1977 at the University of Cambridge in England.

Before going to UC San Diego in 1989, he worked as a research assistant in Cambridge and then as a junior professor at UC Berkeley.

Tsien was a member of the Institute of Medicine, the American Academy of Arts and Sciences, the U.S. National Academy of Sciences, and the Royal Society of London. Among his awards were the Gairdner Foundation International Award, the American Chemical Society Award for Creative Invention, the Heineken Prize for Biochemistry and Biophysics, the Max Delbruck Medal in Molecular Medicine, the Wolf Prize, and the Keio Medical Science Prize.

Scott LaFee is the director of media relations and Heather Buschman is a senior public information officer at UC San Diego Health.

Blind wins Tabor award for work on nuclear lipids

By Mariana Figuera Losada

In August, Raymond Blind of Vanderbilt University won the **Journal of Biological Chemistry/Herb Tabor Young Investigator Award** at the 2016 Phospholipid Signaling in Cancer, Neurodegeneration and Cardiovascular Disease Conference in Steamboat, Colorado. Blind, who has demonstrated that lipid-signaling enzymes can activate genes, received the award from JBC Associate Editor George M. Carman from Rutgers University.

PHOTO COURTESY OF RAYMOND BLIND

Raymond Blind

In addition to being part of cell membranes, lipids, in particular a pool of nonmembrane associated nuclear lipids, also can act as signaling molecules. Researchers have shown that lipid-signaling enzymes are involved in several cancers and in the progression of diabetes. Using genomics, biochemistry and structural biology, Blind and colleagues showed that the phospholipid-binding domains found on lipid-signaling enzymes may sense the presence of nuclear phosphoinositides and induce gene activation. These discoveries, when coupled to work published by others, suggest that nuclear phosphoinositides may act similarly to chromatin histone modifications by reversibly regulating gene transcription.

Blind, a native of Buffalo, New York, completed his Ph.D. on nuclear receptor transcriptional activation in Michael Garabedian's laboratory at New York University. For his postdoctoral training, he joined the laboratories of Tom Scanlan and Holly Ingraham at the University of California, San Francisco, where he developed the work recognized by the Tabor award. In 2015, Blind became an assistant professor at Vanderbilt University School of Medicine in the division of endocrinology, metabolism and diabetes, with appointments in the departments of pharmacology and biochemistry.

Blind's research is funded by the National Cancer Institute, the Vanderbilt Diabetes Research and Training Center, and the Vanderbilt–Ingram Cancer Center through the American Cancer Society. Besides doing research, Blind is also an educator who works to support young underrepresented scientists as evidenced by his postdoctoral experience teaching biochemistry at Muhimbili School of Medicine in Dar es Salaam, Tanzania, to help improve East African health care in collaboration with UCSF Global Health Sciences.

Mariana Figuera Losada (fmariana@hotmail.com) is an associate scientist at Albert Einstein College of Medicine.

Blocking potato blight's ability to set up shop

By John Arnst

A potato showing the characteristic signs of blight.

True to its name, Phytophthora infestans is a destroyer of plants. (In Greek, "phyto" means "plant"; "phthora" means "ruin.") Most notorious for the Irish potato famine, the pathogen also can target other members of the Solanaceae family of plants, which includes tomatoes, spices, weeds, herbs and vines. While a global, potato-based famine isn't imminent, the pathogen still causes about $6 billion of damage to crops of the versatile tubers each year, according to the American Phytopathological Society.

In a Paper of the Week recently published in the **Journal of Biological Chemistry**, researchers in the U.K. report detailed crystallographic information about the interaction between one of the pathogen's effector proteins and one of the potato's proteins. They ultimately hope to exploit this result to engineer plants that are resistant to the pathogen.

"If you can understand interactions and then modify the host–cell target in such a way that it retains its original function in the plant, but is no longer able to be acted on by the effector, that might push the balance of the disease progression in the favor of the plant," says Mark Banfield at the John Innes Centre, the senior author on the paper.

According to Banfield, the effectors, which tend to be small proteins that bind to specific host proteins and modify their activity, often possess dual activities for host and pathogen. "One of them is to work on behalf of the pathogen to manipulate host cells for their own benefit," he says. "But the plants have also evolved ways of recognizing the presence of these molecules as foreign objects inside cells and then are able to mount a response to those molecules directly."

Banfield and his colleagues at the Sainsbury Laboratory Norwich and the Imperial College London, with whom he collaborated on the current paper, previously had characterized the PexRD54 effector protein of Phytophthora infestans and verified its interaction with the host cells' ATG8 proteins. Their characterization appeared in the journal eLife earlier this year.

ATG8 is a protein located in the membranes of eukaryotes' autophagosomes, which are double-layered membrane organelles involved in delivering damaged cellular structures to the lysosomes for degradation, among other functions. PexRD54 works on behalf of the pathogen by binding to this protein in host cells and interfering with its ability to perform its normal cellular function.

For this JBC paper, the investigators wanted to explore further the interaction. The researchers first determined the crystal structure of PexRD54. They then focused on the protein's disordered C-terminus, a region of around 10 to12 amino acids that the researchers knew bound directly to the ATG8 molecule, and used X-ray crystallography to show the complex.

With the components of the linked region well defined, they then turned to a low-resolution technique known as small-angle X-ray scattering to get an image of the surface of the entire bound protein complex. They were then able to dock the separately defined features, including the individual proteins and the interacting region, into the protein surface, forming a complete image of the interaction.

With this interaction now well characterized, Banfield and his colleagues hope to engineer the ATG8 protein to ignore the presence of the PexRD54 effector from the pathogen.

"If we can engineer that molecule in the plant cell to no longer be perturbed by the presence of the effector, clearly the pathogen has then lost the benefit of delivering that effector to host cells," Banfield said. "It goes all the way to delivering it, but it no longer has the activity that it's evolved to have."

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Infant gut microbes' thirst for milk proteins

By John Arnst

Milk is a complicated liquid. Among its ingredients, which include lactose, lipids, free oligosaccharides and proteins, the free oligosaccharides perform the essential prebiotic roles of stimulating the growth of beneficial bacteria and preventing harmful bacteria from binding to epithelial cells in the gut. In a paper recently published in **Molecular & Cellular Proteomics**, researchers at the University of California, Davis, report that the bacteria in infants' guts are also capable of digesting glycoproteins.

The researchers previously had thought of glycoproteins as a source of carbohydrate-bound amino acids that were only consumed by the infant, "but it turns out that parts of it, particularly the oligosaccharide, may also be feeding the microbiota," explains Carlito Lebrilla, the paper's senior author. "It has a dual use here — to give nutrition to the host, but also to enhance the microbiota."

The new paper is a unification of sorts for the researchers, who have focused on the oligosaccharide components of human milk for a number of years and had an interest in the interactions between the microbiota and oligosaccharides.

While there was a good deal of research involving the milk oligosaccharides, Lebrilla explains, he and his colleagues hadn't scrutinized what happens after the milk oligosaccharides interact with the microbiota. "This is one of the first times we've looked … in deep structural detail at what happens to the actual compounds as they go through" the gut, he says.

To determine the effects of digestion on the oligosaccharide portions of glycoproteins in breast milk, the researchers collected breast milk and stool samples from mother–infant pairs enrolled in the university's Foods for Health Institute Lactation Study. They then isolated and cultured the dominant bacterial subspecies of Bifidobacteria longum from the stool samples. B. longum, in aggregate, accounts for up to 90 percent of the gut microbiota in milk-fed infants.

The investigators fed the bacteria the milk glycoproteins extracted from the breast milk. After demonstrating that the bacteria were breaking down the glycoproteins, Lebrilla's group obtained a detailed profile of the oligosaccharides that had been released from the glycoproteins by subjecting the fecal samples to tandem mass spectrometry. The researchers were surprised to find the presence of degraded N-glycans in the fecal samples. N-glycans had been hypothesized as digestive targets because they were present in breast milk, but until now, they had not been observed post-digestion. The finding by Lebrilla and colleagues indicates that the bacterial species act upon the oligosaccharide components of the compound, which suggests the sugar moieties on breast milk glycoproteins can fuel the gut microbiome.

A collaborating group led by David Mills at the university's Foods for Health Institute then sequenced the bacteria to get a comprehensive look at which enzymes were responsible for breaking down the milk oligosaccharides and when they were expressed, as well as their specificity. They found that one of the subspecies of B. longum contained genes for a glycoprotein-cleaving endoglycosidase. The researchers also noted that an exogalactosidase, BLNG_00015, was present in another dominant B. longum subspecies and capable of degrading glycoproteins with a terminal monosaccharide galactose residue. This, Lebrilla explains, is evidence of the specificity of the microbial enzymes for the glycoproteins.

Future work for Lebrilla and his colleagues will include examining the milk proteins that are being deglycosolated, exploring why certain milk protein concentrations seem to confer greater protection against stunting in infants than others, and investigating how the microbiota change in humans from a milk-oriented micobiota to a plant-based microbiota as we age.

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How a single-cell marine organism makes fatty acids

By Courtney Chandler

Omega-3 fatty acids have been heralded as crucial to our health and well-being. Humans and other mammals cannot synthesize these fatty acids on their own. Organisms capable of synthesizing these important molecules, such as a single-celled marine organism called Thraustochytrium, are of interest for their use as dietary supplements. In a recent paper published in the **Journal of Lipid Research**, Dauenpen Meesapyodsuk and Xiao Qiu of the University of Saskatchewan in Canada report the pathway that is responsible for the synthesis of these fatty acids in Thraustochytrium.

Omega-3 fatty acids, which can be categorized as very long chain polyunsaturated fatty acids, known as VLCPUFAs, are important components of cell membranes. They also form products that are involved in blood circulation, metabolism, neurotransmission and inflammation. Mammals can obtain omega-3 fatty acids from foods such as salmon and walnuts or from dietary supplements.

Thraustochytrium has been used as a commercial source for these healthy fatty acids. Scientists knew that these organisms produced large quantities of VLCPUFAs but didn't know exactly how they did it.

Organisms are thought to synthesize VLCPUFAs through two possible pathways. The first is the aerobic pathway. It requires oxygen and involves lengthening and adding double bonds to existing fatty acid intermediates. The second is the anaerobic pathway. It does not require oxygen and uses specific enzymes to build VLCPUFAs directly from small precursor molecules, such as acetate.

Qiu's laboratory previously had demonstrated the presence of an enzyme involved in the aerobic pathway in a species of Thraustochytrium called Thraustochytrium sp. 26185. They also recently had observed the coexistence of the anaerobic pathway in the same organism. "This prompted us to investigate the function and importance of the two pathways for the biosynthesis of VLCPUFAs in the species," explains Qiu.

Qiu and Meesapyodsuk investigated the pathways by analyzing the important genes of each in E. coli or yeast, which essentially served as a blank slate to isolate the Thraustochytrium genes and examine their function. They used gas chromatography coupled to mass spectrometry to analyze fatty acid structure; they used feeding experiments to track VLCPUFA formation.

The data "show that the anaerobic pathway is responsible for the VLCPUFA biosynthesis in the Thraustochytrium," states Qiu. Thraustochytrium uses enzymes to build the VLCPUFAs sequentially from a small base molecule instead of making modifications to existing PUFAs.

What about the aerobic synthesis pathway that also was shown to be present in the same species? "Although both aerobic and anaerobic pathways for biosynthesis coexist in the Thraustochytrium, the aerobic pathway is not complete," explains Qiu. This pathway has several enzymes that are ineffective. This makes it incapable of generating VLCPUFAs.

There is a simple explanation for why both pathways may exist in a species — evolution. "It is believed that the aerobic pathway is a progenitor system, while the anaerobic pathway is later acquired by the species," explains Qiu. The anaerobic pathway is more efficient at producing VLCPUFAs. As time went on, components of the less effective aerobic pathway could have become unnecessary and been lost.

VLCPUFAs are important for our health, so it is important to understand how they are produced in the organisms we rely on to supplement our diets. This knowledge could in turn help engineer similar systems that produce VLCPUFAs. Qiu says, "Metabolic engineering of VLCPUFAs in heterologous systems (could) provide an alternative source of these fatty acids for human and animal consumption."

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The trouble with the testosterone test

While the test does what it should, using a 'baseline' level of testosterone becomes problematic when women compete in track and field events

By John Arnst

Elite athletes tend to be a self-selecting group for physical outliers. Someone naturally has a better shot at rising to the top if he or she has an uncommon advantageous trait, whether it's massive feet or a higher percentage of fast-twitch muscle fibers. But when it comes to testosterone, a steroid hormone that controls the development and maintenance of male characteristics, the issue of how the molecule affects women athletes has dogged professional sports.

While men and women tend to produce different amounts of testosterone, the differences aren't black and white. "There are very distinct differences between males and females in terms of how much androgen is present within a body, but, yes, there are variations within that spectrum," says Fred Schaufele at the University of California, San Francisco, School of Medicine. "Everybody is on all different parts of that spectrum, including females with high levels of androgens."

So how does a governing body overseeing elite athletes establish who can compete as men and who can compete as women? The answer isn't clear. In July 2015, the Court of Arbitration for Sport in Lausanne, Switzerland, ruled that the International Association of Athletics Federations, which oversees track and field, had to suspend use of its controversial "T-test" for two years. The test, which is based on the measurement of testosterone levels in blood, was introduced in 2011 as the most recent method in a convoluted history of determining which athletes could compete against other women.

Testosterone and performance

It's long been argued that the 10- to 15-percent performance gap between men and women in sports is due to the fact that men, on average, endogenously produce 10 times more testosterone than women.

"We know that testosterone is of importance for physical performance due to several effects," says Angelica Hirschberg at the Karolinska Institutet and Karolinska University Hospital in Sweden. Hirschberg served as the official gynecologist for the Swedish Olympic committee for 15 years.

"Testosterone has some direct anabolic effect on muscle tissue. It stimulates increase in protein synthesis and the increase of muscle growth," she says.

Hirschberg adds that testosterone also increases the production of oxygen-binding red blood cells by upregulating the hormone erythropoietin. Erythropoietin stimulates proliferation and differentiation of red blood cell precursors, which lead to increased athletic performance. Men also tend to produce more red blood cells and have larger hearts and lungs.

The connection between the performance gap and testosterone levels is the reason testosterone can be exploited as a performance-enhancing substance in sports. It's also why the use of exogenous testosterone is banned in sports.

But the androgens produced naturally in the body can be a headache in sports circles, because their levels can vary over a range between individuals (see "The passport and the prostate").

For the T-test that the IAAF introduced in 2011, which set the upper boundary for female testosterone levels in blood at 10 nanomoles per liter, the goal was to figure out which athletes could compete against one another as women.

But the test quickly ran into problems; while 10 nanomoles per liter is many times greater than the average concentration of testosterone in women, there are a variety of conditions that cause the excess production of androgens. Women athletes with some of these conditions unexpectedly

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find themselves being pulled out from competition.

Too much testosterone

In 2009, an 18-year-old South African runner won the 800-meter sprint at the World Track and Field Championships in Berlin.

"Caster Semenya won with a very great margin, and there were some accusations that she was not a woman," says Hirschberg. "This was the starting point to develop guidelines for severe hyperandrogenism."

Semenya was subjected to testing, the results of which have not been made public.

In 2011, the IAAF issued guidelines on female hyperandrogenism, which prevent women who naturally produce more than 10 nanomoles of testosterone per liter from competing.

Hyperandrogenisms occur when the body produces excess levels of androgens, such as testosterone. Androgen insensitivity, the most extreme version of hyperandrogenism, is a rare condition that occurs when a person has internal testes and XY chromosomes but is unable to utilize the testosterone the body produces, which usually causes them to grow and develop female characteristics.

There are exceptions made to the 10-nanomoles-per-liter rule. In the case of complete androgen insensitivity, in which women are unable to take advantage of the excess hormone to build muscle mass and produce red blood cells due to insensitive receptors, the athlete is eligible to compete according to the IAAF's 2011 rules, says Hirschberg. If women can suppress the high testosterone level by some means, they also can compete. But other than that, women with a blood level of 10 nanomoles per liter of testosterone were banned from competing in track and field events. (Women who have higher than normal levels of testosterone but don't hit the 10 nanomoles-per-liter level, such as those with polycystic ovary syndrome, were not affected by the guidelines.)

Before the T-test came into play in 2011 to measure testosterone in blood, athletes with androgen insensitivity typically were flagged by chromosome testing, which looks for the presence of the SRY gene on the Y chromosome. That test was introduced by the International Olympic Committee at the 1968 games in Mexico City and was used to prevent women with Y chromosomes from competing for nearly three decades.

In 1992, the IAAF ceased routinely using the chromosome test on all athletes but kept the option to employ it if any suspicions about an athlete's sex arose. The IOC voted to discontinue the practice in June 1999.

Looking ahead

The T-test's suspension in 2015 came as the ruling in Dutee Chand's appeal to the Court of Arbitration in Sport. Chand, an Indian sprinter with hyperandrogenism, had been banned from competing in track and field events in 2014 by the IAAF's Indian affiliate, the Athletics Federation of India.

The court determined that there's not enough evidence that athletes with hyperandrogenism necessarily have an unfair advantage over their competitors. According to the court's ruling, "we have two years, as more scientific evidence is required to show the

degree of the advantage if a women has testosterone levels in the male range," says Hirschberg.

For some officials in the global athletic community, the test's reinstatement, or the establishment of a benchmark of some sort, appears to be an inevitability.

"I believe some kind of regulation is necessary, otherwise I don't think other athletes will like to compete when you know in advance who will win," says Hirschberg.

Were the T-test to be reinstated in two years, Hirschberg notes, testosterone levels can be brought down to a manageable level in advance of competition.

"It's easy to suppress the testosterone levels. You can do it by taking oral contraceptives, for instance," she says. "It could be gradual, but within a couple of weeks you could suppress from more than 20 nanomoles per liter to 1 nanomole per liter."

The issue of testosterone levels in women track and field athletes is complicated, as proved by the 2016 Olympic Games in Rio. Chand finished 50th in the 100-meter dash; Semenya won the gold medal in the 800-meter dash.

Women athletes will have to wait until July for the Court of Arbitration in Sport's response after the IAAF presents the scientific evidence it's been gathering and after experts in testosterone and performance evaluate the evidence.

Until then, the IAAF said in a 2015 press release, "The IAAF will make no further comments on this subject until those discussions are concluded."

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The passport and the prostate

Whether someone's high testosterone level is caused by doping or natural causes can be hard to determine.

"One reason that testosterone is more popular among doped individuals is that they believe that it's more difficult to discern the exogenous testosterone" in urine tests for doping, says Anders Rane at the Karolinska University Hospital in Sweden.

One of the methods for ensuring that an athlete's androgens aren't a byproduct of doping is the World Anti-Doping Agency's Athlete Biological Passport. The program, which was implemented in 2009, monitors athletes' endocrine and steroid levels year-round. It provides a record of what an athlete's normal baseline signals are for various molecules, including testosterone.

"The system tells you, 'OK, if you've naturally got a high testosterone, this is your baseline,'" says Olivier Rabin, the science director at the World Anti-Doping Agency. "The anti-doping monitoring takes this into account."

Another potential method for discerning between exogenous and endogenous sources of elevated testosterone could be testing for the levels of prostate-specific antigen, a protein produced by the prostate. Elevated levels in men commonly are used as an indicator of prostate cancer.

Because women don't have a prostate gland, it was widely believed that they didn't produce prostate-specific antigen, says Eleftherios Diamandis at the University of Toronto and Mount Sinai Hospital in Canada. But, he says, "20 years ago, we found that women actually make PSA, and this PSA in women is usually made in the breast tissue."

He adds that because the PSA gene is regulated by androgens, "we speculate that women who have hyperandrogenic syndrome will have elevated PSA."

In the past, Diamandis says, it was very difficult to measure PSA levels in women, but recently developed assays have made it possible to detect the protein at minute concentrations. In a recent study, he and his colleagues found that normal women make about 1,000 femtograms per milliliter of PSA, which is about one one-thousandth of men's production.

"We were surprised to see that the (women) athletes have lower PSA than normal women who do not exercise," says Diamandis. "We don't know the mechanism."

In another study involving women undergoing hormonal transition therapy, the researchers noticed that testosterone consumption tended to increase PSA levels.

With this knowledge about PSA levels, Diamandis says, "this may be a good test for doping, because, if a woman takes a steroid, an androgenic steroid, the PSA levels will go up, in both serum and urine."

Masters of physiology

By Christie Wilcox

This is an excerpt from Wilcox's book "Venomous: How deadliest creatures mastered biochemistry," which was published earlier this year by Scientific American/Farrar, Straus and Giroux. The chapter "Masters of physiology" opens with a description of the peculiarities of the platypus, one of the 12 venomous mammals, and then delves into the characteristics of venoms and why venomous animals invest the effort into making them. The excerpt below, which has been edited for length and style, is the latter half of the chapter and describes how the analyses of venoms have changed over time.

One of the problems with studying venoms until very recently was that we didn't have very good ways of teasing apart what was present in the crude substances milked from animals. Chemists had nearly mastered the art of separating vastly different types of compounds, such as lipids and proteins, but such methods didn't finely separate venom components. It was like sorting laundry: They could pull shirts from socks but couldn't separate based on fabric color or distinguish long sleeves from short ones. Some venoms have hundreds of different peptides (small proteins), all of which might be soluble in water, for example. That means that an "aqueous fraction," or subsection of a venom separated using water, might contain hundreds of different venom compounds, making it impossible to determine if one or many are responsible for any activity seen when that fraction is injected into a mouse.

Luckily, back in the early 20th century, the Russian scientist Mikhail Tsvet invented a method to separate pigments from plants that came to be known as chromatography, which, with many later variations and refinements, has helped current scientists to isolate and identify venom components. In chromatography, mixtures are dissolved in a fluid (referred to as the mobile phase), which is then passed through a structure (the stationary phase) with certain properties. This structure can be simply a column of material through which the solution passes, drawn by gravity, or it can have specific chemical properties that make it "sticky" to particular types of molecules. When the mixture is run through the stationary phase, even small variations in the compounds' size, 3-D structure or chemical properties cause molecules to travel

IMAGE COURTESY OF ART RESOURCE

"Fight of the Mongoose and the Serpent Armies", a watercolor depiction of the age-old battle between snake-eaters and their prey.

at different speeds, allowing scientists to separate venom components on a much finer scale.

Throughout the 1940s and 1950s, new kinds of chromatography were invented, and what is now known as high performance liquid chromatography entered the scene. HPLC, which uses high air pressure instead of gravity to move the solution through a finer-textured column, is now one of the most important techniques in the study of venoms, as it allows scientists to separate venom samples into individual components. And conveniently, during the mid- 20th century, scientists also invented gel electrophoresis for separating molecules of protein, DNA or RNA. Gel electrophoresis uses an electric field to pull compounds through a gel by attracting negatively charged molecules to one end, while the gel's properties affect which things will move through it more easily, traveling farther in a given amount of time. You can imagine how much faster a needle can be pushed into molasses than a finger can, for example, if they were both pressed with the same amount of force. When it comes to proteins, electrophoresis is mostly used to separate based on size, giving scientists a rough idea of the number of different proteins present in a venom. It also has become an invaluable method for determining whether genetic extractions or amplifications were successful, and is an absolute requirement in just about every lab that studies venom today.

The modern era of venom research followed on the heels of these two major advances in separation technology. By the 1970s, labs worldwide could examine different components of a venom and their individual activities rather than the crude venom as a whole, and they began separating out the ones responsible for the most noticeable venom actions. Captopril—one of the best-selling drugs of all time, used to treat high blood pressure and heart failure—was isolated (from the venom of a Brazilian pit viper, Bothrops jararaca) during this time, as were many other venom compounds.

PHOTO BY CHIP COCHRAN

The speckled rattlesnake has impressive camouflage.

As a part of his Ph.D. thesis published in 1973, Peter Temple-Smith took advantage of the new battery of techniques to determine the contents and activities in platypus venom. He found at least 10 different proteins through electrophoresis and chromatography, and isolated the components that were lethal in mice from ones that caused convulsions. However, the scope of his research was limited, as the separation methods and bioassays still required relatively large amounts of venom (Temple-Smith couldn't complete lethality tests, for example, because he didn't have enough venom to work with). Snakes are easy, as they can be milked repeatedly and produce milliliters, and even liters, of venom fairly readily, but many of the other groups of venomous animals provide only 1/1000th or less of the volume required to run such tests. Though the platypus is capable of delivering upwards of 4 milliliters of venom with each spur, actually getting that much raw material is exceptionally difficult. On average, Temple-Smith and others found they could extract only 100

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microliters at a time—too little, in those days, for detailed analyses.

But soon enough, tests miniaturized, and better technologies emerged to determine the shape and structure of different molecules, removing the large-volume requirements that had hindered progress. Scientists who made advances in mass spectrometry and nuclear magnetic resonance won Nobel Prizes in chemistry, and for the first time, these advances allowed them to deduce the chemical composition of larger, more complex compounds like those found in venoms. Even small volumes of crude venom could be evaluated to find compounds that are responsible for key activities such as reducing blood pressure, shutting down nerve impulses, or destroying red blood cells.

In the 1990s, several studies picked up where Temple-Smith left off. Scientists taking a closer look at platypus venom isolated active peptides, two different proteases and a hyaluronidase (enzymes also referred to as venom "spreading factors" because they cut hyaluronic acid, a major component of skin and the connective "goo" between cells). They could even obtain short sequences from some of these components, and determine that they are similar to snake venom constituents.

Then a new technology completely changed the way in which scientists study venomous animals and their toxins: genomics. (James) Watson, (Francis) Crick, and (Rosalind) Franklin had deduced the structure of DNA in 1953. The first sequencing technology, Sanger sequencing, came about in the 1970s followed by a method for amplifying fragments of DNA based on their sequence. The first full gene was sequenced in 1989, and the first full non-viral genome (a bacterium) in 1995. In the 20 or so years since, genetics and genomics have proved to be among the most rapidly changing fields in science. High-throughput technologies can now sequence entire genomes in a matter of hours, and new methods are regularly introduced that produce more information in less time for a lower price. It took years and cost millions to sequence the first human genome, which

PHOTO BY CHRISTIE WILCOX

Komodo dragons are a species of venomous lizards.

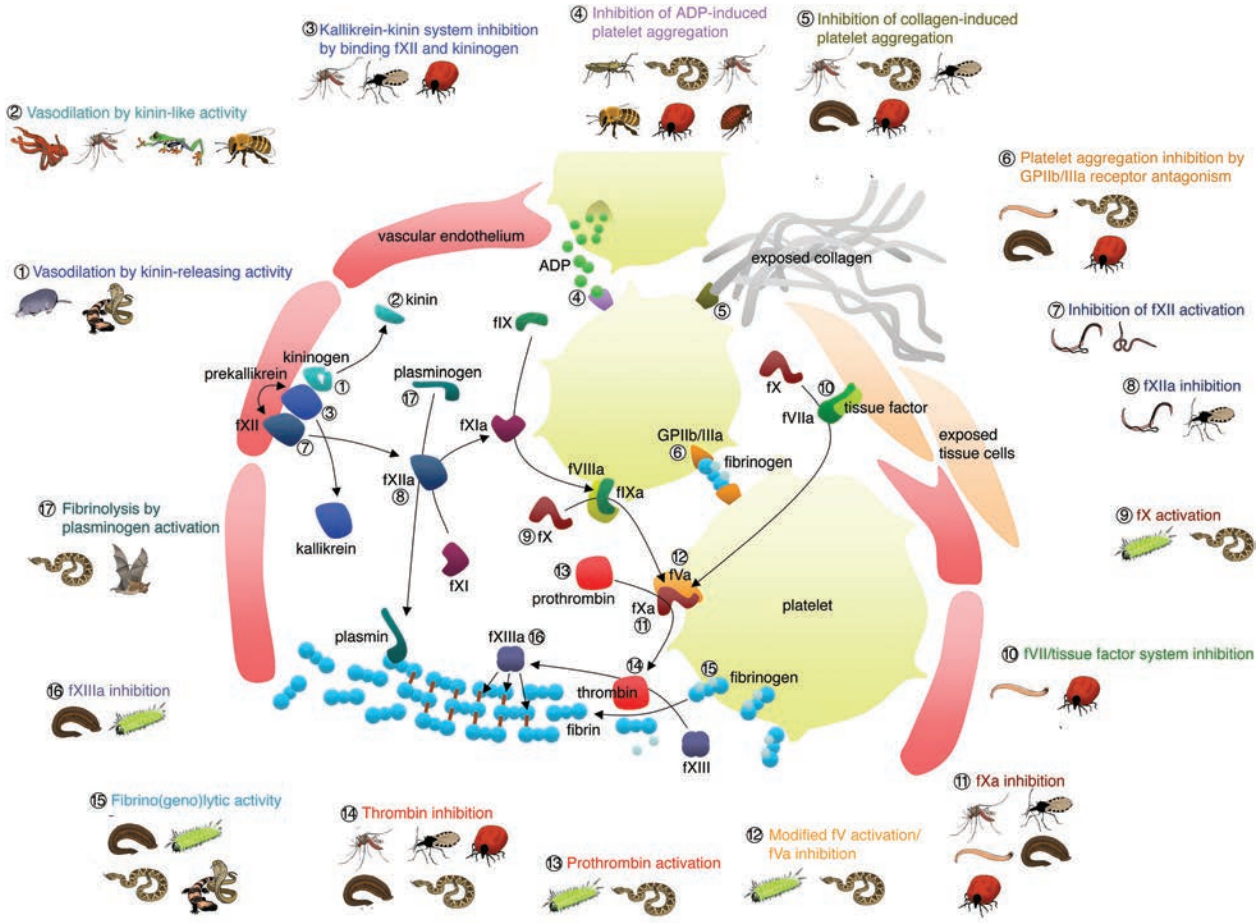

FIGURE BY BRYAN GRIEG FRY

The diversity of hemotoxic venom compounds which disrupt the coagulation cascade.

was finished in 2003—and it's possible that within the next five to 10 years, sequencing an entire human genome will cost less than $1,000.

When it came to studying venoms, the genetics revolution opened up avenues that had never been imagined. Scientists could use genes to look at evolutionary relationships, and determine which species were closely related. They could compare the sequences of toxins to other proteins, and begin to understand how venoms evolve. And it wasn't just DNA—scientists have developed methods of sequencing ribonucleic acid, the step in between DNA and proteins, and can determine which genes are being expressed. Genomics meant that they could sequence every protein expressed in a venom gland to look at the composition of a venom even without a single drop of it. Drug companies can build libraries of venom toxins and search them for ones that might act as enzymes, or have the potential to interact with a "target" such as an ion channel. By combining venom separation and component isolation with genomics, researchers have shifted from the study of venoms to venomics. Through such integrated research, we have come to know venomous animals far more intimately than at any point in history, and we have learned that their biochemical prowess is far more impressive than we ever imagined.

Christie Wilcox is a scientist and an award-winning science writer. Follow her on Twitter at twitter.com/NerdyChristie.

ASBMB '17
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Expand your scientific horizons

"To succeed in science, you have to learn new strategies, form new collaborations and see your work from a fresh angle. At the ASBMB annual meeting, you can meet new people in other areas, fertilize your mind with their knowledge and use this to spark new avenues in your own endeavors."

The quote above comes from Natalie Ahn, president of the American Society for Biochemistry and Molecular Biology, who wrote it in the President's Message for the October issue of ASBMB Today. Ahn, who also is serving as a co-organizer of the 2017 annual meeting with the ASBMB's past president, Steven McKnight of the University of Texas Southwestern Medical Center, is putting those words into action.

At the next ASBMB annual meeting in Chicago, four scientific events will run concurrently for two hours between April 23 and April 26. Ahn and McKnight have recruited 17 leaders from a wide variety of research areas that lie within the realm of biochemistry and molecular biology. To those 17 leading scientific researchers, Ahn and McKnight have given the freedom to put together their dream scientific symposia.

And they have. On the following five pages are descriptions of the 17 scientific symposia that have been brought together by these leaders. (The 17th event, devoted to antibiotics and antibiotic resistance, is sponsored by the ASBMB Minority Affairs Committee.)

What this setup means for attendees is that they will have a veritable smorgasbord of science. From lipid biochemistry to metabolomics, these symposia showcase the best and the most exciting research endeavors happening right now in the life sciences. Cutting-edge science from all over biochemistry and molecular biology will be made available at this one, must-attend conference. Submit your abstract for this meeting by Nov. 17.

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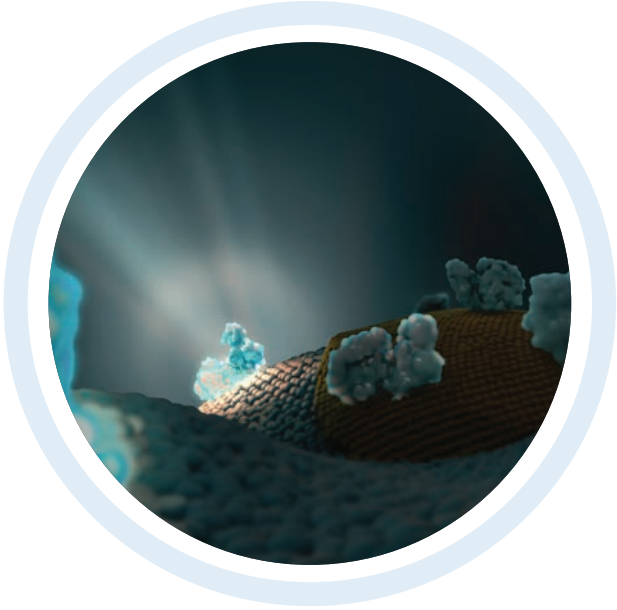

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SUNDAY, APRIL 23

Biochemistry, physiology and pathophysiology of sphingolipids

Lipid biochemistry is experiencing a Renaissance. Unprecedented developments in tools and insights are coming to bear on this field of study and its relevance to biology and human disease. I am organizing a special group of international leaders in lipid biochemistry and biology who will present the status of their respective domains and cutting-edge developments within this field. Howard Riezman of Weill Cornell Medical College will discuss links between amino acid and sphingolipid metabolism and their effects on sphingolipid functions in health and resistance to anoxia. Timothy Hla of Weill Cornell Medical College will describe studies that support the notion that sphingosine-1-phosphate-binding chaperones modulate sphingosine 1-phosphate's signaling in vascular function in pathophysiology. Antonella De Matteis of Telethon Institute of Genetics and Medicine will discuss new insights on membrane contact sites and advances in approaches to study them. Gregory Fairn of St. Michael's Hospital, who is receiving the Walter A. Shaw Young Investigator Award, will discuss subcellular localization and dynamics of lipids. I will present the structure of neutral sphingomyelinase and discuss its roles in the DNA damage response.

— **Yusuf Hannun**, *Stony Brook University*

Life at higher resolution: single-molecule and single-cell technologies

The biological questions we can answer are determined by the precision of the measurements done by the tools at our disposal. In this symposium, speakers will present the latest in single-molecule and single-cell technologies, which can probe DNA and chromatin processes at higher resolution than ever possible and use DNA as a precision self-assembled material to probe cellular and molecular mechanics. You will get a glimpse of the future of single-molecule biology, which lies in the convergence of emerging technologies, such as protein and genome engineering, DNA origami, genomics, microfluidics and plasmonics, to enable capabilities that are currently unthinkable.

— **Taekjip Ha**, *Johns Hopkins School of Medicine and Howard Hughes Medical Institute*

Pharmacological manipulation of the HIF pathway

The HIF transcription factor is a master regulator of genes that promote adaptation to hypoxia. Mounting evidence suggests that increasing HIF would be beneficial in diseases such as renal anemia and regional ischemia, and decreasing HIF would be beneficial in diseases such as specific cancers and pulmonary hypertension. First-generation drugs that stabilize HIF have entered the clinic. Recent structural insights have opened the door for the development of the first inhibitors that work directly on HIF. This symposium will feature talks related to HIF biology and structure and to drugs designed to modulate HIF activity.

— **William Kaelin**, *Dana–Farber Cancer Institute, Harvard Medical School and Howard Hughes Medical Institute*

Dynamics of cytoskeletal assembly

This symposium will feature research that brings together insights from biochemical analysis of reconstituted systems, quantitative measurements in live cells and mathematical modeling to understand cellular mechanochemistry. Melissa Gardener at the University of Minnesota analyzes how microtubule dynamics contribute to the movements of chromosomes during mitosis. Margaret Gardel at the University of Chicago uses measurements on reconstituted networks of actin filaments and myosin to understand the physics of their assembly and force generation. Ohio State University's Marco Sotomayor studies how cadherins contribute to mechanotransduction in the ear. My laboratory combines measurements on live cells and mathematical modeling to explain how the contractile ring divides cells during cytokinesis.

— **Thomas Pollard**, *Yale University*

MONDAY, APRIL 24

New insights into nuclear structure and function

Recent developments in our understanding of nuclear organization and gene expression have helped us better comprehend the inner workings of the cell nucleus. Four leaders in this field will provide critical insights into transcriptional regulation using single-molecule imaging approaches, genetic and biochemical approaches to studying pre-mRNA splicing, the role of the nuclear lamina in nuclear organization and disease, and the role of nuclear retained long noncoding RNAs in cancer biology. Attendees will become immersed in the exciting world of nuclear biology and learn how recent advances in technology have helped to move this field ahead at a remarkable pace.

— **David Spector**, *Cold Spring Harbor Laboratory*

Supramolecular complexes

Proteins associate with one another to form complexes and perform their activities. Edward Marcotte from the University of Texas at Austin and I will describe complementary approaches to the identification of protein-complex components, through extensive biochemical fractionation of cellular lysate or through in vivo biotinylation coupled to mass spectrometry. These presentations will highlight the requirement for computational strategies to derive the composition of the complexes and define changes in these complexes after perturbations. The other two presentations will emphasize the complementary nature of mass spectrometry and cryoelectron microscopy to reveal the structural organization of supramolecular complexes. Albert Heck of Utrecht University will discuss advances in mass spectrometry to assist in the structural determination of protein complexes. John Rubinstein from The Hospital for Sick Children will discuss the development of cryoelectron microscopy and its application to bridge the resolution gaps between more conventional microscopy and the types of high-resolution analyses mostly done by NMR spectroscopy and X-ray crystallography.

— **Anne-Claude Gingras**, *Lunenfeld–Tanenbaum Research Institute at Mount Sinai Hospital*

Basis of longevity and age-related diseases

Aging is one of the most fascinating mysteries in biology. Old age is associated with a plethora of diseases, including neurodegenerative diseases, metabolic diseases and cancer. This symposium will cover the most exciting questions at the forefront of the aging field. Linda Partridge from the Max Planck Institute will discuss the pathways that can slow the aging process and promote longevity. Andrew Dillin from the University of California, Berkeley, will present how different cells and systems communicate to modulate aging. Matt Kaeberlein from the University of Washington will discuss how companion dogs can help us discover aging therapeutics. I will present our work developing the African killifish as a new model for aging and longevity.

— **Anne Brunet**, *Stanford University*

Discovery and development of new enzyme chemistry

With their ability to catalyze complex reactions at high rates and with absolute regio- and stereospecificity outside the repertoire of today's synthetic chemists, enzymes hold unfulfilled promise to transform the way we make drugs and other high-value chemicals. Efforts to map the pathways by which natural products are constructed continue to reveal unmatched enzymatic transformations. These discoveries, coupled with our ability to evolve enzymes in a directed fashion, will enable entirely new synthetic routes. Leaders in this area will highlight recent progress toward the discovery and evolution of new enzymatic reactions with potential utility in synthetic chemistry.

— **J. Martin Bollinger Jr.**, *Penn State University*

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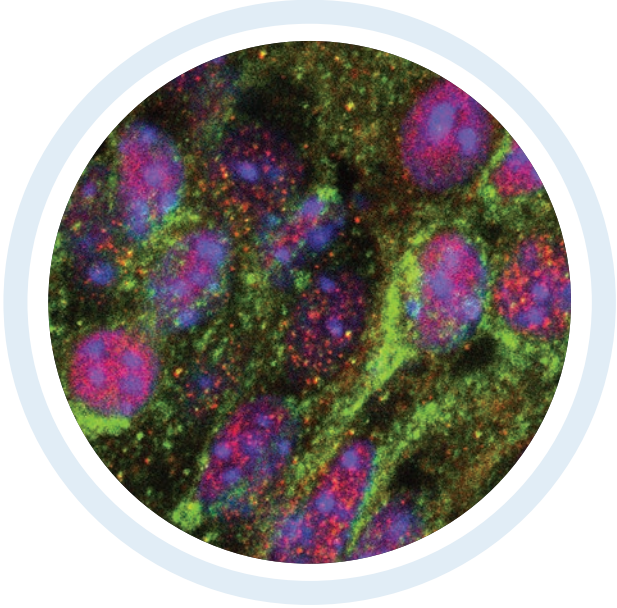

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TUESDAY, APRIL 25

Organelle trafficking and signaling

This symposium will focus on how various cells ensure the integrity of organelles. Neurons are highly differentiated, long-lived cells that depend on autophagy to maintain homeostasis in response to proteotoxic stress or organelle dysfunction. Erika Holzbaur from the University of Pennsylvania will discuss the mechanisms regulating autophagy in neurons. Navdeep Chandel at Northwestern University will describe how his work has elucidated that mitochondria function as signaling organelles for various biological processes. Martin Hetzer from the Salk Institute will describe the mechanisms underlying the repeated rounds of nuclear envelope rupture and repair that have been observed in laminopathy and cancer cells. Finally, my group studies membrane contact sites between the endoplasmic reticulum and other organelles. I will discuss mechanisms that allow membrane contact sites at the endoplasmic reticulum to drive constriction and division of other organelles.

— **Gia Voeltz**, *University of Colorado, Boulder*

Metal homeostasis

Acquisition, management and delivery of metal ions is a significant part of metabolism for all domains of life. Aberrant handling of copper, zinc, iron and manganese is linked to numerous human diseases. The virulence of pathogens depends on a complex interplay between metal acquisition by the pathogen and immune response by the human host. Understanding molecular mechanisms of metal homeostasis is critical to developing new therapeutics, combating microbial infections and even mitigating heavy-metal pollution in the environment. This symposium will highlight recent research at the front lines of this field.

— **Amy Rosenzweig**, *Northwestern University*

Biochemical basis of cellular processes

Biochemistry continues to be a major tool in our quest to understand the fundamental processes of living organisms. Four leading biochemists will demonstrate how classical biochemical approaches, coupled with modern molecular biological and chemical methods, can reveal the molecular mechanisms of several fundamental biological processes. The processes include cell death, epigenetic regulation and fighting microbial infections.

— **Xiaodong Wang**, *National Institute of Biological Sciences, Beijing*

Glycobiology, glycan receptors and functional glycomics

This symposium will cover the exciting roles of glycans in antibody functionality, infectious diseases, innate immunity and organelle biogenesis. Galit Alter from Ragon Institute of Massachusetts General Hospital will describe her work on innate-immunity profiling tools and high-throughput antibody glycosylation profiling that highlight the immunologic programs driving antibody glycosylation and function. Her work is paving the way for the rational design of highly effective vaccine strategies and monoclonal antibodies to prevent infectious diseases, such as HIV/AIDS. Using modern glycomics and microarray approaches, Richard Cummings from Beth Israel Deaconess Medical Center has discovered a wide variety of mammalian glycans that are required for infections by different pathogens. These glycans are recognized by both glycan-binding proteins as well as pathogen-stimulated anti-glycan antibodies. Laura Kiessling from the University of Wisconsin, Madison will describe how glycan-binding proteins function as microbial detectors in innate immunity. I will discuss my group's structural studies on the glycan-binding receptors that are essential for the generation of lysosomes and are targeted in the treatment of lysosomal storage diseases.

— **Nancy Dahms**, *Medical College of Wisconsin*

WEDNESDAY, APRIL 26

New insights in regulated lipid metabolism

This symposium will highlight some of the most exciting recent discoveries in the area of lipid metabolism. Russell Debose–Boyd at the University of Texas Southwestern Medical Center will present his recent work regarding an understudied area in the regulation of cholesterol metabolism: The regulated degradation of the key enzyme involved in cholesterol biosynthesis, hydroxymethylglutaryl-coenzyme A reductase. Lina Obeid from Stony Brook University will present some of her work on the impact of regulated sphingolipid metabolism in cancers. Stephen G. Young at the University of California, Los Angeles, will outline exciting discoveries that expand our understanding of the triglyceride-rich lipoprotein metabolism and laminopathies. Finally, my laboratory has identified a new lipase critical for regulating lipid metabolism, the adipocyte triglyceride lipase. I will present recent research on the role of this enzyme in physiological and pathophysiological processes.

— **Rudolf Zechner**, *Institute of Molecular Biosciences, Karl Franzens Universität Graz*

Molecular quality control

Molecular quality control is the process by which the capabilities of macromolecules are judged. Those found wanting are destroyed, and their components are recycled. This cellular process is central to the fitness of biological systems. We shall explore the subject from different perspectives. Adam Frost from the University of California, San Francisco, will tell us about quality control at the level of the ribosome. Bernd Bukau from the Zentrum für Molekulare Biologie der Universität Heidelberg will tell us how chaperones are implicated in post-production protein quality control. Chris Lima from the Memorial Sloan–Kettering Cancer Center will provide structural insight into the workings of the machinery that turns over defunct macromolecules. Susan Ackerman from University of California, San Diego, and Howard Hughes Medical Institute will provide a physiological perspective on the role of quality control in the context of mouse models of neurodegenerative disease. I will examine the question of quality control in the high-flux environment of the early secretory pathway of complex eukaryotic cells.

— **David Ron,** *University of Cambridge*

Low-complexity domain proteins and the making of germ cells

This symposium will address exciting new developments in germ-cell formation. It has long been known that low-complexity proteins form protein assemblies that bind RNAs and control the formation of germ cells in flies and worms. More recent work has shown that proteins with such characteristics are instrumental in germ-cell formation in most, perhaps all, organisms. Low-complexity domain proteins with RNA-binding properties control meiosis, the cell division that produces germ cells, and are critical for the development of germ-cell characteristics. Talks scheduled in this session will address the mechanistic basis for how this class of proteins mediates these essential germ cell functions and a discussion of why this form of regulation is so critical in germ-cell development.

— **Angelika Amon**, *Massachusetts Institute of Technology and Howard Hughes Medical Institute*

Redox signaling and the metabolome

Oxidation-reduction reactions are the ultimate drivers of all life processes. Redox-active metabolites are the products of energy metabolism, the drivers of biosynthetic reactions and purveyors of cellular signaling. This symposium will capture important aspects of the field by featuring talks about biocatalysts by Joan Broderick from Montana State University and David Sherman from the University of Michigan, redox regulation by Vadim Gladyshev from Harvard Medical School and Brigham & Women's Hospital, and signaling by me.

— **Ruma Banerjee**, *University of Michigan Medical School*

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Annual meeting abstract submission deadline: Nov. 17

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Issues in depth

Issues in Depth is a series of symposia focused this year on antibiotics and antibiotic resistance. The series is sponsored by the ASBMB Minority Affairs Committee.

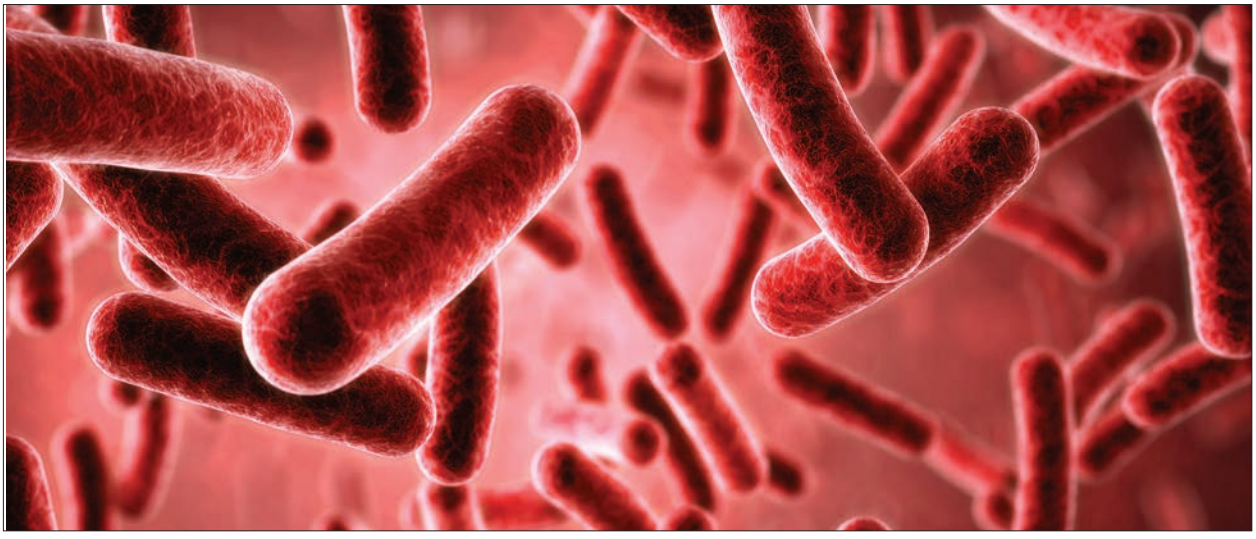
Antibiotics, the drugs that kill pathogenic bacteria, are the most successful medicines ever found by humans. However, due to Darwinian selection, bacteria can develop resistance to the antibiotics. There is a constant race between our ability to find new inhibitors of bacterial growth and the ability of pathogens to find ways to become tolerant to the new drugs. This multi-day series of symposia on antibiotics and resistance will bring together top researchers to discuss new approaches for drug discovery, new insights into the molecular mechanisms of antibiotic action, and new understanding of the principles of appearance and spread of antibiotic resistance.

— **Alexander Mankin**, *University of Illinois at Chicago*

Sunday, April 23:
New approaches for antibiotic discovery

Monday, April 24:
New insights into mechanisms of antibiotic action

Tuesday, April 25:
Antibiotic resistance



The spotlight is on you

By Yan Jessie Zhang & Jessica M. Ellis

You have put your heart into your experiments. You have skipped parties and even occasional free meals because your curiosity will not allow you to tear yourself away from that bench! You are driven by the desire to answer the biological question that is your obsession. Finally, you have figured it out! Your hard work has paid off, and you have shed light on the scientific question that haunted your dreams.

Now, let us shine a light on you! Share your euphoric moment of scientific discovery at the upcoming ASBMB annual meeting, April 22–26, in the big, lake-front city of Chicago. The meeting features new Spotlight Sessions to highlight your brilliant, illuminating work. The Spotlight Sessions will emphasize the most recent and exciting findings that make our scientific passion glow bright.

In the format of short talks, the newest scientific discoveries will be placed at the center of discussion. The presentations for the Spotlight Sessions will be chosen from your submitted abstracts with simple criteria for selection: We want to hightlight innovation, novel technological approaches and paradigm-shifting discoveries that challenge the status quo of scientific areas.

Allow us to celebrate your new and exciting discoveries by putting them in the limelight. Please submit your abstract for consideration for the Spotlight Sessions at www.asbmb.org/meeting2017/abstracts/submissions/ by Nov. 17.

The submitted abstracts will be evaluated by a committee of Spotlight Sessions chairs who are dedicated to the promotion of your breakthrough science. The selected abstracts will be grouped by scientific area and presented in concurrent Spotlight Sessions between April 23 and April 25.

We are waiting for your glowing scientific news.

Yan Jessie Zhang (jzhang@cm.utexas.edu) is an associate professor in the department of molecular biosciences at the University of Texas at Austin. Jessica M. Ellis (jmellis@purdue.edu) is an assistant professor in the department of nutrition science at Purdue University, West Lafayette. Zhang and Ellis are part of the ASBMB Meetings Committee and are overseeing the Spotlight Sessions for the ASBMB 2017 annual meeting.

Promoting lifelong learning

Science involves a dedication to learning new things about the world and ourselves. The American Society for Biochemistry and Molecular Biology will be hosting a variety of workshops that promote learning about cutting-edge techniques and improving professional skills at the 2017 annual meeting.

LEARNING LABS

Academic drug discovery: charting a roadmap for moving basic ideas into the clinic

So you have identified a biological target or a pathway. Now what? This workshop is designed to teach academic investigators how to navigate the challenging but highly rewarding process of small-molecule drug discovery. The workshop will cover major techniques and steps in drug discovery and present specific examples of moving targets and molecules through the drug-discovery process. The workshop leaders, Zhong-Yin Zhang from Purdue University and Shaomeng Wang from the University of Michigan, also will share their best practices and lessons learned.

Beyond DNA methylation and histone modifications

Epigenetic mechanisms, such as DNA methylation and histone modifications, can change gene expression and cause diseases without changing the underlying DNA sequence. Next-generation sequencing has been transforming the field of epigenetics, generating large datasets of BS-seq, ChIP-seq and RNA-seq information. This poses great challenges for data analysis, requiring knowledge of best ways to distill high-dimensional information into comprehensible conclusions. In this workshop, Wei Li from Baylor College of Medicine and Kai Tan from the University of Pennsylvania will present several cutting-edge analytical frameworks for epigenomic data analysis and demonstrate how to integrate multidimensional epigenomic datasets to construct condition-specific transcriptional regulatory networks.

CRISPR-based versatile tools and their major application areas

This workshop, led by Mazhar Adli at the University Virginia School of Medicine and Jacob Corn at the University of California, Berkeley, will present leading-edge CRISPR/Cas9-based technologies and their applications. The wide range of versatile CRISPR-based tools will be covered, with focus given to the design of experiments, downstream analysis and major pitfalls. Specific applications of CRISPR to genome-scale knockout screening and locus-specific epigenetic editing approaches will also be presented.

High-performance mass spectrometry for proteomics

The improvements in performance metrics of mass spectrometers, coupled with the development of new MS/MS methods and new strategies for quantitation, have significantly accelerated the field of proteomics, to the point where nearly every protein in a human cell can be quantified. This workshop, led by Jenny Brodbelt from the University of Texas at Austin, and Josh Coon from the University of Wisconsin–Madison, will showcase some of the latest mass spectrometry technologies for identifying proteins and their post-translational modifications, as well as forefront applications of bottom-up and top-down pro-

teomic approaches to untangling the multifaceted networks that regulate complex organisms and their diseases.

Lipidic cubic phase crystallography

Lipidic cubic phase crystallography and related methods have transformed membrane-protein structural biology. They have led us to most of the known structures of G-protein–coupled receptors, as well as structures of many other membrane proteins, enzymes and transporters. This workshop, led by Andrew Kruse of Harvard Medical School and Aashish Manglik of Stanford University, will focus on how to crystallize membrane proteins by the lipidic cubic phase method and will include a live hands-on demonstration of the technique.

Principles and applications of modern kinetic and equilibrium analysis

This workshop will teach attendees how to answer important questions about enzyme mechanisms by designing the right experiments and interpreting them quantitatively. The workshop will be taught by Kenneth Johnson at the University of Texas at Austin and founder of KinTek Corporation, a leader in precision stepped-flow and quench-flow instruments for rapid transient reaction kinetics. It will present basic foundations and applications of kinetic analysis and then cover topics ranging from chemical kinetics and enzymology to pharmacokinetics and cell biology. It will demonstrate the use of KinTek computer

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simulation software to fit multiple data sets simultaneously, including kinetic and equilibrium measurements. Attendees will learn how to perform a wide range of experiments and interpret them rigorously, without simplifying approximations and making errors inherent to fitting data using equations.

SUCCESS IN SCIENCE

Grant success demystified

The ASBMB grantwriting workshop hosted by the ASBMB Minority Affairs Committee will provide participants with an effective set of tools to enhance their grantsmanship and demystify the grant submission and review process. The workshop presenters are Sonia Flores at the University of Colorado, Boulder and Suzanne Barbour from the University of Georgia, Athens. They have extensive knowledge of all aspects of the process for National Institutes of Health and National Science Foundation submissions, and will focus on practical methods that have been used with great success in the more extensive two-day program for Interactive Mentoring Activities for Grantsmanship Enhancement.

How to get a life in the life sciences

Every scientist can benefit from helpful and entertaining tips on how to navigate graduate school, postdoctoral positions, job hunts and steady funding while finding personal fulfillment. Two self-proclaimed "chronologically gifted" biochemists, William Wickner of Dartmouth University and Nobel laureate Randy Schekman at the University of California, Berkeley, will share how lifelong friendships grown in the lab and bold and feasible directions for your science can lead to long, fulfilling scientific careers.

Publishing in the JBC 101: advice from the experts

Interested in publishing your research in the Journal of Biological Chemistry? Make sure you are presenting your research rigorously, clearly and compellingly! The JBC editors will discuss important aspects authors need to consider when preparing their manuscripts for submission. Topics to be covered include clarity of the text, including title and abstract, data presentation, database compliance and transparency.

PROFESSIONAL DEVELOPMENT WORKSHOPS

Advocacy town hall

You've got questions about policy? Join the ASBMB's public affairs staff and leaders from the ASBMB Public Affairs Advisory Committee, who will be hosting a town-hall style meeting. You will have your questions answered about almost anything happening in the policy world. Your questions can range from funding levels to the influence of the 2016 elections on science. We'll help you connect how policy decisions in Washington, D.C., affect your science.

Constructing your elevator pitch

Being able to describe your research efficiently is a skill that all scientists should have. In this interactive workshop led by members of the ASBMB Public Outreach Committee, you will learn how to construct an elevator pitch, which is a brief, engaging description of your research. We will discuss tips and real-life examples of approaches to communication that work (and don't work) and provide plenty of opportunities for practice and feedback. This workshop will be part of the Graduate and Postdoc Career-Development Event (page 34).

Identifying transferable skills

Scientists build many different skills — from techniques to communication to personnel management — throughout their careers. However, communicating these skills outside the academic research environment can be challenging. Zach Marks, co-founder and chief operating officer of Oystir, an online jobs marketplace that matches candidates and employers based on skills, will lead graduate student and postdoctoral fellows in learning how best to present their skills to potential employers. This workshop will be part of the Graduate and Postdoc Career-Development Event (page 34).

Networking 101

Whether you are an early-career scientist or an established member of your scientific community, developing and maintaining a network of professional contacts will help grow your career. Graduate students and postdoctoral fellows interested in learning how to cultivate professional relationships will develop a personal action plan during this workshop, which will be led by the ASBMB Education and Professional Development Committee.This workshop will be part of the Graduate and Postdoc Career-Development Event (page 34).

Why do science outreach?

Participating in science outreach usually is not seen as essential for a successful scientific career. However, a growing body of research has begun to point to several benefits of getting involved with outreach. During this workshop, representatives from the ASBMB Public Outreach Committee and Northwestern University's Science in Society research center will discuss how taking part in science outreach activities can have both short- and long-term positive impacts on scientists, focusing in particular on skill development, professional advancement and establishment of strong community relationships. This workshop will be part of the Graduate and Postdoc Career-Development Event (page 34).

Annual meeting abstract submission deadline: Nov. 17

Advance your careers, grad students and postdocs!

By Erica Siebrasse

For the past 10 years, the American Society for Biochemistry and Molecular Biology has provided robust career-development programming for graduate students and postdoctoral fellows at its annual meeting. Next year's annual meeting again will have career-development programming for grad students and postdocs, but this time there will be some exciting changes to the Saturday flagship event. Please help us spread the news about these exciting changes to your trainees, colleagues and friends so that they can submit abstracts for the meeting and join us for our events!

In the past, only travel awardees were invited to attend the entire career-development event. While ASBMB travel awardees will continue to be required to attend, up to 100 additional seats will be available for non-travel awardee participants, who may register for the event when they complete their Experimental Biology registration. Remember, though, that the ASBMB offers 200 travel awards of up to $1,000 to graduate students and postdocs (deadline Dec. 1). More information can be found at www.asbmb.org/meeting2017/.

The 2017 Graduate and Postdoc Career-Development Event will be organized by Christopher D. Heinen from the University of Connecticut Health Center and Timothy D. O'Connell from the University of Minnesota, along with me.

To strengthen the skill-development offerings, the organizers added workshops on Saturday afternoon where participants can develop an elevator pitch, improve their networking skills, identify their transferrable skills and learn how to build their skill sets through outreach activities. (More information on each workshop is available on pages 30–33 of this issue.)

The 2017 Graduate and Postdoc Career-Development Event is an opportunity to learn about different careers in science and develop or improve skills before the main scientific programming starts on April 22.

We look forward to seeing you at the 2017 ASBMB annual meeting!

2017 PRELIMINARY PROGRAM

The full program, including confirmed speakers, is available at www.asbmb.org/meeting2017/gradstudentpostdoc/

April 21

• Networking reception with participants and speakers

April 22

• Career options: the bench, the boardroom or in between?

Speakers will share their stories of finding fulfilling industry, academic and nonresearch careers.

• Panel discussions

Speakers will host Q&A panel discussions on industry, academic and nonresearch careers.

• Networking luncheon with participants and speakers

• Career-development workshops

Participants will choose among several skills-building workshops.

Erica Siebrasse (esiebrasse@asbmb.org) is the education and professional development manager for the ASBMB. Follow her on Twitter at twitter.com/ericasieb.

Reminders for the 2017 ASBMB Undergraduate Poster Competition

The Undergraduate Poster Competition at the ASBMB annual meeting is an opportunity for undergraduate students to present their research at an international gathering and compete for awards. Students can network with leaders in the fields of biochemistry and molecular biology and their peers. Each winner of the competition receives a $500 cash prize.

ELIGIBILITY

Each undergraduate who submits an abstract as the first author to an ASBMB topic category (#2000–2324) is eligible to apply for the competition.

The abstract submission deadline is Nov. 17.

HOW TO APPLY FOR THE COMPETITION

- In early February, eligible students will receive an emailed invitation to apply for the competition.
- Students should apply early! Spots for the competition are limited.
- After submitting an application, each student will receive an email receipt. The email receipt is not a registration confirmation.
- In late February, approved applicants will receive registration confirmations.

TRAVEL AWARDS

Visit the ASBMB website to learn about our undergraduate student travel awards and to apply. All undergraduate travel awardees are required to present at the ASBMB Undergraduate Poster Competition as well as at a regular poster session that is part of the main ASBMB meeting.

ASBMB '17
ANNUAL MEETING
CHICAGO | APRIL 22 – 26

Learn more about the 2017 meeting: www.asbmb.org/meeting2017

Are postdocs still invisible?

By Mike Schaller & Gary McDowell

In 1969, the National Research Council published a report entitled "The Invisible University." It was referring to the status of postdoctoral researchers, or "postdocs," as a rarely appreciated part of academe despite being essential to producing the future leaders of the research enterprise. This status prevented equitable compensation and opportunities for career development. Postdoctoral fellows had no voice to express their needs. While progress has been made and some institutions have developed exemplary postdoctoral training experiences, this type of training is not universal, and one factor contributing to the disparity of postdoc experiences is the diverse titles used to classify postdocs.

We already have too many names for "postdoc" to count. Even though the postdoctoral position is a crucial step on the academic career path and research productivity is highly dependent on their experience, postdoctoral researchers have been slotted into various designations across departments and institutions in a piecemeal and unregulated fashion. Their positions often depend on the hiring departments, international tax codes and grant requirements.

Academe is unable to count them (most often, individual institutions cannot even give an accurate figure for their own postdoctoral researcher population). Consequently, an unknown fraction of postdoctoral researchers are missing institutional training opportunities designed to enhance career development beyond the laboratory, such as grant writing, mentoring and leadership. This invisibility also means that the range of postdoctoral benefits and salaries is vast, and individuals remain in postdoctoral positions for unknown periods of time. It is not unheard of for postdoctoral researchers to be on salaries of around $25,000 after more than a decade of experience. These incidents illustrate the difficulty in tracking the career development of postdoctoral researchers. We do not know who they are, how long they hold postdoctoral positions or where they go afterward. This means that a group recognized federally as both trainees and employees and mostly federally funded is largely an unknown entity both in demographics and training. This is a very real barrier to efforts to establish how postdoctoral researchers are contributing to the society that invests in them beyond research output. It is also a hurdle to creating a diverse and highly trained professoriate.

We are proposing a reform of postdoctoral categorization. Institutions should collect all postdoctoral hires into one grouping labeled "postdoc" that can then be broken down into as many subtitles as the institution wishes. For example, an institution may choose three titles: "postdoctoral employee," "postdoctoral fellow" and "postdoctoral fellow paid direct." All three titles would be allotted the same career-development opportunities and would participate in the same postdoctoral benefits program. The first classification, "postdoctoral employee," would be paid from a grant. "Postdoctoral fellow" would refer to those paid by the institutional allowance attached to a fellowship. "Postdoctoral fellow paid direct" would mean those paid with funds made available for benefits paid directly to the postdoc. In collaboration with institutions and human resources groups, we are preparing a detailed plan to provide guidance for implementation, comparing best practices and common challenges to establish the plan.

This proposed change comes at an important time, given the new regulations regarding salary exemptions for overtime pay through the Fair Labor Standards Act. Institutions will need to track postdoctoral trainees to demonstrate compliance with these and other federal regulations. What we propose will lessen the administrative and, potentially, legal burden for institutions in addition to providing equitable training opportunities and aiding in the analysis of this critical population in academe.



Mike Schaller (mschaller@hsc.wvu.edu) is a member of the American Society for Biochemistry and Molecular Biology Public Affairs Advisory Committee and chairman of the Department of Biochemistry at West Virginia University School of Medicine. Gary McDowell (garymcdow@gmail.com) is the executive director of the nonprofit organization Future of Research and a resident at Manylabs.

2017 Special Symposia Line Up

ASBMB members save $50 on meeting registration.

Evolution and Core Processes in Gene Expression
Organizers: Julia Zeitlinger, Stowers Inst., David Arnosti, Michigan State Univ., Justin Fay, Washington Univ. in St. Louis
July 13 – 16, 2017, Kansas City, Mo.

Transforming Undergraduate Education in the Molecular Life Sciences
Organizers: Michael Carastro, Univ. of Tampa, J. Ellis Bell, Univ. of San Diego, Jim Lawrence, Univ. of Wisconsin, Stevens Point, Regina Stevens-Truss, Kalamazoo College
July 20 – 23, 2017, Tampa, Fl.

Membrane-Anchored Serine Proteases
Organizers: Qingyu Wu, Cleveland Clinic, Karin List, Wayne State Univ, Sch. of Med.
Sept. 14 – 17, 2017, Potomac, Md.

Emerging Roles for the Nucleolus
Organizers: Jennifer Gerton, Stowers Inst., Thoru Pederson, Univ. of Massachusetts Med. Sch.
Oct. 26 – 29, 2017, Kansas City, Mo.

ASBMB
American Society for Biochemistry and Molecular Biology

www.asbmb.org/specialsymposia/2017

Upcoming ASBMB events and deadlines

NOV

Nov. 9–12: Annual Biomedical Research Conference for Minority Students, booth #701, Tampa, Fla.
Nov. 17: Abstract submission deadline for ASBMB 2017 Annual Meeting, Chicago

DEC

Dec. 1: Travel award deadline for the ASBMB 2017 Annual Meeting, Chicago
Dec. 1: Deadlie for 2018 Special Symposia proposals
Dec. 3–7: American Society for Cell Biology annual meeting, booth #835, San Francisco

ASBMB
American Society for Biochemistry and Molecular Biology

Exemplifying Sewer's commitment to diversity

Minority Affairs Committee announces scholarship winners

By Andrew Macintyre

This year's recipients of the Marion B. Sewer Distinguished Scholarship for Undergraduates exemplify the late Sewer's unwavering commitment to biomedical research and workforce diversity and inclusion. The highly accomplished Sewer was a professor of pharmacology at the University of California, San Diego, and former deputy chair of the American Society for Biochemistry and Molecular Biology Minority Affairs Committee. Sewer died in January.

Sewer believed in doing community service for the biomedical research enterprise and played a key role in organizing the ASBMB's grant-writing workshop. This workshop is now a central component of the MAC's Interactive Mentoring Activities for Grantsmanship Enhancement, or IMAGE, mentorship program for senior postdoctoral scholars and junior faculty.

In recognition of Sewer's untiring commitment to the support of underserved populations in the biomedical research community, the ASBMB established the Marion B. Sewer Distinguished Scholarship for Undergraduates in March.

The scholarship provides tuition support for ASBMB undergraduate members who excel academically and are committed to enhancing diversity in science. To apply, students have to explain how they foster diversity on their campus or in the scientific community, outline how a scholarship will help them reach their career goals, and describe the challenges they have conquered while pursuing their education.

Applications for the 2016 scholarship were evaluated by members of the MAC and Student Chapters Steering Committee. There were a number of exceptional applications from which it was evident that many of the society's undergraduate members are both actively engaged with their local communities and enthusiastic about building an inclusive scientific environment. After extensive discussion, the reviewers identified five students whose scientific and service accomplishments best align with the goals of the scholarship.

The following are the 2016 recipients of the Marion B. Sewer Distinguished Scholarship for Undergraduates.

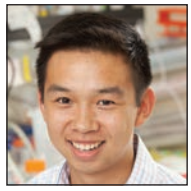
Samantha Brown (Yale University)

For the past three years, Samantha Brown has acted as a tutor and mentor for juvenile inmates at correctional facilities throughout the state of Connecticut via the Yale Undergraduate Prison Project. Brown works one-on-one with inmates to build their writing and math skills. In addition, she coordinates the project's post-GED program, a weekly roundtable discussion for inmates who already have either a high-school diploma or a GED.

In addition to working with inmates, Brown established a partnership between Yale students and A Better Chance House, a residential program for academically talented young people of color. ABC House brings ABC scholars together to attend high school and helps them to prepare for leading four-year colleges and universities. Through the partnership, Yale tutors help the scholars with homework, exam preparation, and other academic and personal challenges.

Besides her community service, Brown has undertaken two neuroscience research internships at the pharmaceutical company Pfizer. For the past year, she has been working in a research lab at Yale to understand better the neuroscience of nicotine addiction. Once she graduates, Brown aims to continue to explore the molecular mechanisms of brain disorders by obtaining an M.D.–Ph.D. degree.

Matthew Cheung (Saint Louis University)



Matthew Cheung previously received an ASBMB distinguished undergraduate scholarship when he was a rising junior at Saint Louis University. After receiving the scholarship, he spent a summer performing research at Washington University through the Amgen

Scholars program. Now a senior undergraduate, Cheung continues to serve as a resident adviser for the Health Sciences Learning Community at Saint Louis and recently won the Excellence in Community Building Award from the department of housing and resident life.

After graduating, Cheung intends to undertake postbaccalaureate training at the National Institutes of Health and become a physician-scientist. After completing an M.D.–Ph.D. degree, he says, he intends to "run my own disease-specific outpatient clinic while simultaneously running a laboratory that aims to elucidate the underlying mechanisms of that disease."

Wesley Godfrey (University of Texas at Austin)

Wesley Godfrey is studying biology at the University of Texas at Austin, where he also is performing research on T-cell acute lymphoblastic leukemia. Once he graduates, he intends to combine his research and clinical interests by obtaining an M.D.–Ph.D. degree.

Godfrey was raised largely by his Mexican-American grandparents in El Paso, Texas, a few miles from the U.S.–Mexico border. He speaks both English and Spanish. Godfrey volunteers with UTeach Outreach, a program in which college students teach weekly science lessons to students living in disadvantaged neighborhoods around Austin. While the lessons are taught in English, the students often come from Spanish-speaking homes. "I would often explain concepts in Spanish to students who couldn't understand," wrote Godfrey in his application for a scholarship. "Because I spoke Spanish, I was able to connect better with the students and made a bigger impact than if I only spoke English."

Sofia Gonzalez (Truman State University)

Sofia Gonzalez has worked on research projects at Purdue University, A.T. Still University and the Scripps Research Institute. "Research is more complex than a test" in class, wrote Gonzalez in her application. "I find that (it) favors how I look at science and the world."

Currently in her final year at Truman State University in Missouri, Gonzalez intends to obtain a Ph.D. and pursue her passion for research. "I find immense satisfaction in knowing that I am contributing a small drop to the sea of knowledge that is required for improving science," she said with enthusiasm.

For the past two years, Gonzalez has led United Speakers, an on-campus organization that works with the local immigrant community to break down barriers by providing ACT prep and classes in English. Gonzalez herself is an immigrant from Mexico, and she aims to continue her outreach and tutoring work when she goes to graduate school. Indeed, in her scholarship application, Gonzalez noted that "it is a privilege to have the trust of people who have experienced the world in such a different manner."

Austin Maduka (University of Maryland, Baltimore County)

Despite growing up in an environment where science was not emphasized as a career path for young black men, Austin Maduka pursued his interest in chemistry and biology throughout high school. He was accepted into the prestigious Meyerhoff Scholarship Program at the University of Maryland, Baltimore County, and he now serves as a peer adviser to junior participants in the program. "I can accredit much of my success to the support I found within the Meyerhoff program," wrote Maduka in his application. "It is important for every student who faces barriers to education to develop a network of support, academically, socially and emotionally."

Maduka has helped found a number of programs to mentor and support students interested in pursuing careers in science and medicine. He is a founding member of the first professional fraternity at the UMBC, the Phi Delta Epsilon Medical Fraternity. He is also vice president and co-founder of Achievement and Inspiration through Mentorship, which is an initiative to provide long-term mentoring to underserved adolescents in the city of Baltimore. AIM has more than 30 mentors, many of whom are working with black and Hispanic students interested in math and science.

Alongside his outreach activities, Maduka has worked in research labs at the Johns Hopkins University School of Medicine and the Massachusetts Institute of Technology. He presented his work from Johns Hopkins at the 2015 ASBMB annual meeting in Boston. After graduating, Maduka said he intends to earn an M.D.–Ph.D. degree, practice cardiology, and "teach and inspire the next generation of leaders in health care."

Andrew Macintyre (am277@duke.edu) was an education and professional development manager at the ASBMB. He now is a shared-resource laboratory manager at the Duke Human Vaccine Institute.

Diversifying the scientific workforce with IMAGE

By Takita Felder Sumter

The American Society for Biochemistry and Molecular Biology Minority Affairs Committee has a longstanding commitment to diversifying the workforce engaged in life-science research. Federally funded efforts to increase the number of underrepresented minority, or URM, undergraduates who pursue biomedical graduate training have been very successful in promoting the matriculation of these students into doctoral programs. In fact, the National Institute of General Medical Sciences Postbaccaulaureate Research Education Program matriculates 65 percent of its participants into Ph.D. programs; of these participants, 63 percent complete their Ph.D.s (1).

However, the growth in the number of doctorates awarded to URM students has not led to a commensurate number of URM individuals in tenure-track faculty positions or in higher-level administrative positions within academia. In fact, the number of URM STEM faculty members in tenure-track positions in the U.S. staggers below 10 percent. It is even lower at the rank of professor. We still need innovative approaches to address critical junctures in the biomedical career path where minorities drop out of the academic pipeline. Recent studies clearly have illustrated racial disparities in securing funding from the National Institutes of Health (2).

Based on an exploration into the barriers that URM investigators encounter when competing for federal funding, the MAC has been working on developing mentoring approaches to address these needs. As part of this effort, the MAC developed the Interactive Mentoring Activities for Grantsmanship Enhancement program, known as IMAGE, with generous support from the National Science Foundation. The program is designed to increase the number of federally funded minority faculty members as well as faculty members at minority-serving institutions to build a more inclusive scientific enterprise.

This long-term goal is being addressed by providing assistant professors and senior postdoctoral scientists with intensive mentoring on grantsmanship skills and career-development strategies. Although the program is open to everyone, we place particular focus on URM faculty members and faculty members at minority-serving institutions. The IMAGE program has a three-pronged approach:

At an annual workshop, mentors who have a demonstrated track record of securing federal funding share best practices on proposal preparation. They provide real-time feedback on potential specific aims. One-on-one guidance assists with proposal preparation and submission. A web-based interactive forum allows for the dissemination and exchange of career-development resources.

Data from the first three years of the program (2013, 2014 and 2015) indicate that 70 percent of participants felt that the feedback about their research objectives was likely to improve their grant-writing skills, and 80 percent found the interaction with the mentors valuable. Significantly, 44 percent of the 2013 cohort, 53 percent of the 2014 cohort and 39 percent of the 2015 cohort successfully secured federal funding, with 45 percent of these grant recipients being URM faculty members or faculty from minority-serving institutions. These data provide further support for the importance of mentoring in STEM disciplines with culturally competent role models. Given that 50 percent of the workshop mentors are URM faculty members, our outcomes emphasize the pivotal role that interactions between junior and senior URM faculty members can play in career development. These positive outcomes have provided the impetus for the 2016 grant writing workshop component of IMAGE that recently occurred in July. The workshop included the participation of several members of the MAC, including Suzanne Barbour at the University of Georgia, Squire Booker at the Pennsylvania State University, Sonia Flores at the University of Colorado School of Medicine, Christopher Meyer at the California State University and me. Booker, Flores and I were the workshop co-organizers.

This year's applications were solicited via advertisements on the ASBMB website and diversity mailing lists as well as through letters to department chairs. Application materials included a summary of the candidate's research interests and a letter of support from the department chair; these were reviewed with several goals in mind. First, we sought to identify projects that were well rationalized and were within the scope of the ASBMB's interests. Second, we aimed to have 30 to 50 percent of the mentees be URM senior postdoctoral fellows and assis-

The 2016 IMAGE workshop helped participants improve their grant-writing skills and provided career development opportunities.

tant professors or non-URM senior postdoctoral fellows and assistant professors from minority-serving institutions. Finally, we aimed for gender and geographical diversity. These selection criteria resulted in a dynamic cohort.

The workshop agenda included presentations from program officers from the NSF (Christopher Meyer and Wilson Francisco) and the NIH (Vernon Anderson from NIGMS). We also conducted an NSF proposal review panel and held presentations on the elements of a successful proposal, such as how to respond to reviewers in proposal resubmissions; how the NSF and NIH differ with respect to funding; and general faculty-life issues, including managing productive collaborations. The most significant portion of the three-day workshop experience was dedicated to 15- to 20-minute presentations from all mentees. The workshop participants provided an overview of a potential research proposal, which included a discussion of the research area, the central hypothesis to be addressed, preliminary data, experimental approaches, and future directions in a low-risk and safe-space peer-review setting. Presentations were clustered based on research topic (e.g., molecular biology, enzymology). Mentors and other attendees provided feedback and suggestions. Examples of mentors' suggestions included providing more preliminary data, suggesting collaborators, focusing the research plan, and targeting another funding agencies (such as the Department of Defense or the Research Corporation). Additionally, the participants received guidance on how to integrate feedback from the workshop into proposal revisions during a presentation by a recent workshop attendee and CAREER award winner, Rick Page at Miami University.

In addition to networking opportunities, a final component of the workshop was a panel discussion on balancing research, teaching and service, professional ethics, research ethics (led by William Trenkle from the U.S. Department of Health and Human Services Office of Research Integrity), broader impacts (led by Jory Weintraub from Duke University), and managing collaborations and navigating departmental politics. The various types of programmatic activities helped mentees interact with mentors and NIH and NSF funding officials. Mentees also got opportunities to interact with each other. In the future, mentees also will have an invaluable opportunity to receive guidance with proposal writing and revisions from ASBMB members with expertise in the given area. Please contact us if you have an interest in mentoring these bright young scientists.

We conclude that the use of a multipronged approach to providing opportunities for career development, networking and scientific exchange is critical to diversifying the STEM workforce. The members of the MAC and I use this article as a call to action for broadening the future of the life-science enterprise.

REFERENCES

1. Hall, A. *et al.* Analysis of Scholar Outcomes for the NIGMS Postbaccalaureate Research Education Program (2015).
2. Ginther, D. *Science* **333**, 1015–1019 (2011).

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Cultivating a focus on diversity as a community

By Beronda L. Montgomery

This essay is in response to the call in the February 2016 issue of ASBMB Today for thoughts and opinions about diversity in the scientific enterprise.

Recent national conversations regarding race relationships and interactions across diverse demographic groups do not stop at the doors of our laboratories, institutions or disciplinary societies, because science, education and research do not occur in vacuums. The national discussions provide opportunities for us to assess our efforts and commitment in terms of promoting diversity and inclusion as an American Society for Biochemistry and Molecular Biology community.

Indeed, in the context of these intense and needed discussions, there is a growing recognition in biochemistry and many other areas of STEM that efforts to increase access and success of diverse individuals continue to be an issue that requires targeted attention and effort, as there are perceptions in the ASBMB community itself that "although scientists say they want full equality, they don't do what's necessary to achieve it" (1). The specific roles and responsibilities that societies and professional associations have to all of their members are critical, and we continue to grapple with what discrete actions flow from those responsibilities.

Disciplinary societies serve as "an important organizational structure through which scientists build communities of practices, reward achievements, and enable members to share information" (2). Societies, including the ASBMB, have responsibilities to support and advocate for all society members in these endeavors. Frequently societies have a minority affairs or diversity committee. Indeed, the ASBMB has an active and effective Minority Affairs Committee whose efforts are laudable.

The ASBMB MAC oversees a number of efforts, including the Marion B. Sewer Distinguished Scholarship for Undergraduates, which recently changed its name to honor the prolific scholar and former MAC member Marion Sewer. The award provides financial support for recipients who are committed to enhancing diversity in science (see page 34). The Ruth Kirschstein Diversity in Science Award was established five years ago. The MAC also sponsors professional development activities that are supportive of members from underrepresented groups and members at large. These efforts include the Careers Beyond the Bench workshop, which highlights nonresearch-based careers and the Interactive Mentoring Activities for Grantsmanship Enhancement, or IMAGE, grant writing workshop for early career scholars transitioning to independence (see page 36). The careers of diverse ASBMB members also are highlighted in the Research Spotlight forum.

One collaborative effort between the MAC and the ASBMB Student Chapters Steering Committee is the Minority Serving Institutions student chapters partnership program. This program encourages the formation of new ASBMB student chapters at MSIs by partnering MSI faculty interested in starting a chapter with faculty who are running established student chapters.

These programs are just a sampling of efforts spearheaded by entities such as the ASBMB MAC. Such efforts are still critical, as targeted attention to the inclusion of individuals from groups under-represented in particular STEM fields can lead to short- and long-term change and opportunities.

As we consider the roles and actions that societies, such as the ASBMB, currently are taking and those that stand yet to be realized, there are many questions to contemplate. Have our societies actively recruited and engaged a membership that reflects national demographics? If not, why? The easy answer may be that the pool of potential members from which the society draws does not reflect national diversity. If that is indeed the case, what efforts can the ASBMB make jointly as a society to contribute to changing that? An additional question to reflect on is "Are the efforts of the society actively supporting all of its current members independent of the demographic group of origin?"

Why the targeted focus on the role of societies such as the ASBMB? In the "Summary of the broadening participation working group report on the NSF response to the Committee on Equal Opportunities in Science and Engineering's 2011–2012 recommendation," scientific societies specifically were highlighted as important for their potential to "play a major role in deploying best practices to the community and pursuing broadening participation."

Professional societies also have impactful roles to play in assisting in quantifying progress toward improving recruitment, retention and success of underrepresented groups, such as women of color (3). Society-driven initiatives can both motivate and serve members seeking specific and effective avenues to engage in broadening participation and outreach activities. Such collaborative attention from society members has great potential for increasing the impact of societies in seeking and disseminating best practices as well as promoting its members to serve a diverse pool of scientists effectively.

Among many strategies that have proved effective for increasing access and success for individuals from diverse backgrounds, mentoring has emerged as a critical factor in promoting recruitment, retention and persistence. Many societies, including the ASBMB, have visible efforts in mentoring, including the ASBMB's aforementioned professional-development workshops. While professional development interventions improve individual access to communities such as the ASBMB and success in individual careers, research also has indicated that long-term transformation of communities into ones that serve a broad array of individuals from diverse backgrounds also includes targeted attention to assessing community or organizational climate and culture (4–7).

Here, an opportunity emerges to initiate internal discussions about the breadth and depth of our knowledge and understanding of the ASBMB's organizational culture and its potential for ensuring long-lasting change that will broaden participation of current and future members. Are the individuals that we attract to the ASBMB through outreach and intake efforts and the work of the ASBMB MAC to increase visibility of diverse members finding a welcoming environment in the ASBMB and at our annual meetings once they arrive? Are they seeing diverse members recognized and celebrated broadly — that is, outside of the recognized "diversity-sponsored" places and avenues? Such an effort will require the input and buy-in of many across the ASBMB and strategic collaboration to be effective.

There is evidence emerging from the efforts of a range of societies regarding efforts to increase representation of women and individuals from groups underrepresented in STEM in society activities and annual meetings. Recent research indicates that ensuring that the programming committee is aware of gender statistics results in a significant increase in the number of female speakers at symposia and conferences (8–10). Similar results are likely to emerge in regards to targeted interventions for diversifying symposia organizers across many demographic groups.

It is time that we as members of the ASBMB and, indeed, the larger society in which we belong, truly ask what our specific roles may be in transforming our spaces into ones that fully embrace, engage and celebrate everyone openly and in the most public and accessible spaces and ways.

REFERENCES

1. Dockett, L. & Hopp, A. *ASBMB Today* **15**, 2 (2016).
2. Frehill, L. M. *Disciplinary societies' role in women's status in chemical science, computer science, and mathematics*. In "Blueprint for the Future: Framining the Issues of Women in Science in a Global Context" (Didion, C., Frehill, L. M., and Pearson, W. eds.), National Academies Press, 101–104 (2012).
3. Frehill, L. M., & Ivie, R. *New Directions for Higher Education* **2013**, 7–21 (2013).
4. Whittaker, J. A., & Montgomery, B. L. *JUNE* **11**, A44–A51 (2012).
5. Whittaker, J. A., & Montgomery, B. L. *Innov High Educ* **39**, 263–275 (2014).
6. Whittaker, J. A. *et al. JUNE* **13**, A136–A145 (2015).
7. Zambrana, R. E. *et al. Am Educ Res J* **52**, 40–72 (2015).
8. Sardelis, S. & Drew, J. A. *PLoS ONE* **11**, e0160015 (2016).
9. Casadevall, A. & Handelsman, *mBio* **5**, e00846–e00813 (2014).
10. Casadevall, A. *mBio* **6**, e01146–e01115 (2015).

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Wrestling with life

By Zachary A. Kemmerer

PHOTO BY LARRY SLATER

Kemmerer wrestled while in college.

When I was 5 years old, I stepped on a wrestling mat and began to dedicate my entire youth to the sport. As a product of a violent, broken family, I held wrestling as my golden ticket to the American Dream. I wanted family dinners and bedtime hugs. Instead, division and foul rhetoric filled the air. My parents separated when I was 7, and I spent most of my childhood with my dad. Sadly, our relationship dynamic mirrored the battles on the wrestling mat. If I won a match, life at home was peaceful; if I lost, my life was unpleasant for weeks at a time. I was scared in my own home more often than I care to remember. At a young age, I reasoned that wrestling could rescue me from that life: I could be the first in my family to go to college, get a good job and start a family of my own. The right way. Someday.

In my hometown of Linfield, Pennsylvania, a small suburb one hour northwest of Philadelphia, I put countless hours, blood, sweat and tears into mastering this art. I sacrificed my body and mind for a dream. In doing so, I became the winningest wrestler of all time in high-school wrestling history in the state of Pennsylvania and earned two state championships along the way. I was recruited as the No. 1 overall wrestler in the country. This sacrifice landed me at the University of Pennsylvania.

Embracing the grind

As a Division 1 wrestler at UPenn, my life was often chaotic. Juggling academics and athletics, I constantly was competing both in the classroom to survive the grading curve and on the mat to outlast my opponent.

UPenn was the blacksmith of my character development as I continued my wrestling career while doing a double major in chemistry and philosophy as an undergraduate student. Although many college students call themselves student-athletes, the life of a wrestler required a special kind of sacrifice and discipline to be successful.

Just take a typical Wednesday morning during my junior year. Our first practice of the day had just finished at 7 a.m. My vision blurred as I kneeled on the mat, replaying what just happened in my mind. After a brief warm-up and 45 minutes of drilling, my wrestling partner and I had engaged in a 30-minute nonstop grind match. Thirty minutes to out-think, outmaneuver and outperform my partner. A clash of wills played out in those 1,800 seconds as we tried to break each other down, both mentally and physically, with a constant barrage of shots, jarring head snaps and counterattacks.

When my vision returned, I looked down to see a puddle of sweat had formed beneath me. Despite having reached a state of complete physical and mental exhaustion, I had barely begun my day. I still had several more pounds to lose before my upcoming dual meet with national powerhouse Cornell University's wrestling team, and I needed to prepare for my physical chemistry exam the next day. I closed my eyes, took a deep breath and slowly exhaled. I knew the real challenge had yet to come. This challenge was an internal one in which I would wrestle with the uncomfortable and daunting nature of my situation. My path ahead was steep. But I refused to quit and take the easy way

out. I continued to push forward.

I learned not to resent or fear the tasks before me but rather to embrace the discomfort. Each day in college, I redefined my notion of impossible on the wrestling mat and in the classroom until the concept of impossible didn't exist in my mind.

The rush of discovery

In 2011, I earned All-American honors at the national wrestling tournament held in Philadelphia. I ended my wrestling career with 117 wins, which was good enough for fourth overall standing in UPenn wrestling history.

When my wrestling career ended, I was thrown into a period of self-discovery. How does my next chapter read? After declining an opportunity to work in industry, I started in the master's chemistry program at Villanova University.

There, I joined the laboratory of Aimee Eggler, a chemistry professor. I was given the opportunity to delve into research on the cytoprotective response of phytochemicals via the Nrf2 transcription factor. I remember the rush I got from reading new literature, bouncing from one reference to another, immersing myself in the field. PubMed was a conduit to mechanisms and models, catalytic residues and new therapeutics. The Nrf2 field was spilling over into metabolic regulation and carcinogenesis, yet definitive identification of the Nrf2 protein was still far from trivial.

I yearned for answers to the number of gaps apparent even to an untrained eye. I wanted to find those answers. Once I picked up a pipette, I knew science was my new passion.

Climbing into science

My two years at Villanova as a master's student were countless 12-hour days and weekends in the lab, many months of searching for funding, and drafting manuscripts. I also juggled

PHOTO BY JOE ROBBINS/NBC

Kemmerer's stage name is "The Science Ninja" on the NBC reality show "American Ninja Warrior."

teaching responsibilities and mentoring undergraduate researchers.

But I didn't want the grind to end! So I decided to pursue a Ph.D. With a competitive resume in hand, I accepted an offer to join the biochemistry Ph.D. program at the University of Wisconsin–Madison.

The transition was not easy. I was leaving Pennsylvania for the first time in my life to begin a journey quite different from what I was accustomed to. Academia and wrestling are two professions rarely associated with one another: I was climbing up the ivory tower after dedicating my life to a blue-collar sport. I felt out of place. Everyone seemed more qualified than me. My peers had known for years that a Ph.D. was their next step. I had not. My peers knew techniques and terms that I never had encountered as well as names and papers that I had not seen. I distinctly remember the embarrassment I felt having never purified a recombinant protein. I had a basic understanding of bacterial overexpression, but I couldn't explain the difference between IPTG-inducible and auto-induction protein expression. Ion exchange chromatography made sense in a textbook, but in a laboratory setting I couldn't distinguish between the HiTrap SP, Q, DEAE or CM columns. And unfortunately, Stuart Schreiber and Jennifer Doudna were just ordinary names to me. I thought I had made a terrible mistake.

I later realized that I was not alone in my insecurity. My classmates were all just as scared to embark on this journey, but we adapted. We placed our faith in the investigative process and embraced the daily challenges and endless questions in the world of science.

Powered by mitochondria

I joined Dave Pagliarini's group to do my thesis work. I am now a third-year graduate student. The Pagliarini group focuses on elucidating the biological role of mitochondrial uncharacterized proteins. For my thesis project, I am using protein engineering and chemical biology to study Coq8p, a protein required for coenzyme Q biosynthesis. Coenzyme Q is a requisite part of the electron transport chain that enables ATP production via oxidative phosphorylation. CoQ deficiency is associated with a wide range of diseases, including cerebellar ataxia, nephrotic syndrome and various myopathies. It also is associated with

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chronic disease states, such as diabetes, Parkinson's disease and general aging. CoQ supplements are used by roughly 3.5 million Americans nationwide either as a therapeutic or for general health purposes. Unfortunately, the efficacy of CoQ supplementation is still clinically unclear.

My current work is aimed at improving our understanding of CoQ biosynthesis to develop more effective therapeutics for raising endogenous CoQ levels. I love my work.

Becoming 'The Science Ninja'

Success never is achieved alone. Friends, coaches and research mentors all have contributed to my success. I am especially indebted to Tom Hontz (my high school wrestling coach), Jake Hunter (my best friend), Matt Valenti (my college assistant wrestling coach), and Aimee Eggler (my research adviser in the master's program). With their words and actions, they changed my life. They each provided invaluable guidance and unconditional support, two essential intangibles I rarely received at home growing up. Without their influence, this essay likely would read differently. Because of them, I believe that I should give back to society, so these days I engage in science outreach and youth wellness programs.

This past year, I volunteered with Adult Role Models in Science and Beat the Streets. Sharing my passion for science and wrestling with the Madison youth is beyond rewarding. When my students ask questions and acknowledge the proper controls, I know they are prepared for success. When my athletes stay after practice to run sprints with me, I know they are chasing a newfound dream. I see outreach as a ripple effect: Impacting one child can change the lives of so many more.

PHOTO COURTESTY OF ZACHARY KEMMERER

"Success never is achieved alone," says Kemmerer who is shown here with his girlfriend.

It was inspiration from both of these organizations and a passion for competition that landed me on NBC's hit reality TV show "American Ninja Warrior." For those of you who don't know, "American Ninja Warrior" selects interesting people to compete on the world's most exciting and difficult obstacle course. The show has become immensely popular, as it pits men and women against seemingly impossible obstacles. You cannot help but root for each competitor who steps up to the platform!

My first appearances on the show were on April 27 and 28 in Indianapolis, just six days after passing my preliminary exam that qualified me as a Ph.D. candidate. With five of six obstacles completed, I stared up at the infamous warped wall, the last obstacle. Nearly triple my height, this wall stood before me as a metaphor for life — a seemingly impossible task that I had to face head on.

As thousands of fans chanted, "Beat that wall! Beat that wall!" I steadied myself. I darted toward the incline, and, three big steps later, my fingers latched onto the top of the towering 14.5-foot wall. After an effortless mount, I hit my first buzzer and turned to the crowd as adrenaline crashed through my veins. In my rookie season, I completed the Indianapolis Qualifier course, placing 15th out of 120 competitors.

For the show, I adopted a stage name "The Science Ninja." It seemed appropriate, as the past four years of my life had been dedicated to advancing basic science. As a mitochondria enthusiast, I study the organelle and the pathways that enable me to scale a 14.5-foot wall. My diet is connected to energy production and metabolic homeostasis while I compete. An intricate nexus of metabolism, nutrition and fitness is revealed within my intellectual interests, athletic endeavors and extracurricular passions.

With my new ninja status, I have been granted a platform and a unique opportunity to promote science, health and fitness. Kids love ninjas, so maybe they'll like science ninjas just as much. And maybe, just maybe, I can impact their lives in a positive way just as my mentors and friends have done for me.

Zachary A. Kemmerer (zkemmerer@wisc.edu) is a third-year graduate student at University of Wisconsin–Madison. He also is training to become the next American Ninja Warrior.

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Re: "A good little girl" (October 2016)

October's ASBMB Today featured an essay by the pseudonymous "Sydney Phlox" on academic institutional service. While the essay does raise valid concerns on the problem of balancing administrative workload in academia (a topic I also have written about: www.psblab.org/?p=282), its message is diluted by a somewhat sexist narrative, a cynical view on the importance of service for career development and a proposed solution that amounts to "screw the system." It bears remembering that such a complaint about the burden of being involved in decision-making roles in academia comes against a backdrop of decades of discussion regarding the lack of female representation in such roles.

Dr. Phlox begins with a series of personal anecdotes about male versus female student behavior, but the narrative quickly degenerates into sweeping statements in which various undesirable character traits are assigned exclusively to males. Hiding behind the universal disclaimer of "in my experience," Dr. Phlox tells us that all obstinate students are male and that various atrocious study habits never are seen in females.

The problem with such statements — particularly the use of words such as "all" or "never" — is the thin line between assignment of an undesirable characteristic exclusively to a people versus the assignment of an entire people to a given characteristic. A parallel example from racist language would be the phrase "all good math students are Asian," which is virtually indistinguishable from "all Asians are good at math." Both phrases are offensive despite their very different meanings. In her essay, Dr. Phlox claims all disobedience is male, without perhaps realizing this may be interpreted as implying all males are disobedient.

The second part of the essay is a critique of the value of institutional service in general, in which we hear anecdotes about committees Dr. Phlox has sat on being a "waste of time." While most academics can relate to at least some worthless administrative activity, there is a need for service to be looked at in ways other than "what's in it for me?" There are clearly numerous indirect mechanisms by which service can enhance one's career: Serving on a promotions committee can help with preparing your own packet. Serving on a National Institutes of Health study section undoubtedly improves your grant-writing skills. Exposure to the journal editing process results in crafting better responses to reviewers. Serving on an animal use committee may afford input on modifying regulations. Yes, committees are a time suck, but it is naïve to claim service is useless just because it does not lead to whatever direct personal gain one might anticipate.

The third problem with the essay is Dr. Phlox's proposed solution to an overburden of institutional service. Having built a case that males are perhaps better at saying no, her proposed solution is for females to get better at saying no. It does not take much logic to realize the dire consequences of a world in which everyone says no!

Clearly, there are areas of academic life where certain groups (males, if Dr. Phlox is to be believed) are not pulling their weight. When we see other academics shirking their community responsibility, it may be tempting to emulate them. But the result is a selfish race-to-the-bottom culture. In particular, if women say no more often, what will that do for their already poor representation in the decision-making processes of academia? Instead we should be thinking about how to get everyone to contribute, incentivize service for those who do not see its value and share administrative burdens more fairly. If we all become refuseniks, everyone loses.

— Paul S. Brookes, University of Rochester Medical Center

Re: A good little girl (October 2016)

OK, let's follow this to logical conclusions: We all quit reviewing. No reviews happen, and nothing gets published in a timely fashion. Administration does a further takeover of responsibilities, as faculty has abdicated them. No one is tending to admissions tasks, so you have no new students. Is that what functional academia looks like?

Why not encourage men to step it up and do the service work that is required to make the profession go, to stand up to the man who called you a good little girl and say "That's damned right, and you should be too?"

—Ann Taylor, Wabash College


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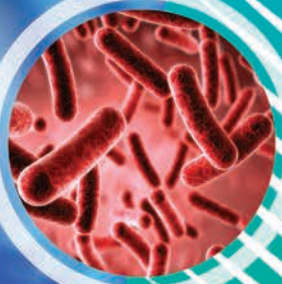

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- 2100 – Chemical Biology, Drug Discovery and Bioanalytical Methods
- 2120 – Systems Biology Technologies and Applications
- 2140 – Signal Transduction and Cellular Regulation
- 2180 – Microbial Systems and Parasitology
- 2200 – Metabolism and Bioenergetics
- 2220 – Lipids and Membranes
- 2240 – Cell and Organelle Dynamics
- 2300 – Education and Professional Development

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