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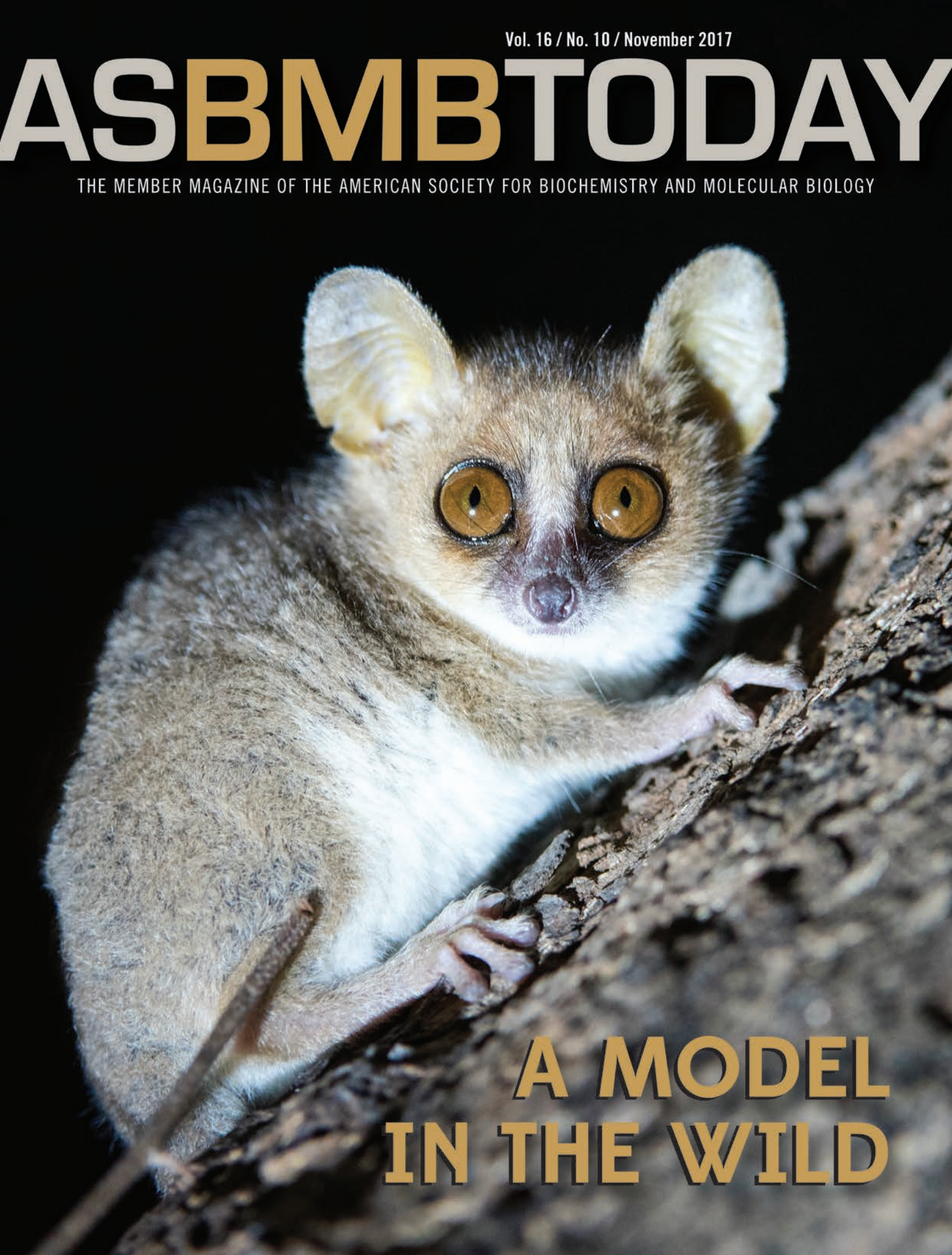
ASBMB TODAY

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



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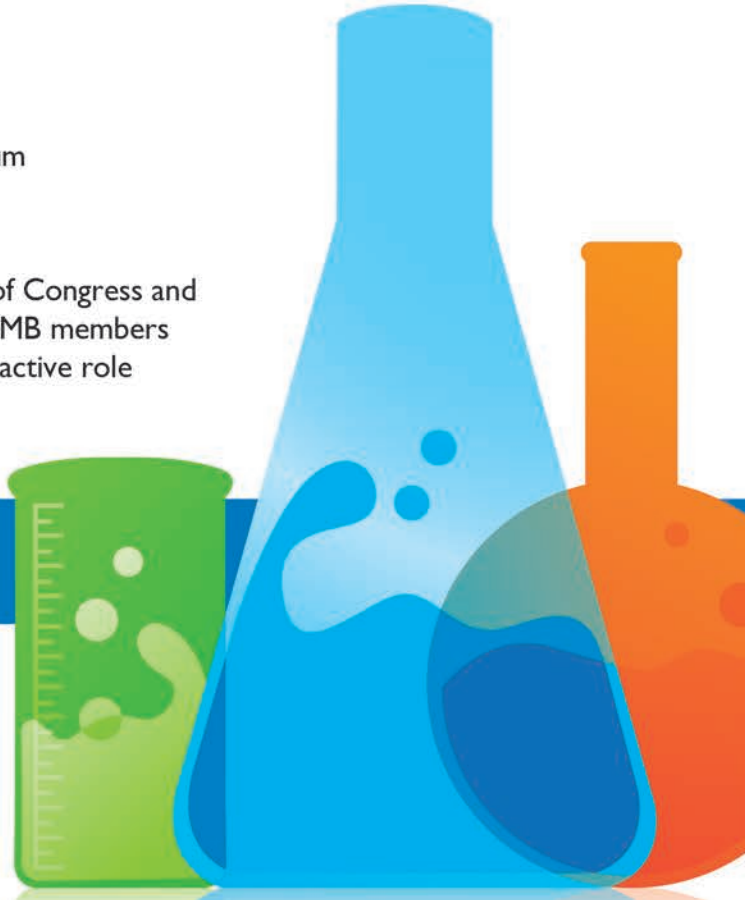

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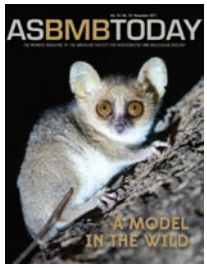

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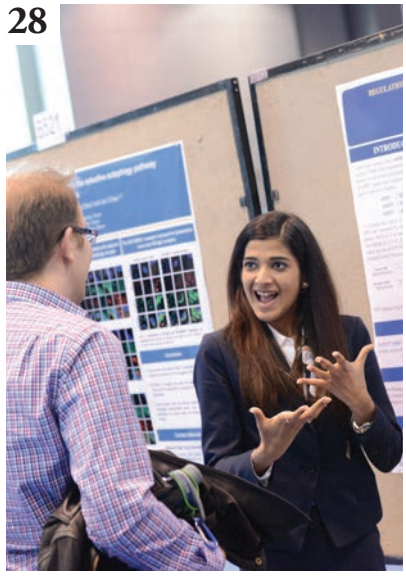

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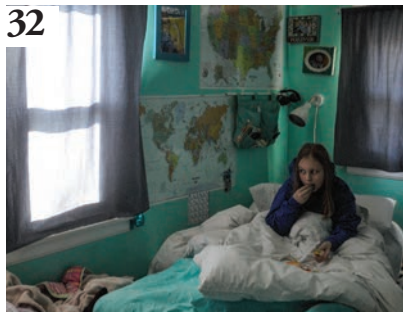

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ASBMB TODAY
THE MEMBER MAGAZINE OF THE AMERICAN SOCIETY FOR BIOCHEMISTRY AND MOLECULAR BIOLOGY

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It's time for advocacy

By Natalie Ahn

I try to not be vexed by what's in the news, but some days I just cannot help myself. The White House decision to end the Deferred Action for Childhood Arrivals program, or DACA, followed by a 70-point plan for tightening immigration, was a worrying addition to an increasingly nativist tone from our government and undue harassment and detention of individuals trying to travel.

I take this personally; my father is an immigrant, as were my mother's parents. The proposed plans discount the contributions by foreign-born residents to U.S. prosperity. In 2016, their economic impact was $2 trillion, as estimated by the National Academy of Sciences. The Cato Institute, a libertarian think tank, predicts that deportation of DACA recipients — who tend to be better educated, with 17 percent pursuing advanced degrees — would reduce economic growth by $280 billion over 10 years. A hard line on immigration policy impacts every enterprise, including the life sciences, where nearly 60 percent of postdoctoral fellows are temporary U.S. residents. The advances that we enjoy have always been fueled by the work of individuals from around the world, and the U.S. has been a training destination for decades. It is hard to see the logic of policies that jeopardize our ability to attract the best and brightest.

Beyond economic impact is the loss of dignity. At a recent American Society for Biochemistry and Molecular Biology Student Chapters Committee meeting, members told of undergraduates whose morale and confidence have been wrecked by a menacing political atmosphere. I see this in my own lab. Apprehension has stoked fear and anger in one of my trainees, undermining his ability to concentrate and be creative.

The ASBMB takes a forceful stand in this debate, with public statements and visits to Congress by the Public Affairs Advisory Committee, or PAAC, to explain the impact of hardline immigration and DACA policies on science. Stay abreast at the ASBMB Policy Blotter (policy.asbmb.org).

National policies affect all of us who care about maintaining a well-trained scientific workforce and a fertile environment for discovery. There is a need for scientists to unify voices, stand up and be heard on issues that will impact the future. Therefore, as we did in April when we marched in many cities, we must all contribute as advocates for science.

The PAAC has developed tools to teach us how to do this. They host webinars to provide us with information and training. They mobilize and teach us how to engage with our own congressional leaders via phone calls, letters and/or personal meetings, which is the most effective way to inform policy leaders about the impact of their decisions. Additionally, they monitor, research and respond to political and funding policies, and engage with legislative groups as well as federal funding agencies. I urge everyone to sign up now for the Grassroots Advocacy Network (asbmb.org/Advocacy). Get involved to sustain the future of scientific research.

And if you're not an ASBMB member, please join. If you're already a member, enlist a colleague. Help the society represent you — and work for you — by joining our community.

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

We're thinking about the future of funding — and looking for your two cents

By Benjamin Corb

The National Institutes of Health has issued not one but two proposals this year aimed at funding as many grants and as many investigators as possible, even if the pot of money for grants is not increasing. Specifically, NIH leaders are concerned about how to ensure that the research enterprise is taking the steps necessary to support the next generation of researchers.

In the spring, the NIH announced a plan for spreading funding more widely among funded investigators, the Grant Support Index, or GSI. Its goal was to cap the number of dollars an investigator could receive so as to ensure maximum productivity. The proposal received significant community comment, both supporting and opposing, and ultimately was abandoned by NIH leaders.

Out of the failed GSI came a new idea, the NIH's Next Generation Researcher Initiative, or NGRI, a plan to increase success rates for early-stage investigators and for investigators about to lose all their funding. The NIH would rearrange priorities to free up at least $210 million per year, ramping up eventually to $1.1 billion per year, to fund grants by early-career investigators within the 25th percentile of scored proposals. Additionally, more emphasis would be placed on existing programs to support early- and mid-career investigators, such as the NIH Common Fund's New Innovator Awards. The NIH also would develop and test metrics to assess and ensure that the initiative meets its goals. The NIH will develop NGRI implementation plans over the next year.

When introducing the NGRI, NIH Director Francis S. Collins wrote, "We are shifting toward a bold, more focused approach to bolster support to early- and mid-career investigators while we continue to work with experts on approaches to evaluate our research portfolio."

As we wrote in the ASBMB Policy Blotter this summer, the NGRI addresses the difficulties that early- and mid-career investigators face in getting funding for their research and aims to achieve long-term stability for those developing independent research careers.

The American Society for Biochemistry and Molecular Biology public affairs staff and Public Affairs Advisory Committee are providing the NIH with feedback on the NGRI as the plan develops — representing the needs of our community and working to see that NIH actions support young scientists but that the support is balanced and ensures a sustainable future. In fact, the PAAC cares so greatly about this issue that it has created a working group charged with proposing innovative ideas to support the next generation of scientists.

This is where you fit in! We invite you to help develop a proposal from the ground floor. Imagine you have a blank piece of paper:

- What are the largest issues facing the community today?
- What policies should be re-evaluated when it comes to supporting the next generation?
- What initiatives work in other places that the NIH should consider?

The PAAC urges you to reach out to us and share your thoughts. They can be as detailed or as broad as you like — a one-sentence comment or a 10-page proposal. We'll share and exchange ideas in this space and online. Together, we can build a case for where the NIH should focus its attention, assuming its intention is to support the next generation.

Post your comments under the topic "The future of funding" at asbmbtoday.submittable.com/submit.

Interested in science policy?

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

Hall wins Lasker Basic Medical Research award


HALL

Michael N. Hall, professor of biochemistry at the Biozentrum of the University of Basel, has received the 2017 Albert Lasker Basic Medical Research award.

Hall was recognized for his discoveries related to the nutrient-activated TOR proteins and their central role in the metabolic control of cell growth.

The Albert Lasker Basic Medical Research award is given to a scientist who makes a fundamental discovery that opens up a new area of biomedical science. It carries a $250,000 prize.

This award is one of several that comprise the Lasker awards program, established in 1945 by Albert and Mary Lasker to highlight significant biological and clinical research that improves human health.

Blair receives ACS Founders Award


BLAIR

Ian A. Blair has received the 2017 Founders Award from the American Chemical Society's Division of Chemical Toxicology. An expert in the use of mass spectrometry, Blair was honored for his outstanding research in chemical toxicology.

Blair has used mass spectrometry to identify biomarkers for carcinogenesis, cardiovascular disease and neurodegeneration. He also has used mass spectrometry to develop the technique of electron capture atmospheric pressure chemical ionization, which allows for high-sensitivity quantitative analyses of chiral biomolecules.

Blair is the A.N. Richards professor of pharmacology and director of the Center for Cancer Pharmacology at the Perelman School of Medicine at the University of Pennsylvania.

He received the award during a symposium held in his honor in August at the ACS national meeting.

In memoriam: Neil Madsen

Neil B. Madsen, emeritus professor of biochemistry at the University of Alberta, passed away of natural causes March 22. He was 89.


MADSEN

Madsen was born Feb. 8, 1928, in Grande Prairie, Alberta, Canada, to Anders and Rose Madsen. He received his undergraduate and graduate degrees from the University of Alberta in 1950 and 1952, respectively, before obtaining his Ph.D. from Washington University in 1956.

Madsen joined the faculty at the University of Alberta's department of chemistry in 1962. He stayed there for more than 30 years before retiring in 1993.

Madsen's research focused on the study of enzymes. Along with Robert Fletterick, Madsen discovered the structure of the enzyme glycogen phosphorylase. He also contributed research to a glycogen-debranching enzyme.

Madsen was president of the Canadian Society of Biological Sciences and a fellow of the Royal Society of Canada. Among his many accolades, Madsen received the Queen's Silver Jubilee medal as well as the Order of Canada.

He is survived by his sisters, Jean and Elizabeth; daughter, Maureen; and son, Ian.

Jarosz named Vallee Scholar


JAROSZ

Daniel Jarosz, assistant professor in the departments of chemical and systems biology and developmental biology at Stanford University, has been selected as a 2017 Vallee Scholar.

Supported by the Bert L. and N. Kuggie Vallee Foundation, the Vallee Scholars Program recognizes early-career scientists who demonstrate the ability to contribute significant and innovative research in the biomedical sciences.

Jarosz founded an independent research group at Stanford in 2013, where his research explores the molecular mechanisms that contribute to robustness and evolvability.

Jarosz completed his undergraduate studies at the University of Washington and received his Ph.D. from the Massachusetts Institute of Technology. He completed postdoctoral training at the Whitehead Institute.

The award provides $250,000 in discretionary funding for basic biomedical research.

Charpentier, Doudna share Albany med center prize


CHARPENTIER


DOUDNA

Emmanuelle Charpentier and Jennifer Doudna are among five scientists who will share the 2017 Albany Medical Center Prize in Medicine and Biomedical Research for their roles in developing CRISPR-Cas9.

CRISPR-Cas9

is a gene-editing technology that has revolutionized the field of genetics, allowing geneticists and researchers to modify specific parts of the genome.

Awarded since 2001, the Albany Medical Center Prize goes to a scientist or group of scientists whose research has contributed to advances in health care and scientific research. It carries a $500,000 award and is one of the largest prizes in medicine and science in the U.S.

CRISPR-Cas9 has shown the potential to aid in development of therapeutic treatments for a variety of diseases. This new technology has been praised for its simplicity, efficiency and versatility in gene engineering.

Charpentier is director of the department of regulation in infection biology at the Max Planck Institute for Infection Biology, Berlin. Doudna is a professor of molecular and cell biology and chemistry at the University of California, Berkeley.

Curnutte joins board of Pliant Therapeutics

CURNUTTE

John Curnutte, executive vice president of research and development at Portola Pharmaceuticals, has been named to the board of directors at Pliant Therapeutics Inc.

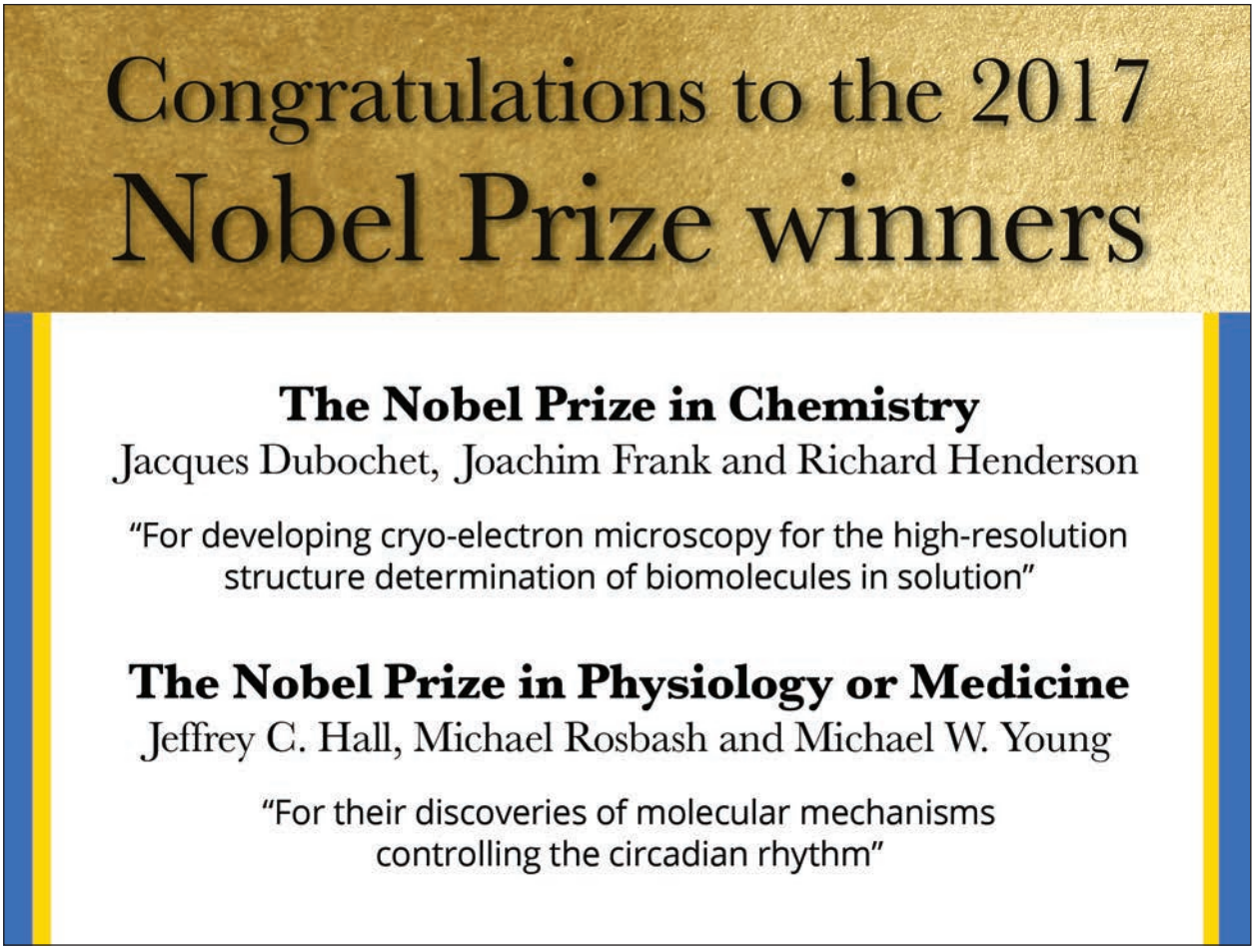
At Portola, Curnutte leads the company's research and development initiatives. He previously served as chief executive officer of 3-V Biosciences and as president at Schering-Plough Biopharma.

Curnutte received his undergraduate degree from Harvard University and his M.D. and Ph.D. from Harvard Medical School.

Pliant Therapeutics is a biotechnology company focused on discovering and developing treatments for fibrotic diseases through the therapeutic application of integrin biology and TGF-beta modulation.

Curnutte will use his leadership experience in biotechnology to help guide Pliant Therapeutics in its efforts to develop new medicines to aid fibrosis patients.

Erik Chaulk (echaulk@asbmb.org) is a peer-review coordinator and digital publications web specialist at the ASBMB.



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Ph.D. student wins Tabor award for long-distance factor work

By Amber Lucas

How do complex multicellular organisms coordinate the functions of distant tissues and organs to facilitate whole-system responses to stimuli? How does one small signaling molecule secreted in one area of an organism travel long distances to communicate with a distant organ? These are the questions Harvard graduate student Ilia Droujinine is addressing, and for his work on the proteomics of protein trafficking in the underexplored area of long-distance biological communication, he is a recent winner of the Journal of Biological Chemistry/Herb Tabor Young Investigator Award.

Complex organisms must be able to coordinate multiple tissues and organs to maintain homeostasis as a whole system. To do this, organisms use secreted factors to perform long-distance biological communication, although the mechanism for this is still largely a mystery. Droujinine's work builds on this theme by developing methods for systematic identification of interorgan communication factors.

Using Drosophila as a model organism, Droujinine and colleagues established a novel high-throughput technique for identifying proteins that were trafficked from one organ directly to another for communication. The researchers then were able to use organ-specific mutants to characterize the explicit functions of these factors as interorgan communicators. This method is widely applicable and could be used to understand the function of these communication factors in many model organisms, including mammals. Deeper understanding of long-distance communication factors is important for unraveling how local organ misfunction, such as kidney failure, can have widespread systemic effects that go far beyond what is thought to be the organ's primary function.

COURTESY OF ILIA DROUJININE

Ilia Droujinine was nominated for the JBC/Tabor award in July after the Federation of American Societies for Experimental Biology conference, Glucose Transport: Gateway to Metabolic Systems Biology.

"This research is important because many diseases have systemic effects, and the functions of organs are interconnected with one another," Droujinine said. "Many of the factors we identified are conserved to mammals, and further research will determine the function of these factors in mammals."

Droujinine was nominated for the award by JBC Associate Editor Jeffrey Pessin after the Glucose Transport: Gateway to Metabolic Systems Biology meeting in July.

"At the meeting, he truly stood out as an outstanding young scientist at several levels," Pessin said. "His oral and poster presentation was outstanding in terms of his understanding and creativeness, and the project itself is highly novel and cutting-edge. His work will provide the scientific community with a powerful new approach to perform in vivo proteomics to identify tissue-specific secreted protein factors."

Droujinine received his Bachelor of Science in biochemistry at the University of Waterloo in 2011 before joining Norbert Perrimon's lab at Harvard Medical School to pursue his Ph.D. His work in the lab has been supported by a Natural Sciences and Engineering Research Council postgraduate scholarship, the Brigham and Women's Hospital Osher Center for Integrative Medicine, and the Harvard Medical School Department of Cell Biology Innovation Grant Program. After six years at Harvard, his interest in long-distance biological communication is stronger than ever.

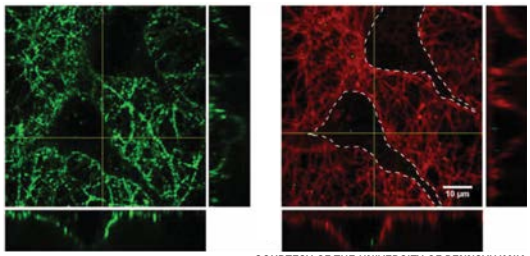
"My favorite part of research is making sense of results after years of investigation," Droujinine said. "I want to continue a career in academia after I graduate with my Ph.D., pursuing my interest in identifying factors involved in long-distance biological communication."

Amber Lucas (aluca685@gmail.com) is a graduate student in the Department of Biological Sciences at Carnegie Mellon University.

Tracing the path of Parkinson's disease proteins

By Sasha Mushegian

As neurodegenerative disorders such as Parkinson's and Alzheimer's disease progress, misfolded proteins clump together in neurons, recruiting normal proteins in the cell to also misfold and aggregate. Cells in which this occurs degenerate and eventually die. Being able to keep an eye on the whereabouts of these corrupted proteins is key to unraveling these diseases and developing cures.



COURTESY OF THE UNIVERSITY OF PENNSYLVANIA

These images show cell cultures treated with fluorescently labeled synthetic alpha-synuclein fibrils. Treatment with trypan blue dye (right) extinguishes fluorescence of extracellular fibrils, allowing the fibrils taken up by cells to be quantified.

A team of researchers has now developed a set of tools to observe, monitor and quantify how misfolded proteins associated with Parkinson's disease enter neurons in laboratory cultures and what happens to them once they're inside. The results were published recently in the **Journal of Biological Chemistry**.

Alpha-synuclein is a protein found in all neurons, where it is thought to be involved in regulating neurotransmitter release. Incorrectly folded alpha-synuclein sticks together, forming fibrous deposits called amyloid fibrils. These are the main components of Lewy bodies, the masses seen in the neurons of Parkinson's patients.

In 2011, Virginia Lee's group at the Center for Neurodegenerative Disease Research at the University of Pennsylvania showed that if lab-produced alpha-synuclein fibrils were added to neurons growing in a dish, the neurons would develop Lewy bodies and display other symptoms of neurodegeneration. This study and others hinted that misfolded alpha-synuclein could spread from cell to cell, rather than forming anew in every individual cell. However, there was no way to directly observe the initial steps of alpha-synuclein fibrils entering cells.

"Our understanding of neurodegenerative disease — or even the normal function of the healthy brain, for that matter — is limited by the techniques we currently have at our disposal," said Richard Karpowicz Jr., a postdoc in Lee's lab who led the new study.

Karpowicz devised a simple but sensitive method to visualize alpha-synuclein fibrils entering cells. First, he cultured neurons and synthesized alpha-synuclein fibrils tagged with fluorescent proteins. Next, he put the cells and fluorescent fibrils in a dish together. Then he added a dye, called trypan blue, that turns off fluorescent tags. Importantly, this dye cannot pass through intact cell membranes, which means it cannot turn off tags that are already inside cells. Once he added the dye, the glowing fibrils outside of cells turned off, but the ones that had already entered the cell continued to glow, allowing him to visualize and count the internalized fibrils.

Furthermore, in collaboration with E. James Petersson's research group in the Department of Chemistry at the University of Pennsylvania, the researchers also developed fibrils labeled with long-lasting fluorescent tags that were either sensitive or insensitive to acidity. Based on whether the fluorescence was visible, the researchers could determine when the fibrils entered acidic compartments in the cell, allowing them to deduce the cellular processes that acted on the fibrils.

Using these methods, the team was able to gain several insights into the fate of fibrils entering cells. They found that fibrils were actively engulfed by the cell membrane and transported to the lysosomes, the cell's waste disposal compartment, where most of the fibrils remained for days. "It's amazing how much the cell is able to sequester," Karpowicz said. But despite the cells' best efforts, some fibrils found their way out of the lysosomes and induced protein aggregation.

When the researchers added chloroquine to the cells to inhibit lysosomal activity, more and more of the native alpha-synuclein was recruited to form aggregates. Lysosomal dysfunction is often observed in patients with neurodegenerative diseases. "We know that some of (the pathological proteins), somehow, get out of the lysosomes," Lee said. "But we don't know how that happens."

But being able to accurately quantify the amount of fibrils taken up will allow researchers to rapidly screen potential pharmacological compounds that could one day be used to stop the spread of the corrupted proteins in a patient. "Once you can look at (fibril) uptake into the cell and quantify how much is inside the cell, then you can add small molecules to it to see if you can reduce uptake," Lee said. "It's really a simple assay and doesn't take very long." Karpowicz added that looking at genetic variation in these uptake pathways could provide hints as to why some people are more susceptible to the disease than others.

Sasha Mushegian (amushegian@asbmb.org) is scientific communicator for the Journal of Biological Chemistry.

New insights into bacterial toxins

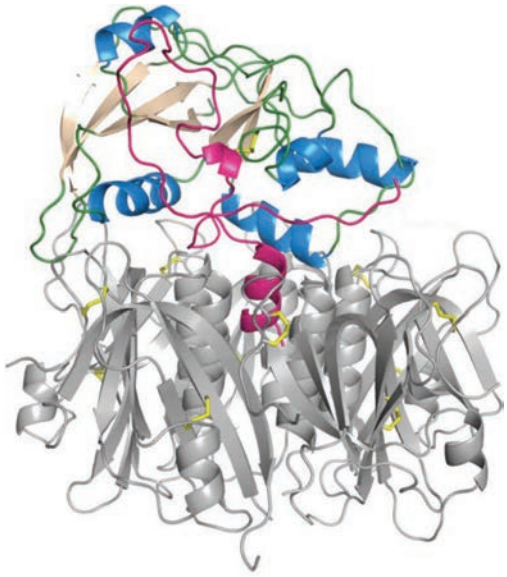
By Sasha Mushegian

A toxin produced by a bacterium that causes urinary tract infections is related to, yet different in key ways from, the toxin that causes whooping cough, according to new research. The findings, published in a recent issue of the **Journal of Biological Chemistry**, could aid in the development of new vaccines.

The key ingredient in the existing vaccine against whooping cough, or pertussis, is an inactive form of pertussis toxin. Active pertussis toxin works by entering white blood cells and chemically modifying a category of G proteins, which are essential signaling molecules. These modified G proteins are no longer able to bind to their receptors, which disrupts essential signaling inside the cell, locally disabling the immune response and allowing the bacteria to proliferate. Inactive pertussis toxin found in the vaccine teaches the immune system to avoid this silencing.

Proteins similar to the pertussis toxin are produced by many bacteria, but relatively little is known about what they do or how they work. A research team overseen by Jamie Rossjohn at Monash University in Melbourne, Australia, was interested in investigating the diversity of understudied pertussislike toxins and seeing what could be learned from them.

Pertussis toxin "is really quite an amazing molecule, and it's been highly essential in the vaccine against whooping cough," said Dene Littler, the research fellow who led the work. "I got really excited about the idea that there could be other forms of this toxin in other bacteria, perhaps in bacteria that cause long-term chronic infections where it is quite necessary for bacteria to turn off the immune system in order to live."



COURTESY OF MONASH UNIVERSTIY

In this model of E. coli pertussislike toxin, the A domain examined by Littler and colleagues is highlighted in pink.

Littler and his colleagues searched for DNA sequences similar to those encoding pertussis toxin among the published genomes of bacteria. They found a number of pertussislike toxin sequences in the genomes of the subset of strains of Escherichia coli that can live benignly in the gut but cause symptoms if they enter the blood or urinary tract. This was a clue that pertussislike toxins are widespread among pathogenic E. coli, but it was unknown whether the E. coli pertussislike toxin, or EcPlt, works the same way that pertussis toxin does.

"I was particularly interested in what happened once the toxins (produced by E. coli) were inside the cell," Littler said. Many studies of bacterial toxins examine how toxins first enter cells and the effects on the cell, not precisely how the toxin changes — and is changed in — the intracellular environment.

The team carried out biochemical studies on EcPlt from a bacterial strain that causes urinary tract infections. They produced the first report of the EcPlt's active form inside human cells, describing how the chemical environment inside the cell caused the protein to change shape and activate.

They also found that although EcPlt modifies the same G protein and disrupts the same signaling pathway as the pertussis toxin, it does so in a slightly different manner. Pertussis toxin is able to modify only one specific amino acid in its human G protein target; if that amino acid changes, the G protein is no longer affected by the pertussis toxin. EcPlt, on the other hand, modified a different amino acid but similarly disrupted G protein signaling.

"Perhaps the way that pertussis does (this modification) is simply harder for human cells to undo," Littler said, speculating about why the whooping cough caused by pertussis toxin is a more severe disease than urinary tract infections caused by EcPlt-producing bacteria.

Littler is hopeful that understanding the natural diversity of pertussislike toxins could help improve existing vaccines and create new ones.

"Our toxin structures help identify how pertussislike toxins function and help define ways to produce inactive versions," Littler said. "The pertussis toxin component of the DTaP vaccine is highly successful. Vaccines directed against other pertussislike proteins could be equally efficacious in preventing disease."

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Solo researcher links insulinlike growth factor family polymorphisms to rare diseases

By Lee D. Gibbs

Insulinlike growth factors, or IGFs, are essential for physiological processes, such as somatic growth and development, in humans and other animals. They promote proliferation, differentiation and survival of various cell and tissue types. In rare cases, something as small as a mutation in one gene — IGF1, for example — can cause huge problems for a person, ranging from growth and developmental defects to intellectual abnormalities.

Many questions about IGFs remain unanswered: How prevalent are variations in IGF family proteins in the human population? Are these variations predictors of disease susceptibility? Can they be used to track evolution?

While more and more publications display a multitude of coauthors, publicly available databases have opened a new door in the scientific field, allowing a single investigator to dig into the depths of genomic and proteomic data. A recent paper in the **Journal of Biological Chemistry** comes from an author who took advantage of this new opportunity. Physician-scientist Peter Rotwein interrogated the exomes of more than 60,000 people to assess variations in genes in the IGF family. These exomes are part of a database made publicly available by the Exome Aggregation Consortium, or ExAC, a group of geneticists who study human biology on a large scale.

Rotwein's population-based genomic study revealed alterations in the coding regions of 11 IGF family genes. His analyses show limited population variability in IGF1 and IGF2 genes, more common amino acid modifications in IGF receptors, and a wide range of variation in IGF binding proteins and the IGF acid labile subunit, proteins that function primarily as transporters of IGF1 and IGF2 in blood and extracellular fluid.

COURTESY OF PETER ROTWEIN

Peter Rotwein is vice president for research at Texas Tech University Health Sciences Center in El Paso.

In an extensive interview with ASBMB Today contributor Lee D. Gibbs, Rotwein described his career path from physician to scientist and offered advice for others. The interview has been edited for length, clarity and style.

How did you pursue this discovery as a single investigator?

I was previously faculty and chair of the department of biochemistry and molecular biology at Oregon Health and Science University, and three years ago I made a transition into an administrative role as vice president for research at Texas Tech University Health Sciences Center in El Paso. As I transitioned out of doing lab-based molecular biology, I became really interested in population-based molecular genetics and the large-scale analysis of genomic data. During my transition from the wet bench to administration, I found that publicly available genomic databases provided valuable and robust data that I could analyze. That allowed me to continue my pursuit of understanding mechanisms of action of IGF family members.

What is the Exome Aggregation Consortium?

The Exome Aggregation Consortium, or ExAC, consists of a group of geneticists who joined forces to study human biology on a large scale. They published their first papers in the fall of 2016 examining a series of themes resulting from analysis of the exons of genes sequenced from over 60,000 people but primarily focused on the big data aspects of it. Since the ExAC data are publicly accessible for anyone to study, I thought it would be useful to examine a few genes in detail as a test case of what a single scientist could do with the information. I then started looking at the entire IGF gene family. Once I had the primary data analyzed, which consisted of assessing every potential modification scored by ExAC, I then connected the results to other databases, such as Online Mendelian Inheritance in Man and a few others that examine human disease, and I came up with this paper.

My hope is that scientists who are interested in mechanistic aspects of human biology can first look at their favorite genes and the derived proteins in ExAC and then test the potentially most intriguing specific variants experimentally. I would hope that some of their goals would be to determine how single amino acid changes prevalent in different human populations might affect both protein structure and function and to learn if

"If I had known what I know now, I would probably have done a combined M.D.-Ph.D., which would have allowed me to get rigorous training on both sides and then see how to fit them together."

– PETER ROTWEIN

these changes could have an impact on human physiology and maybe even disease susceptibility.

As a physician, what led you to pursue a career as a researcher? Did you always know that you wanted to go into research?

Ha! It was not a direct route. I fumbled along for a while. I was interested in biological sciences and I had really no mentorship in that area, so I decided to go to medical school. There, I found what appealed to me more than anything was biochemistry. As I went through and wanted to figure out a field of medicine to pursue, I focused on endocrinology, in part because it was the most biochemical field and it always appealed to me how molecules work and pathways. Also, the influence of people who were available at the appropriate time as guides made a difference in the choosing of my career path.

During my medical training, I found that, more than endocrinology practice, it was the science that appealed to me most. At that point, I had the opportunity to work in a molecular biology lab and discovered that I loved both the technical and intellectual aspects of it. This was the early 1980s, and there were no kits for anything, and no PCR! I thus spent considerable time doing plasmid and bacteriophage preps and generating cDNA and genomic libraries but also, most importantly for me, reading about molecular biology. This of course took a few years, but along the way it seemed like the right career path for me.

Is there any advice you can provide to students who would like to pursue a career in research?

If I had known what I know now, I would probably have done a combined M.D.-Ph.D., which would have allowed me to get rigorous training on both sides and then see how to fit them together. In fact, during my career in Oregon I was head of the M.D.-Ph.D. program for eight years, so I have often preached that. But if you are a physician who wants to be a scientist, you have to really put in the time and work to learn how to really do it well. One way you can meet this goal is by getting a really good mentor and surrounding yourself with people in the lab who can help and teach you. You have to expect that this will take some time and know you are going to mess up a lot and do really stupid things in the lab and botch experiments, while understanding that you will learn through experience and this will prepare you to become both technically and intellectually proficient. At some point you will be ready to run your own lab.

When I was an endocrine trainee, I did clinical and lab work part time for two years, then was full time in the lab for another three-plus years before I was ready. So five years of postdoc on top of a total of five years of clinical work — that's what it took for me to be good enough to get a faculty job and get enough data to write manuscripts and grants and enough feasible ideas to develop my own research program. Everyone has to find out what is right for him or her, and that is the toughest thing to do. You have to find out what type of career you want and what will make you professionally satisfied and provide whatever challenges you think you need to have a rewarding professional life.

Can you share any advice on how to overcome the challenges of a career in research?

My key to overcoming challenges during my years as a junior faculty person was my family. Having my wife, Bonnie, and our four daughters around when things were tough reminded me there are other things more important in life. The deal Bonnie and I made when the girls were young was that I always had to be home for dinner. I could go back to the lab at night as long as all the kids were asleep, and I would have to sometimes do grocery shopping at midnight. I spent a lot of time in the lab as a postdoc and junior faculty.

You are going to have hard times. You will have papers rejected, grants rejected, and you will have to try to learn from each one of those. And not everything you do will be successful, but if you are persistent, if you reach out for advice from others and work hard and focus on important scientific problems, you will find a path where you can do much of what you want to do as a scientist. For me I can't think of any other more rewarding career.

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Obesity affects even 'good' cholesterol in teen boys at risk for type 2 diabetes

By Lauren Borja

Childhood obesity brings an increased risk of adolescent type 2 diabetes, a metabolic disease characterized by an increase in blood glucose levels. People with type 2 diabetes are insulin-resistant, meaning the body is no longer sensitive to the insulin it produces. Individuals may be diagnosed as prediabetic if their blood glucose levels are not high enough to be considered diabetic. To improve health, anyone with type 2 diabetes needs significant lifestyle changes, such as increased exercise or restricted diet to control glucose levels.

Type 2 diabetes increases imminent and latent health risks. In adolescents, type 2 diabetes has been connected with early signs of cardiovascular disease, or CVD (1). About 70 percent of adults with type 2 diabetes die of cardiovascular complications (2). Researchers want to discover treatments to reduce CVD risk for adolescents and adults with type 2 diabetes.

But of the three type 2 diabetes risk factors — blood glucose levels, insulin resistance and obesity — which is most strongly associated with the risk of CVD in youth? After analyzing risk factors among male adolescents with type 2 diabetes, a research group lead by Amy S. Shah at Cincinnati Children's Hospital Medical Center and W. Sean Davidson at the University of Cincinnati found that obesity was most strongly correlated with abnormal lipids that increase the risk for heart disease. Their research was published in a recent issue of the **Journal of Lipid Research**.

To associate blood glucose levels, insulin resistance and obesity with early risk for CVD, Shah's research group looked at the different subspecies of high-density lipoprotein across groups of adolescent males. HDL refers to a class of lipids that usually are referred to as "good cholesterol." Instead of just looking at the HDL cholesterol numbers, Shah and her colleagues summarized the total distribution of HDL particle sizes by measuring an HDL particle profile for each individual. The HDL profile grouped the subspecies into six differently sized subcategories. Previously, Shah had identified a specific HDL profile in youth with type 2 diabetes that was unlike that in healthy adolescents. Adolescents with this distinct profile, indicative of type 2 diabetes, also showed early signs of heart disease (1). In the recent study, Shah analyzed HDL profiles from male youth who exhibited some of the risk factors for type 2 diabetes but were not yet diagnosed with the disease.

"We found obesity was the major risk factor associated with the altered HDL subspecies profile previously reported in adolescents with type 2 diabetes, with smaller contributions from insulin resistance and diabetes," Shah said. For individuals with type 2 diabetes, this study suggests that weight loss might be the most beneficial action for adjusting the HDL profile away from one with an increased risk for CVD.

This research suggests additional courses of action to study in the future. To separate the effects of the various risk factors, only male subjects were included in the four test groups. Future research could focus on how these factors affect the HDL profiles in female adolescents. Additionally, changes beyond the size of the different HDL particles, such as changes in structure and function, could provide further insight.

"We hope this article highlights that not all HDL is equal," Shah said, "and that quantifying traditional lipid measurements may not always give the most information about CVD risk."

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We shall know thine enemy, honey bee

By John Arnst

Varroa destructor is appropriately named, given the havoc it wreaks on colonies of western honey bees. Since it first arrived in Florida in the 1980s, the parasitic mite has pushed bee colonies across North America to ruin, and it is believed to be the most significant contributor to the recent spike in colony deaths in the United States and Canada. Despite the scope of the mite's damage, however, surprisingly little is known about its inner molecular workings.

As a first step in ultimately combating this bee-barian, researchers in the lab of Leonard Foster at the University of British Columbia in Canada have published a protein atlas in **Molecular & Cellular Proteomics** that details 1,433 differentially expressed proteins across the various developmental stages of V. destructor.

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A western honey bee rests on a flower.

"One thing that a lot of people who are studying model systems or human systems don't really appreciate is that when you move outside of those model systems and try to understand something at a molecular level about an organism without that huge body of knowledge that has been built over the years in that particular organism, you really don't have any idea where to start," Foster said. With this in mind, Foster and colleagues, including graduate student Alison McAfee, set out to create a document of the entire proteome that the male and female mites might produce throughout their life cycles.

"It's a tool that other researchers can use to come up with their own questions about Varroa biology," said McAfee, whose research focuses on the defense mechanisms bees mount against the mites.

In addition to quantifying the mites' proteins, the researchers found that males and females expressed proteins involved in chromatin remodeling differently.

"Very little is known about the sex determination system in Varroa," McAfee said. "Part of what that might be pointing to is the mites exposing different parts of the DNA to express more sex-specific proteins."

The harm that V. destructor inflicts on honey bees is multifold; in addition to feasting on the bees' blood and leaving open wounds ripe for infection, the mites are vectors for the deformed wing virus, which cripples wing growth in developing honey-bee pupae.

The scope of damage from mites is a consequence of abrupt introductions — the longer a host and parasite have coexisted and coevolved, the more harmonious, if still exploitative, their relationship will be.

Such is the case with V. destructor and its original host, the Asian honey bee, which have had millions of years to get to know one another. However, V. destructor and its viruses have just barely begun to make evolutionary introductions with honey bees, giving their new hosts few genetic weapons to fight them off.

According to Foster, Varroa's use of odorant-binding proteins is likely key to their predatory interactions.

"Varroa have to be able to detect bees of certain ages, and this has to depend on odors," he said. "At some point, we will want to try to define the molecular mechanism that is underlying that interaction, and knowing which proteins are expressed in which stages in the Varroa will be important for that eventual understanding."

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From the journals

By Sasha Mushegian, Angela Hopp & Saddiq Zahari

We offer a selection of recent papers on a variety of topics from the **Journal of Biological Chemistry**, the **Journal of Lipid Research** and **Molecular & Cellular Proteomics**.

Genetic vulnerability to drugs prescribed for mental illness

Between 1 percent and 3 percent of humans carry at least one defective DHCR7 gene, which produces the enzyme responsible for the final step in cholesterol production in many cell types. People with two defective DHCR7 genes have a condition known as Smith-Lemli-Opitz syndrome. The syndrome can be mild (with physical abnormalities and learning and behavioral problems) or severe (with profound intellectual disability and life-threatening physical defects). But being only a carrier of a defective DHCR7 gene also carries risks. A new study in the **Journal of Lipid Research** reports that defective DHCR7 carriers may face undesired effects from the commonly prescribed antipsychotic drug aripiprazole (marketed as Abilify) and the antidepressant trazodone (marketed as Oleptro and other brand names). Researchers led by Ned A. Porter at Vanderbilt University tested the drugs on human fibroblasts and observed significant, dose-dependent increases in 7-DHC levels. This was consistent with a 2013 report that found the drugs can elevate 7-DHC levels in those with and without Smith-Lemli-Opitz syndrome. The authors wrote: "We argue that in the era of precision medicine, potential differences in response to compounds that disrupt the cholesterol biosynthesis pathway must be respected, especially as their effect may be defined by both genetic makeup and life events at the same time." The authors note that there are 33 other known drugs that affect 7-DHC levels, "so the studies reported here may point to a problem of broad scope."
doi: 10.1194/jlr.M079475

Treating Parkinson's with a parasite drug

The anti-helminth drug nitazoxanide has off-target effects on mitochondrial respiration. Niharika Amireddy of the Indian Institute of Chemical Technology and colleagues examined the effect of nitazoxanide on mice treated with a neurotoxin to induce Parkinson's disease symptoms, which include effects on mitochondrial function. In a paper in the **Journal of Biological Chemistry**, they report that nitazoxanide ameliorated apoptosis and neuron loss in these mice, suggesting that this drug potentially could be repurposed to treat Parkinson's disease.
doi: 10.1074/jbc.M117.791863

Demystifying virus-host interactions

When a virus enters a host cell, its genome interacts with a myriad of host factors to promote viral gene expression, DNA replication and virion assembly. Identifying these interacting host factors can provide insights into the critical regulatory steps during the infectious process. To do this, a team led by Matthew Weitzman of the University of Pennsylvania crosslinked the host factors of infected human cells with the DNA of adenovirus, herpes simplex virus and vaccinia virus. The viral DNA was purified along with the bound host factors, which subsequently were identified using mass spectrometry. The investigators uncovered a number of host factors that were deactivated by early viral proteins and identified a subgroup of nucleolar proteins that aid virus replication. The comprehensive databases generated in this study, published in **Molecular & Cellular Proteomics**, provide valuable resources for probing virus-host interactions.
doi:10.1074/mcp.M117.067116

Tracing signals in developing teeth

As organs develop, growth factors and other signaling molecules often are produced from clusters of specialized cells called signaling centers. Wei Du of Sichuan University and colleagues used developmental lineage tracing to identify the origins of signaling centers in developing teeth. As reported in a recent paper in the **Journal of Biological Chemistry**, they found that signaling centers in molars and incisors are formed by two distinct mechanisms, one involving de novo assembly of signaling centers and the other involving progeny from previously established signaling centers.
doi: 10.1074/jbc.M117.785923

Document your storage methods — and preserve your HDL!

Researchers at the Medical University of Graz in Austria evaluated 100 research papers sourced from PubMed using the search terms "HDL ultracentrifugation" and "HDL proteome" and found that the majority — 64, to be precise — said absolutely nothing about how the HDL used in the experiments had been stored. Led by Michael Holzer at the Institute

Weekend feasts do a number on triglyceride levels

There are plenty of reasons to hate Mondays. Now you can add triglycerides to the list. A recent study in the **Journal of Lipid Research** reports that our Monday triglyceride counts may reveal our lazy, food-filled weekends. A research team led by Jörn Jaskolowski at the University of Copenhagen took a look at 1.8 million blood samples from patients in Denmark and found that workweek triglyceride levels are highest on Mondays and then gradually subside through Friday. This was true for both children and adults, which reduces the likelihood that alcohol intake is a significant factor. The authors note that high triglyceride levels are seen in patients with metabolic syndrome, so they are tracked in various research projects. "(C)areful planning of future studies may help to avoid undesirable differences attributed to the day and the time of the day the measurement was obtained," they wrote.
doi: 10.1194/jlr.M074062

of Experimental and Clinical Pharmacology, the research team went on to determine that "prolonged freezing at -20°C or -70°C led to a shedding of apolipoprotein-AI from HDL and to the formation of large protein-poor particles, indicating that HDL is irreversibly disrupted." The team also reported in the **Journal of Lipid Research** that using sucrose or glycerol, both cryoprotectants, could preserve the structure and function of HDL for at least two years. Flash freezing, often used to store tissues, was not protective, however. They wrote: "HDL is a complex particle requiring special attention when stored. The use of cryoprotectants will improve the reproducibility and quality of the research data obtained." Bottom line: Do yourself and science a favor by employing cryoprotectants and recording your methods.
doi: 10.1194/jlr.D075366

A bacterial protease that manipulates blood clotting

Bacterial sepsis often is complicated by improperly regulated blood clotting, and it is thought that pathogens can protect themselves from the immune system by hiding in blood clots. Giulia Pontarollo and colleagues at the University of Padua provide new support for this hypothesis in their report in the **Journal of Biological Chemistry** that subtilisin, a serine protease secreted by Bacillus subtilis, is able to activate the human coagulation-promoting enzyme thrombin through a different mechanism than that used by human cells to activate it.
doi: 10.1074/jbc.M117.795245

A novel virulence factor in Salmonella

Salmonella typhimurium is a bacterial pathogen that can cause a wide spectrum of diseases, from intestinal inflammation to typhoid fever. It delivers its virulence factors, also termed effector proteins, to infected cells via two type III secretion systems, SPI-1 and SPI-2. In a study in **Molecular & Cellular Proteomics**, Xiaoyun Liu and colleagues at Peking University applied quantitative secretome profiling to catalogue the effector proteins delivered by SPI-1. They identified a novel effector, which they named SopF, that they showed to be toxic to host cells and important in intracellular replication. The study underscores the utility of a quantitative secretome profiling strategy in identifying novel bacterial virulence factors.
doi:10.1074/mcp.M117.068296

Cancer-related protein Notch requires rare sugar modification

Modifying proteins with sugars increases the diversity of protein structures and functions. In contrast to other types of glycosylation, O-linked modifications with glucose and fucose affect only a small number of proteins, including the essential signaling receptor Notch. Hideyuki Takeuchi of the University of Georgia and colleagues used CRISPR/Cas-based knockout of the enzymes responsible for these modifications to show that they were necessary for Notch transport to the cell membrane. In a recent paper in the **Journal of Biological Chemistry**, they write that fucose and glucose were attached only to Notch EGF repeats in their folded form, suggesting that these modifications serve as a

quality-control mechanism for Notch folding.
doi: 10.1074/jbc.M117.800102

Advancing glycoproteomics analysis

Glycosylation is among the most abundant and diverse protein post-translational modifications, regulating important cellular processes such as protein folding and cell-cell interactions. High-throughput identification of glycans by mass spectrometry remains challenging due to the limited number of computational programs available to analyze the vast complexity of glycan structure and composition. In a study in **Molecular & Cellular Proteomics**, Sriram Neelamegham and colleagues at the University of Buffalo introduced an open-source computational framework called GlycoPAT to address this limitation. GlycoPAT includes advances in glycan identification, scoring schemes and false discovery–rate calculation. Using GlycoPAT, the investigators identified 960 unique glycopeptides from prostate cancer cells.
doi:10.1074/mcp.M117.068239

How iron maintains checks and balances

Iron is essential for many proteins to function, but excess iron is toxic to cells. Accordingly, cells have finely tuned regulatory systems for controlling iron levels. IRP-1 is an mRNA-binding protein that represses the expression of various proteins involved in iron homeostasis. When intracellular iron is high, IRP-1 is inactivated by the insertion of an iron-sulfur cluster. In a recent paper in the **Journal of Biological Chemistry**, Nathan Johnson and colleagues at the University of Wisconsin-Madison write that they found that IRP-1 activity also could be suppressed by degradation when the iron-sulfur cluster biogenesis system was disabled, and that there were regulatory feedbacks between the protein degradation and iron-sulfur cluster mechanisms.
doi: 10.1074/jbc.M117.785741

A mysterious mosquito protein

Understanding insect development and physiology is important for developing strategies to control vector-borne diseases such as malaria and dengue fever. Juvenile hormone regulates development and reproduction in arthropods. Il Hwan Kim of the National Institutes of Health and colleagues discovered a protein of unknown function that specifically binds juvenile hormone in several species of mosquito. A recent paper in the **Journal of Biological Chemistry** describes how they found that this protein was structurally similar to mosquito salivary proteins important for parasite transmission during blood feeding, but that it was present in the hemolymph of both male and female adult mosquitoes.
doi: 10.1074/jbc.M117.802009

Heartfelt signals from the z-disc

The z-disc is a structure involved in the contraction of cardiac and skeletal muscle, and mutations in z-disc proteins are associated with heart and muscle diseases. In a recent paper in the **Journal of Biological Chemistry**, Franziska Dierck of the University Medical Center of Schleswig-Holstein and colleagues write that they identified a previously uncharacterized z-disc protein named CEFIP upregulated in cardiomyopathy. CEFIP bound to proteins in the calcineurin signaling pathway and enhanced calcineurin-dependent signal transduction, suggesting a mechanism for its involvement in pathology.
doi: 10.1074/jbc.M117.786764


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Mouse lemurs — a model in the wild

The petite primates found in Madagascar's rainforests are changing both our understanding of human disease and the African nation's scientific education programs

By John Arnst

Tens of millions of years ago, possum-like Ur-mammals roamed supercontinents and fed milk to their Ur-children. As evolution tinkered over millions of subsequent lifespans, these mammals' descendants branched out and gave rise to the taxonomic class that counts several species of bats, bears, whales, rodents and primates among its members. One branch from our ancestral primates eventually gave rise to the diverse lemurs of Madagascar, ranging from the cat-size sifaka to the palm-size mouse lemur.

Far from an adorably nightmarish chimera of its namesakes, a mouse lemur is a lemur that's about twice the size of a standard mouse. Like its more famous ring-tailed and red-ruffed cousins, the mouse lemur is a primate found only on Madagascar, an island nation slightly larger than France that sits off the southeast coast of Tanzania. More closely related to humans than to mice, the pint-size prosimian is possessed of a prolific nature and a similarity to humans that make it a near-perfect organism to revolutionize the study of many human diseases, experts say.

This is the goal that Mark Krasnow, a biochemist at Stanford University, and a consortium of biochemists, ecologists, conservationists, evolutionary biologists and high school students have pursued in their efforts to identify a new model organism for the study of human biology and disease and catalogue its physical traits and underlying genetics without the large-scale sacrifice and expense that mouse models require.

Musculus displaced

Climate change and human encroachment have endangered the rainforests of Madagascar, but within and without that habitat, mouse lemurs are one of the country's most abundant species, with numbers in the millions.

"They are the rodents of Madagascar, essentially," said Krasnow, who has spent decades puzzling out the activity of genes in animal models such as Drosophila and M. musculus, commonly known as fruit flies and laboratory mice, respectively. "They're everywhere, in virtually every habitat."

Mice have been used in labs for biomedical research since the 16th century and have become a go-to model lab organism largely thanks to their rapid reproduction, docility and a biology relatively similar to our own, all of which mouse lemurs share. Though near-innumerable mouse breeding lines have been created for cancer subtypes and diseases such as diabetes, mice fall short, for one thing,

at approximating human lungs. This first became apparent in the 1990s when scientists attempted to breed knockout mice for the gene whose absence causes cystic fibrosis.

"The mice didn't get the disease," Krasnow said. This was one of many examples of mice poorly modeling human disease that would crop up in the following years.

"When we started working on the lung, it soon became clear that many of the most prominent diseases were not well modeled in mice," he said. "It occurred to us a few years ago that instead of trying to make mouse more like human … what made more sense was to find an organism that was more like human."

This led Krasnow to begin a survey in 2009 of mammals that might replace mice for his studies and others. This past July, Krasnow and his colleagues published their results and proposal for the mouse lemur as a genetic model organism in a paper in the journal Genetics.

"Outside the primates, rodents are among our closest relatives," Krasnow said. "That meant looking for small, rapidly reproducing animals that were somewhere on the evolutionary tree between rodents and humans."

This search was performed by Krasnow's daughter, Maya Krasnow, and two of her close friends, Jason Willick and Camille Ezran, during a summer break while they were all still in high school. It mostly began as a literature survey on PubMed for primates that might have suitable characteristics.

"I remember the day we all sat around the table and (Mark) asked us, 'Given the fact that mice are not always a good model organism for certain human diseases and for certain research questions, could there be another model organism that could be better than mice?" said Ezran, who has continued as the project's pioneer and is now a medical student at the University of Rochester. "Towards the

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The rainforests of Ramonafana National Park are home to several species of lemurs. At right is Sarah Zohdy's veterinary student assistant, Victoria Crabtree.

end of that first summer in 2009, we decided that mouse lemurs were probably the best candidate."

Some of the animals ruled out included the primates colloquially called bush babies, due to their tendency to contract zoonotic diseases in captivity; tarsiers, due to highly specific dietary and environmental needs; and northern tree shrews, because they are genetically closer to rodents than to primates.

After settling on mouse lemurs, Krasnow reached out that autumn to Stanford colleague Megan Albertelli, a professor of comparative medicine and an expert in laboratory primates, and later to Sarah Zohdy, now a professor in the School of Forestry and Wildlife Sciences and College of Veterinary Medicine at Auburn University who studies disease transmission between mouse lemurs and human populations in Madagascar. The next summer, Krasnow, his daughter, her friends and Albertelli took their first trip to Madagascar, with Zohdy.

"I had the privilege of showing them around Madagascar for the first time," said Zohdy.

Much of the lemur research in Madagascar goes through the Centre ValBio research station, which sits on the edge of the 106,000-acre (about 186-square-mile) Ramonafana National Park in the island's southeast. Centre ValBio was founded in 2003 by conservationist and primatologist Patricia Wright.

Wright, who serves as the director of Centre ValBio and spends six to eight months onsite each year, first traveled to Madagascar in 1986 in search of the greater bamboo lemur. After finding the lemur and discovering additional species, Wright helped establish Ramonafana National Park in the early 1990s to protect the animals' natural habitat. She went on to found Centre ValBio in 2003.

In 2012, Krasnow, who met Wright in 2010, helped her establish a new

COURTESY OF SARAH ZOHDY

The majority of mouse lemurs are docile and tend to keep these personality traits through their lives.

15,000-square-foot building at the station with modern molecular biology labs, housing areas for staff and visiting researchers, high-speed internet and the only bio-safety level 2 lab on Madagascar outside of the capital city. The center employs more than 70 Malagasy, and has dedicated outreach groups focused on the relationship between the local populations and the rainforest as well as the residents' health and living conditions.

When Zohdy first traveled to the island in 2007 to examine the effects of aging in wild mouse lemurs, she was a graduate student working alongside Wright and her colleagues, with whom she continues to collaborate.

To assess the lemurs, the researchers capture them with live traps baited with pieces of banana. "Mouse lemurs absolutely love banana," Zohdy said. As pollinators in their ecosystem, the mouse lemurs largely feed on fruits and nectar, making bananas a natural fit. "We set the traps out for a few hours, capture the lemurs and do our assessments, and then release them on the same branch that we captured them on a few hours later."

The assessments are gentle but thorough: Examine the mouse lemurs for phenotypic traits, measure weight, take small skin and blood samples, collect fecal samples for parasite analysis, collect a small amount of hair for dietary analysis through isotopes, and subject the nocturnal critters to a behavioral assay to determine whether they're aggressive or docile. Most importantly, the researchers insert a microchip smaller than a grain of rice into each lemur so they can identify individuals that are recaptured over the years. The researchers also create dental molds of the lemurs, which allow them to estimate an individual lemur's age during its first assessment.

"Today, we still have several mouse lemurs that were initially captured in 2003," Zohdy said. "Fun fact — about 80 percent of the mouse lemurs are docile most of the time, and they tend to keep those behavioral types or personalities consistent over the years."

Driving across Madagascar's rugged

COURTESY OF GABRIEL ANDRLE

Out in the field, Sarah Zohdy (left) and Victoria Crabtree (right) perform physical examinations on multiple mouse lemurs each night.

terrain can eat up the better part of the day — the drive between Centre ValBio and Antananarivo, the nation's capital and location of its leading university, the University of Antananarivo, usually takes between 10 and 12 hours, Zohdy said. During these drives in 2010, she and Krasnow began to discuss using wild mouse lemurs as a study population, rather than bringing the animals back to the labs at Stanford and creating knockouts, "something that took decades with the mouse and would probably take 50 or 60 years with the mouse lemur," she said.

Lemurs in the lab

Much of the laboratory research involving mouse lemurs takes place at the world's largest captive mouse lemur colony in Brunoy, France.

"They're kept in a beautiful chateau outside of Paris," said Wright, who first traveled to the facility in 2003 with her student Caitlin Karanewsky, now a postdoctoral fellow who has been playing a leading role along with Zeph Pendleton in the mouse lemur project in Krasnow's lab. "It's absolutely gorgeous, and you don't even realize that it's a research lab until you get close enough to smell it."

The lab, which was led for many years by Martine Perret and is now run by Fabienne Aujard and owned by France's National Center for Scientific Research and National Museum of Natural History, is home to about 500 of the nocturnal animals living in large, light-controlled cages that make observing them during daylight hours easier for the scientists. After visiting the lab, Wright applied for and received a grant from the National Science Foundation to fund the initial capture-and-microchip work in Madagascar.

Zohdy became interested in field research involving mouse lemurs after reading a paper published by Aujard's group that discussed the animals' tendency to experience Alzheimer's-like neurodegeneration in captivity at about 3 to 4 years old, in addition to losing their sense of smell and devel-

COURTESY OF SARAH ZOHDY

In the wild, mouse lemurs have been found to live upwards of 13 years.

oping cataracts.

During her first trip to Madagascar as a graduate student, Zohdy examined dozens of wild mouse lemurs for symptoms similar to Alzheimer's disease. While she, Wright and colleagues found that wild mouse lemurs lacked the debilitating hallmarks of age neurodegeneration, they weren't able to rule out Alzheimer's entirely due to the difficulty in diagnosing the disease without an autopsy or MRI.

"Most mouse lemurs in captivity past the age of 4 are considered elderly, and in the wild we were capturing 8-, 9- and 10-year olds," Zohdy said. "We didn't see any of the visible symptoms of senescence, but the question of whether or not they have the brain plaques is still kind of up in the air."

The largest mouse lemur colony in the United States is at the Duke Lemur Center in Durham, North Carolina. When evolutionary biologist Anne D. Yoder took over as the director of the center in 2006, mouse lemurs no longer were being kept at the center, so the initial specimens had to be brought over from the colony in France.

"I was especially concerned given the research that had been coming out of France…relating to mouse lemurs as models for Alzheimer's disease," Yoder said. "I knew that an important component of our research enterprise would have to be to have a mouse lemur colony that could be studied for that purpose."

The Durham center, ensconced in 80 acres of native deciduous forest, consists of eight natural habitat enclosures and two large indoor-outdoor buildings. While many of the 18 species housed there are allowed to range freely in the forests and along the pathways that lead back into the indoor habitats, mouse lemurs must be kept inside.

Yoder is fond of saying, "Do unto the lemurs as you would unto yourself." All the research conducted at the center is founded on a strictly "do-no-harm" policy. The center acts as a hub of resources for researchers

COURTESY OF SARAH ZOHDY

The metal boxes that are used to capture mouse lemurs are baited with bananas, for which the lemurs will often be waiting at the ready. To avoid repeat captures, the traps are rotated through different locations.

who need to acquire blood samples or use veterinary facilities.

In Yoder's collaborative efforts with Krasnow, whom she met in 2011, she has brought her noninvasive approach to studying the lemurs to the forefront.

Krasnow and his colleagues hope that by sequencing the genomes and cataloguing the physical phenotypes of the millions of mouse lemurs on Madagascar, they will be able to identify and assess all of the animals' naturally occurring mutations and the impact these have on the lemurs' biology, behavior, diseases and ecology,

"Individual humans have about 100 null mutations, so, if we could study the entire mouse lemur population and they have a similar number of null mutations, we wouldn't necessarily need to create knockouts," Zohdy said.

Moving beyond knockouts

In 2011, Krasnow convened a meeting of about 40 mouse lemur biologists and scientists with experience in designing transgenic mice models at the Howard Hughes Medical Institute's Janelia Research Campus in Ashburn, Virginia, then known as Janelia Farm Research Campus. Here, the researchers formally settled on eschewing large-scale knockout lemur colonies in favor of studying the wild populations.

"I knew enough about transgenic models to know that it would not be compatible with the conservation mission and ethics of endangered species," Yoder said. "I could see peoples' faces sort of dropping as the transgenic people were talking about how you create a transgenic model." A rift was averted, however, when Jeff Rogers from Baylor College of Medicine's Human Genome Sequencing Center proposed creating an updated reference sequence of the mouse lemur genome to match to the phenotypic data that were being collected in the field. "He made this beautiful speech about the power of genomics and how that would obviate the need for sacrificing hundreds and hundreds of mouse lemurs."

COURTESY OF SARAH ZOHDY

Mouse lemurs are nocturnal and subsist largely on fruit and pollen.

While still in the auditorium, Yoder was able to contact a colleague who had a preserved collection of mouse lemur tissues that had been used to create the first iteration of the genome roughly a decade prior.

With the tissues secured, she and Rogers formed a collaborative group on the spot. That group published an updated assembly of the mouse lemur genome in the journal BMC Biology this month.

The researchers assembled the genome with a bionano optical map, which visualizes how the sequences are aligned, organized and ordered along large scaffolds.

"Having a genome that's annotated with robust and high-quality long scaffolds as a resource is absolutely incredible," said Peter Larsen, the first author on that paper. "We can now peer into this organism in ways that we never imagined before."

Out of the classrooms and into the trees

While Yoder, Rogers and their collaborators begin to probe the genome for genes shared by the lemurs and humans, Krasnow, Zohdy and their colleagues, including those in Madagascar, are enlisting local high school, college and graduate students in the daunting task of cataloguing, the lemurs' traits.

"We need an even larger research community," Krasnow said. "We need to screen many thousands or even millions of mouse lemurs to do basically the largest systematic screen that has ever been done in a mammalian system."

Inside of the laboratories at ValBio, Krasnow and his colleagues are bringing the lively study of mouse lemurs to the scientific education programs of Madagascar.

"By studying the natural populations, we have the potential to build scientific capacity in Madagascar and bring world-renowned scientists there," Zohdy said. "So instead of taking this knowledge away, we can bring it there and help this developing nation come into the future and really accelerate their science programs."

To this end, Krasnow teaches a weeklong workshop for students from Malagasy high schools, from the University of Antananarivo and from classes taught by Hanta Rasamimanana at École Normale Supérieure, the university's training arm for professionals. The workshop introduces participants to professors and familiarizes them with genetics, genomics and how both can be applied to the tiny mammals living around them.

"By bringing teachers and professors to these workshops, he's really scaling up the scope of this," Zohdy said. "It's no longer just training one or two individual Malagasy graduate students in the science of genomics, but training an entire generation."

To this end, Krasnow partnered with Stanford biological engineer and 2016 MacArthur Fellow Manu Prakash to implement the inventor's ultra-cheap paper microscopes, Foldscopes, as part of a wider push for citizen science in the Malagasy education system.

"The kids are absolutely loving it," Wright said. "I'm sure there's going to be a whole generation of people going into science in Madagascar because of Mark and his project."

John Arnst (jarnst@asbmb.org) is ASBMB Today's science writer. Follow him on Twitter @arnstjohn.

Upcoming ASBMB events and deadlines

NOV

11–15: ASBMB exhibits at Neuroscience 2017, booth 613, Washington, D.C.

DEC

5: 2019 Special Symposium proposals due
7: Abstract-submission deadline for the 2018 ASBMB Annual Meeting, San Diego
14: Travel award deadline for the 2018 ASBMB Annual Meeting, San Diego

JAN

TBA: Art of Science Communication course opens

FEB

27: Early registration deadline for the 2018 ASBMB Annual Meeting, San Diego

ASBMB
American Society for Biochemistry and Molecular Biology

For an upcoming special issue on **science funding**, we'd like to hear from you, our members and readers.

We know most of you get the bulk of your funding from the National Institutes of Health; however, we'd like to share stories about other funding sources.

Have you ever received research funding from:
Industry and/or a **foundation**?
State or **federal** (non-NIH) **programs**?
Crowdfunding? (or have you ever donated to crowdfunding of basic research?)
Some combination of the above?

If so, we want to talk to you.

We are preparing ASBMB Today articles on these topics, and we're looking for members to interview. If you'd like to share your thoughts and experiences, please email Managing Editor Comfort Dorn at cdorn@asbmb.org before Nov. 17.

No need to write much — just a sentence or two describing your work and funding. We'll contact you for a more in-depth interview.

How mentoring moments are made

The ASBMB annual meeting offers opportunities for young scientists to connect with professionals

By Comfort Dorn

Natasha Brooks' mentor didn't hire her — but he did everything he could to help her land the right job.

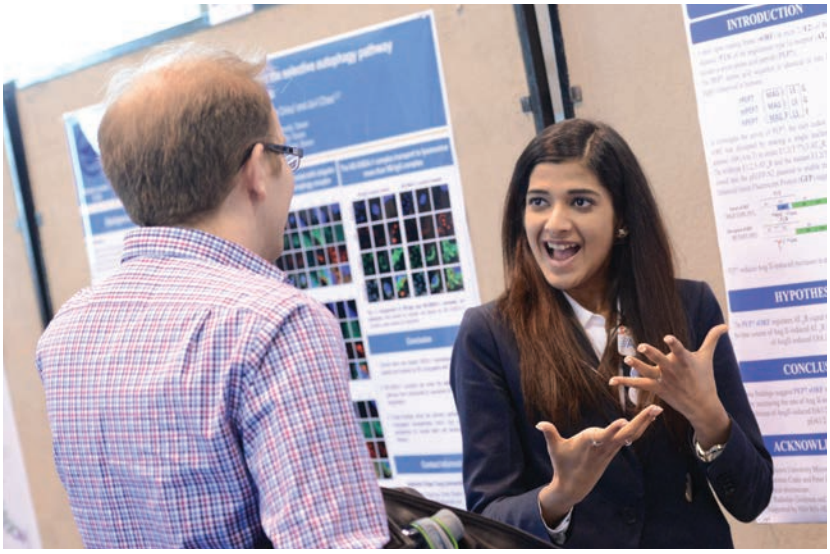
While employed at a hospital in Texas, Brooks worked with the U.S. Food and Drug Administration to remove a clinical hold from an ongoing clinical trial. That led her to thinking about a career at the FDA, so at the 2015 Experimental Biology conference, she connected with Marcus Delatte, a pharmacology/toxicology reviewer at the FDA.

Brooks sought out Delatte and asked him about his work. He responded by taking an interest in her future. "He helped me with writing down my career goals for where I wanted to be in five years, in 10 years, in 15 years," Brooks said, "and strategies for those goals."

Delatte put Brooks in touch with medical writers and regulatory affairs specialists to get a feel for what they do. "Those talks helped me tailor my resume and get a sense of what kind of questions I'd be asked in an interview … They helped me get the job."

Now a medical writer at Technical Resources International, Brooks believes in the value of mentoring, so much so that she coordinates what are known as the "professor rounds" at the American Society for Biochemistry and Molecular Biology annual meeting, along with Lana Saleh, who began as an ASBMB mentor before partnering with Brooks this year.

The ASBMB annual meeting, held in conjunction with the EB conference, offers numerous opportunities for students and early-career scientists to meet mentors, everything from the structure of the professor rounds to a more casual "meet the speaker" event during poster presentations.



COURTESY OF ACTIONFOTO CONVENTION PHOTOGRAPHY

Parnika Kadam, a Ph.D. candidate at Georgetown University, presents her and her colleagues' poster on the exhibit floor of McCormick Place in Chicago during the 2017 ASBMB Annual Meeting. Their research, Regulation of Angiotensin Receptor Trafficking by an Upstream Short Open Reading Frame in the mRNA 5' Leader Sequence, was published in The FASEB Journal. Meet-the-speaker events at the poster presentation are an informal way to make mentor connections at the annual meeting.

Ways to connect

Professor rounds are offered in conjunction with the ASBMB Minority Affairs Committee's travel awards to the meeting. After the awards are announced, Brooks and Saleh contact the recipients to ask if they want to be paired with a mentor. About 75 percent of the 15 to 20 recipients each year express interest, Brooks said, and each is matched with a mentor based on career and research goals.

Students who want careers in academic research can usually find plenty of potential mentors on their home campuses, but for those interested in industry, science policy, consulting or biotech, the MAC program opens different doors.

About six weeks before the annual meeting, Brooks and Saleh start to get the ball rolling. They reach out to other MAC members for help in identifying potential mentors based on

the interests expressed by the students. Once the matches are made, they send the mentors' contact information to the students, suggesting that the students get in touch to set up a meeting during the annual meeting.

Asking the students to make the first move is important, Brooks said. "It forces them to take the first step in networking."

The MAC hosts a reception at the annual meeting, and mentors sometimes will suggest meeting there. Or they might get together with their mentees for coffee. Sometimes, a mentor can't be at the annual meeting so they touch base via Skype, Google Hangouts or a phone call. The point is for the mentee to make the connection and ask questions.

Opportunities for mentor connections also exist at the ASBMB graduate student and postdoctoral fellow career event held the Friday and Saturday before the main annual meeting program. Chris Heinen and Tim O'Connell co-organize the event, which has evolved over the years to provide more time for students to interact with speakers representing a variety of career fields.

"We have multiple opportunities for the students to talk to our speakers, including Q&A panels and lunch where the speakers sit with groups of trainees," Heinen, an associate professor at UConn Health who has co-organized the event for 10 years, wrote in an email. "I personally have overseen a Q&A panel on starting your own lab for nine years," he wrote. "I also sit with students at lunch and answer career-related questions."

Continuing the conversation

Mentorship is not a marriage. Aspiring scientists can have multiple mentors as they develop and hone their career interests — sometimes several at once. Brooks recalls her own experience as a graduate student at the 2012 EB meeting, where she was paired with a mentor through the professor rounds and also made mentoring connections with professionals at a workshop organized by Heinen.

COURTESY OF ACTIONFOTO CONVENTION PHOTOGRAPHY

Attendees at the 2017 Experimental Biology conference and ASBMB Annual Meeting in Chicago gather over hors d'oeuvres at the ASBMB Minority Affairs Committee welcome reception. Mentors designated by the MAC sometimes suggest meeting their mentees at the reception. Pictured, from left, are Yan Jessie Zhang, organizer of the annual meeting's Spotlight Sessions; MAC members Squire Booker and Kayunta Johnson-Winters; Craig Cameron, former MAC chair; Regina Stevens Truss, former MAC member; and Beverly Pappas of the University of the Pacific.

Brooks knew then that she didn't want a career in academia. Before the meeting, she researched career paths and decided she was interested in science writing and science policy. "Fortunately, I was able to meet professionals in both fields from the workshop," she wrote in an email. "I asked both of them if they were available for coffee at some point during the meeting for a one-on-one session and they both agreed." She treated the one-on-one sessions as informational interviews, asking what steps she could take to prepare herself to enter and work in those areas. "I was able to get an understanding of both fields, the type of training required, and what exactly someone in that particular field does on a daily basis."

Mentoring can begin and end with that one-on-one over coffee or it can continue for years via regular emails, phone calls or Skype chats. Brooks said she and Delatte update each other about once a month. Both are now in the Washington, D.C. area "so we live close enough to meet for coffee," she said. She is in touch with her medical writer mentors about four times a year. "You have to keep up with people," she said.

In the last three years, Saleh, a staff scientist in the research department at New England Biolabs, has been a mentor to four students who wanted to pursue careers in industry. She has maintained contact with one of the four, helping him polish his resume, discussing interview strategies and keeping him updated with industrial openings she thinks would be a good fit based on his qualifications. "I plan to keep in touch with this mentee and ensure I am there for him to offer any guidance he wants in the next phases of his career," she wrote in an email.

Keys to success

What makes a successful mentor-mentee relationship? "This is the golden question!" Saleh wrote. Like any good professional or personal relationship, "(t)hey are the ones that start with some form of chemistry and continue strong due to open and fre-

quent communication, reciprocity, clear expectations, and last but not least mutual respect."

Brooks believes the first and most crucial piece is "a willingness of the mentee to seek out or take advantage of opportunities for mentorship." It's also important for the mentee to understand that "the relationship may not directly lead to a position but will give you more insight and connect you to more people." Mentees also need to ask good questions about the career field, and they need to follow up, she wrote. "Many times (myself included) we do the initial work with identifying a mentor, but after the first interaction, we do not continue to develop the relationship. I suggest every few months to send an email to the person to tell them how you are doing … Share with your mentor what your goals are and what you are working towards as they may have a solution for you or be able to connect you with another person who has the answer you're looking for."

Saleh stresses that the communication needs to go both ways. "The mentor should take the first steps of keeping the line of communications open by checking in on a mentee and encouraging him/her to reach out," she wrote. "On the other hand, a mentee should not be intimidated to be up front and should communicate a clear set of goals that he/she desires to achieve from this mentoring relationship."

Both Saleh and Brooks encourage mentors and mentees to take advantage of social media and the latest forms of electronic communication to keep in touch if they are too far apart for that cup of coffee.

Doing more

The minority affairs committee, the education and professional development committee and all the organizers of the ASBMB annual meeting believe strongly in the importance of good mentor relationships to build careers in science. But even with multiple opportunities scheduled, students and young scientists sometimes may have a hard time making the connection.

Danielle Snowflack, the ASBMB's manager of public outreach, offers a suggestion to address this challenge. "One of the hardest things for a young researcher to do is to reach out to someone that they don't know, especially someone who may serve as a mentor. It helps to have a brief introduction to your scientific projects prepared," Snowflack said. That's one of the reasons the Public Outreach Committee has developed a workshop called "Constructing an Elevator Pitch," which will be offered twice at this year's Experimental Biology meeting. "It's important to have a well-crafted message explaining your interests ready to go," Snowflack said, "so that you're comfortable with what you are going to say before you take the leap and interact with a potential mentor, collaborator, employer or with anyone interested in what you do in the lab and why you are doing it."

Once a mentor connection is made, the student then needs to know what questions to ask. For help with this, the Education and Professional Development Committee has prepared a short video on informational interviews that can be found on the Career Development page at asbmb.org.

Heinen also recognizes the challenge for trainees to interact with more senior scientists at the annual meeting. "The volume of people is so large that people tend to interact with those they already know," he wrote. "It is more difficult to have spontaneous interactions with new people." In addition to the weekend events for grad students and postdocs, he suggests some planned lunches during the week centered around certain interest areas (research or otherwise) where selected faculty and other professionals would be asked to attend and specifically interact with trainees.

Due to the time constraints of the annual meeting, Brooks suggests it might be difficult to add additional sessions. "However, one possible way to strengthen existing mentoring relationships or build new ones would be to offer quarterly podcasts or Skype meeting outside of the annual conference in which potential mentors from varying backgrounds could connect with students," she wrote.

During a MAC meeting in October, members decided to establish a mechanism for following up with both mentors and mentees after the annual meeting to assess its programs. "This way we can collect more information regarding our pairing process as well as the success and effectivity of the connections that were established at ASBMB," Saleh wrote. "This feedback will help us in the planning of the next professor rounds and mentoring workshops."

In the final analysis, a mentor can be a bridge to the future, broadening a student's horizons as they provide direction and encouragement. A good mentor "leads you to the people who can tell you about the jobs you would like," Brooks said. "They have access to opportunities you might not know."

Be a mentor

Would you like to be a mentor at the 2018 ASBMB meeting — or just learn more about these mentoring opportunities?

Mentors are always needed, especially in the fields of industry, biotech, consulting and science policy. You can be a mentor even if you don't plan to attend the annual meeting.

Contact Natasha Brooks at nbrooks@tech-res.com or Lana Saleh at saleh@neb.com to learn more.

Comfort Dorn (cdorn@asbmb.org) is managing editor of ASBMB Today. Follow her on Twitter @cdorn56.

Keep it safe

by Kaoru Sakabe

Over the course of the year, I've discussed best practices in image acquisition and manipulation, but I haven't really talked about data and data management. I recently had the opportunity to hear Brian Nosek from the Center for Open Science speak, and he summed it up perfectly: "The report is advertisement for research. The data is the actual research."

What steps are you taking to ensure that the research record is maintained and that the data you've labored to gather are protected?

I'm sure you've heard many times about the importance of keeping good research records and storing samples appropriately in obligatory classes on responsible conduct of research or from your mentor, so I won't belabor these points. Nothing is more frustrating when you're assembling figures or writing up your results months or years after data collection than not being able to piece together how an experiment was performed. Additionally, proper storage ensures that samples can be used later, which may be particularly important when sample size is limited or you need to return to these samples years down the road. But what about film, pictures or any other data files that you've collected?

With regard to blots or micrographs, I suggest multiple forms of storage. If you are acquiring images from blots using an imaging system, retain the native, system-generated file in addition to the exported image file in TIFF format. The same goes for micrographs. TIFF files are a universal file format that can be opened by anybody without specialized software. The same cannot be said for

the system-generated file. If you are scanning film, save it in TIFF format and be sure also to save the film. If the computer collecting the data is a shared computer, make sure you keep a copy for your records. With multiple users, you cannot guarantee that your file won't get accidentally deleted or corrupted.

What about data from an instrument using obsolete software? Some people keep a legacy system so they can open the original system-generated file long after the instrument stops running. If at all possible, export the data into a universal file format. Often you can export column runs or FACS data as Excel or PowerPoint files.

When you are saving images, make sure you save the entire blot or gel, because it tells the whole picture of the experiment. You can always make a copy of the image to crop if the additional space isn't necessary for the paper. The original always should be retained, as it's better to keep something rather than throw away information that may be useful later. For example, a reviewer may ask you to indicate molecular weight markers or to show the full scan of the blot, and you would be at a loss if you only saved a portion. Also, while adjusting the settings of your image may be necessary when assembling figures, make sure to save a completely unaltered image for your records.

Finally, it's important to back up your files and to store them in a safe location. Ideally, a backup should be kept separate from the original data in case something catastrophic should happen at the original location. Cloud storage as well as the availability of cheap, portable hard drives make storing safe, secure backups a relatively easy thing to do.

How long are you supposed to retain your data? There's no clear-cut answer. Institutions generally have their own policies in place. If your research is funded by the National Institutes of Health, then the general rule is that data must be retained for at least three years after filing the final financial report for the grant. Another number often thrown around is six years, as this is the statute of limitations for pursuing cases adopted by the Office of Research Integrity, the oversight office for research funded by the U.S. Public Health Service. What is likely less known is that any time an author benefits from the work, such as citing the work in a grant application or paper, the clock resets for the ORI to investigate cases of falsification, fabrication and plagiarism. Change also is on the horizon as the NIH develops policies on data retention and sharing. Remember, though, there is no limit to how long an article may be read and cited, so why should there be a time limit for retaining data?

Kaoru Sakabe (ksakabe@asbmb.org) is the data integrity manager at the ASBMB.

Transitioning from science to science writing

By Lily Williams

I spent four undergraduate years at Vanderbilt University as an unimpressive science student. I had taken Advanced Placement Biology in high school, really excelled, and then decided to major in biology in college, thinking this level of success would translate. It didn't.

After barely scraping through general chemistry and biology in my first two years of college, I took the requisite organic chemistry in my junior year. On the second test, I received a 35 percent. For the third test, I employed the techniques that gave me success in high school: hours of note-taking, reading, rereading, studying and practice problems. I received a 23 percent.

That was my breaking point. I figured it was time to switch paths. I was also working toward a minor in English, and those classes felt stress-free, natural and easy.

I did well in high school biology in part because I had the time to study. In college, I sidetracked myself. I was a varsity athlete, an editor of a school paper and a leader for alternative winter break volunteer programs. But also, I hadn't taken AP Chemistry or AP Physics in high school. Had I taken these classes and realized my lack of aptitude for these critical subjects, I might have thought differently about science in college.

But the problem, if you could call it that, was that I really still loved biology. The year before the orgo debacle, I received a coveted undergraduate summer research grant for infectious disease study. I enjoyed and did well in my lab classes. And I only had three semesters remaining of college, not enough time to switch majors.

I passed orgo but with a D, and I wanted to grasp the subject. So I retook the class the summer before my senior year. Half of each of summer day was spent in class, which meant I couldn't do research or work a full-time job. But the remaining half-day was enough for a part-time gig.

At the time, I was writing for Vanderbilt's satire paper, and the editor had sent out a list of summer internships. One was at Nashville's National Public Radio affiliate, WPLN. I figured I might as well try something completely different. I applied, interviewed, and WPLN chose me to be one of two summer interns. They were even lenient with my class schedule.

I felt like a button that had finally found its corresponding buttonhole. My editor at the station often assigned me to somewhat science-y topics, such as planning meetings for establishing a green corridor around Nashville.

I felt like a button that had finally found its corresponding buttonhole … I knew what questions to ask, and I could produce stories without having to research basic concepts.

I learned that my chemistry and biology classes had prepared me to understand more than someone who had not studied science. I knew which questions to ask, and I could produce stories without having to research fundamental concepts.

I left the internship with the editor's suggestion that I improve my writing. Formal science journalism training seemed like the best way to improve my writing and simultaneously keep a foot in the door in the sciences.

So I applied to master's programs in science journalism. There are quite a few: Berkeley, University of North Carolina at Chapel Hill and Michigan State are some that have full science-writing specializations. Other universities offer a handful of science-writing classes within their journalism graduate schools. I applied to five programs and chose the Medill School of Journalism in Chicago, with a full specialization in health, environment and science. Two others in the 12-student specialization also had degrees in the sciences: One had a bachelor's in entomology; another had a Ph.D. in biological mathematics.

In graduate school, my work was often well outside the realm of what I had studied as an undergrad. I researched the patentability of psychedelic drugs. I produced an audio final on seasonal affective disorder. I spent a quarter embedded in a materials science and engineering lab, watching students build a small satellite used to run experiments in space. Even my short study of the sciences helped me process information quickly and

COURTESY OF LILY WILLIAMS/MEDILL

Much of Lily Williams' work at Medill was multimedia-focused. One photo essay demonstrated the effects of myalgic encephalomyelitis. Lizzie Mooney of Riverside, Illinois, pictured here, has been sick for more than two years with chronic pain and sensitivity and can barely leave her home.

understand what was most important to know about the science at hand.

The project that convinced me of science journalism's importance came in my third quarter at Medill. The subject was an 11-year-old girl, bedridden from myalgic encephalomyelitis, or ME, a disease also known by the euphemism "chronic fatigue syndrome." She was growing increasingly ill, and her parents were desperate for people to believe her illness was serious; research and funding for ME is minimal. It was my job to capture her day to day, and I — a stranger — spent a week in their home, witnessing intimate moments of suffering. For her parents, I was not only someone who would help in the push for treatment for their daughter but also someone who would just listen and really try to understand.

This graduate program taught us how to translate scientific concepts for the layperson. It helped the students without science degrees understand which topics are important and gave them skills to ask the right questions. And it helped those of us with science backgrounds find a balance between technical writing and writing for someone who knows nothing about science, which is no small feat.

Science writing has been an excellent application of my interest in biology. I hope to share the excitement of biology with others and use my knowledge to identify topics that might be important but go unnoticed by a journalist who doesn't know what they are looking for. A science background also can support necessary journalism skills, such as interpreting data.

And while writing has always felt very natural for me, my graduate program gave me the tools to tell stories and discuss research in a more concise and appealing way. Science journalists serve as the bridge between scientists and nonscientists. Their writing must be correct and efficient but also eloquent and captivating. A year or two in a master's program can help you share scientific information with a much broader audience.

Lily Williams (Williams.lilybeth@gmail.com) has a B.A. in ecology, evolution and organismal biology from Vanderbilt University and a M.S. in science, health and environmental journalism from Medill School of Journalism at Northwestern University. She is a freelance journalist and communications director based in Asheville, N.C.

Becoming a scientist-educator

Veronica Segarra, an assistant professor of biology at High Point University, shares how her graduate school experiences in teaching and outreach inspired her to pursue a career in science that combines bench work, teaching and outreach. Segarra describes how lessons learned from past failures are instrumental in guiding current pursuits and talks about the inherent requirement of continuing to take risks as an innovative scientist.

"You have to find what works for you and what drives you. You are your own cheerleader. Once in a while, someone will come along and will offer you help and support — accept it and be thankful for it. Pay it forward as soon as you are able."

– VERONICA SEGARRA

Tell us about your current career position.

I am an assistant professor of biology at High Point University, a primarily undergraduate institution. In this position, I am a scientist, a teacher, a mentor and a community organizer focused on science outreach. My lab at HPU studies membrane traffic during times of cellular stress using baker's yeast as a model system.

What are the key experiences and decisions that have enabled you to reach your current position?

As a graduate student, I looked for opportunities to engage in volunteer work with the hope of identifying what I was passionate about in a larger context. I knew I loved bench work, but were there other options or aspects that I would enjoy in a career? Two experiences that were key in shaping who I am today come to mind. I shadowed faculty and taught chemistry at a community college, and I mentored middle school students through their science fair projects. While living these experiences, I discovered that I love teaching when surrounded by students who are eager to learn and colleagues who care deeply about their teaching and their students. I also discovered a love for partnering with the community in science outreach projects. Moving forward, my goal, if possible, was to combine all of these passions and to include bench work, teaching and outreach in my career as a scientist. Once I had identified these interests in teaching and outreach, I sustained these types of activities while training as a scientist at the bench. I wanted to refine my interests and abilities in these areas. It also allowed me to meet a lot of interesting people, some of whom have been instrumental in helping me get to where I am today. I am so thankful for these experiences and colleagues.

How did you first become interested in science?

I first became interested in science through experimentation. I had a middle school science teacher who was really good at engaging us with experiments. The scientific method seemed so intuitive. I was hooked!

Were there times when you failed at something you felt was critical to your path? If so, how did you regroup and get back on track?

I have failed a lot. Failure can be painful and embarrassing, especially when others are looking and taking note. In my experience, the important thing is not to let that pain and embarrassment prevent you from moving forward or taking other risks. If you are not taking risks, you are likely not innovating in the type of work that you are doing. Unpacking or analyzing your failures is the key to learning from them. What worked? What did not work? How do I move forward from here? Keeping the larger picture in mind also will help you meet failure elegantly and with class. Why are you doing what you are doing? What is your ultimate goal? For example, in graduate school, sometimes your driving force will be the science topic of interest — "I want to figure X out." Other times your driving force will be the desire to finish your degree — "I just want to get my degree and move on." You have to find what works for you and what drives you. You are your own cheerleader. Once in a while, someone

COURTESY OF VERONICA SEGARRA

Veronica Segarra was inspired by her graduate school experiences to pursue a career that combines bench work, teaching and outreach.

will come along and will offer you help and support — accept it and be thankful for it. Pay it forward as soon as you are able.

What advice would you give to young persons from underrepresented backgrounds who want to pursue a career in science similar to yours?

First and foremost, you are an individual, a scientist, not an underrepresented minority. Let this guide your career trajectory.

What are your hobbies?

I recently purchased a home — I have been spending a lot of time in the yard. I would say gardening is one of my hobbies now.

What was the last book you read?

Like other HPU students and faculty, I am reading "How to Fly a Horse: The Secret History of Creation, Invention, and Discovery" by Kevin Ashton. Every year, the HPU community engages in a common reading to foster discussion of important themes. The topic we are discussing this academic year is "Creation, Connection and Community."

Do you have any heroes, heroines, mentors or role models? If so, describe how they have influenced you.

I do have these, too many to list. Not only are they more experienced scientists but also peer mentors similar in career stage.

What is it that keeps you working hard every day?

I have two main drivers or long-term goals for inspiration these days. One of them is wanting to attain tenure at my institution. A second source of inspiration is my students. I want to be the best scientist and mentor I can be so that they can have the best experience. In this context, I have a set of personal goals that provide a scaffold for the goals described above. One of them is that I strive to be a happy scientist with a fulfilling personal and spiritual life, and I want to have fun at work. If one of these personal goals is not being met, I know that it is time to make an adjustment to the way I am doing things.

About the Research Spotlight

The American Society for Biochemistry and Molecular Biology's Research Spotlight highlights distinguished biomolecular and biomedical scientists from diverse backgrounds as a way to inspire up-and-coming scientists to pursue careers in the molecular life sciences. Eligible candidates include Ph.D. students, postdoctoral fellows, and new or established faculty and researchers. To nominate a colleague for this feature, contact education@asbmb.org.

Join the Lipid Research Division of the ASBMB

Does your work involve lipids? If so, the ASBMB Lipid Research Division wants you to join its ranks.

The new division co-directors, George Carman of Rutgers University and Rob Stahelin of Purdue University, invite you to share your ideas about everything lipid to help the division serve your interests even better than it does already.

Learn more at the Lipid Research Division website (www.asbmb.org/lipidcorner) and join our Facebook group (www.facebook.com/groups/ASBMBLRD/).

ASBMB
LIPID RESEARCH DIVISION

CALL FOR ESSAYS

WHEN SCIENCE MEETS SICKNESS

For an upcoming essay series, ASBMB Today is asking readers to send in essays about their experiences as scientists who become patients.

Does your understanding of biology make the diagnosis and treatment easier or more difficult? Does it increase your fear? Are you more critical of your doctors' decisions?

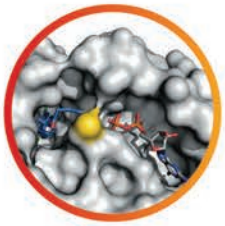
If you want to share your story, be honest and true. Be open to editing and coaching. Your essay must be unpublished and between 500 and 1,000 words. Submissions should be sent to asbmbtoday.submittable.com. Submit under "Science meets sickness." Please include a title and complete contact information.

Questions?

Send them to Comfort Dorn, ASBMB Today managing editor, at cdorn@asbmb.org.

2018 ASBMB Special Symposia Series

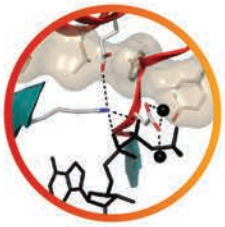
Building Inclusive Excellence in Science
June 14–17, St. Louis, Mo.



RAS Signaling: Isoform and Mutation Specific Roles in Oncogenesis
Sept. 13–16, Stratton, Vt.

Science Outreach: Models, Methods and Measures
Oct. 3–6, New York, N.Y.

Transcriptional Regulation by Chromatin and RNA Polymerase II
Oct. 4–7, Snowbird, Utah



The Many Faces of Kinases and Pseudokinases
Dec. 9–12, San Diego, Calif.

Reminder: ASBMB members save on meeting registration.

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I AM A

COLLABORATOR

And I advance my research when I exchange ideas with scientists in related fields.

The 2018 ASBMB Annual Meeting provides countless occasions to step outside your niche and collaborate with scientists with different strengths. Thanks to the ASBMB's affiliation with the Experimental Biology conference, you'll have the opportunity for interdisciplinary learning and exchange. The event represents five host societies, multiple guest societies and attracts more than 12,000 scientists and exhibitors from throughout the biology research sphere.

KEY DEADLINES
ABSTRACT SUBMISSION – DEC. 7
TRAVEL AWARDS – DEC. 14

asbmb.org/meeting2018

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