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ASBMB TODAY

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

ASBMB '18

ANNUAL MEETING

SAN DIEGO | APRIL 21–25

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The Art of Science Communication

Fall session begins Oct. 2
Registration deadline is Sept. 25

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American Society for Biochemistry and Molecular Biology

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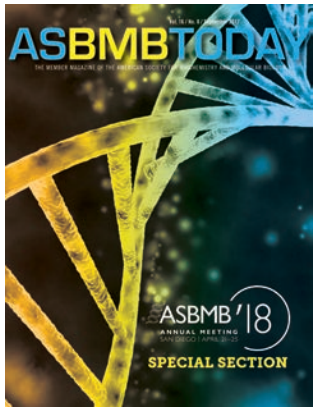

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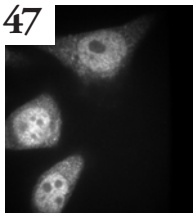

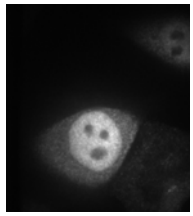

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Seasonal highlights

By Natalie Ahn

Three highlights as we enter the fall season at the American Society for Biochemistry and Molecular Biology:

First, congratulations to our new president-elect, Gerald Hart. Jerry is the DeLamar professor and director of biological chemistry at Johns Hopkins University and a distinguished investigator who discovered protein covalent modifications by O-linked N-acetylglucosamine. He has contributed throughout his career to the ASBMB and will be a devoted leader.

Welcome also to incoming members of the ASBMB Council, Takita Sumter, JoAnn Trejo and Blake Hill; committee members for education and professional development, Jennifer Loertscher and Nathan Vanderford; Student Chapters, Martina Rosenberg and Craig Streu; meetings, Sarah Martin and Melanie McReynolds; minority affairs, Joseph Chaney, Adela Cota–Gomez and Kayunta Johnson–Winters; nominations, Tony Kossiakoff and Iqbal Hamza; public outreach, Ana Zambrana, Matt Koci and Ana Maria Barral; public affairs, Anita Corbett, Katherine Friedman, Kimberly Jackson and Nicholas Rhind; and publications, Brian Crane and Ruth Welti.

Our thanks to outgoing members who served on Council, Karen Fleming, Jared Rutter and Michael Summers; committee members for education and professional development, Chloe Poston, Joseph Provost and Fred Hughson; Student Chapters, James Hazzard and Michael Pikaart; meetings, Steven McKnight and Florencia Pascual; minority affairs, Regina Stevens–Truss; outreach, Teaster Baird and Michael Klymkowsky; public affairs, Bob Matthews, Jack Kaplan and Jeremy Berg; publications, Jeanne Hardy; and awards, Steve McKnight.

Committees are the engines and gears of our society, whose members work to advance biochemistry and molecular biology through discovery, education, networking and advocacy. Our immense thanks to all who serve.

Second, as anyone following current events realizes, now more than ever is the time for all of us to be strong advocates for science. All politics is local, and the most effective action we can take is to tell our own congressional lawmakers about our work, how it saves lives and how budget cuts proposed by the White House would undermine the strength of science in the U.S. The ASBMB Public Affairs Advisory Committee keeps us abreast and develops tools for training. Get involved by joining the Grassroots Advocacy Network (asbmb.org/advocacy/grassrootsnetwork/).

Finally, get ready for the 2018 ASBMB Annual Meeting! Thanks to co-chairs, Jin Zhang and Wilfred van der Donk, and the dedicated ASBMB meetings committee, ASBMB 2018 is shaping into a fantastic program, with superb symposia on the latest topics, including the Issues in Depth symposium on RNA epigenetics, talks by award winners on foundational discoveries and workshops on new technologies. The Spotlight Sessions offer more opportunities for attendees to present their latest findings (for details, see page 24). Save the dates on your calendar — April 21–25 in San Diego — and submit your abstracts by Dec. 7 to be considered for a Spotlight Session talk.

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

Congress must act on funding

By Benjamin Corb

The unfortunate reality of partisan politics and Congress' inability to perform its usual duties has made the budget and appropriations process little more than the legislative version of a Rube Goldberg machine, where even the simplest and least contentious points are complicated by unnecessarily complex hurdles.

Congress has yet to act on a fiscal 2018 spending plan and is months behind what is typically referred to as "regular order," putting the scientific community in its usual position of budget uncertainty, with the specter of either a continuing resolution or even a government shutdown looming on the not-too-distant horizon.

Earlier this year, President Donald Trump released a budget request that would be disastrous for the scientific community, cutting by upwards of 20 percent investments in the National Science Foundation, the National Institutes of Health and most other science-funding agencies that support the basic biomedical research community. Those cuts were rejected soundly by both Democrats and Republicans in Congress as too deep, given the importance of and support for these investments.

Congress, unfortunately, has been slow to fulfill its responsibility of funding the government through the budget and appropriations process. Coming back from the August recess, Congress has not yet passed a budget for fiscal 2018; nor has it completed any of the appropriations bills that would fund the work of American Society for Biochemistry and Molecular Biology members.

The House and Senate differ on how to invest in the NSF (the House calls for a flat budget, while the Senate calls for a small cut). The Department of Energy's Office of Science also would see a flat budget with the Senate's plan, but the House would give it a slight increase. And the NIH would receive a $1 billion increase from the House Appropriations Committee, while the Senate has yet to release its spending proposal.

With members of Congress returning Sept. 5, they will have only 25 days to negotiate a spending package that is acceptable to Democrats, Republicans and the president. A short-term continuing resolution, or CR — keeping funding at the current level until a deal can be reached — is increasingly likely.

While a CR is better than a budget cut or a government shutdown, CRs are damaging to the scientific community in ways lawmakers don't always recognize. Science funding agencies often hold back funds during a CR to ensure they can continue funding grants that already have been awarded, which often means a 10 percent cut to grant funding during the CR. The uncertainty of funding for the next fiscal year often causes funding agencies to act more conservatively in funding decisions, which can affect grant paylines and reduce the number of grants awarded in the early part of the fiscal year.

These problems are not unique; nor are they unknown. Last fall, the ASBMB hosted a panel of experts to talk about the effects on the scientific enterprise of not following regular order with budgets. Our advocacy efforts include calls to pass a fiscal 2018 spending package that provides the funding needed to keep the U.S. as the global leader in biomedical research and innovation.

It is time, now, for Congress to take action and pass a fiscal 2018 spending plan.

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

Interested in science policy?

Follow our blog for news, analysis and commentary on policy issues affecting scientists, research funding and society. Visit **policy.asbmb.org**.

In memoriam: Richard A. Harvey


HARVEY

Richard A. Harvey, biochemist and former professor of biochemistry at Rutgers Medical School, passed away April 14. He was 80.

Born Nov. 21, 1936, in Salt Lake City, Utah, Harvey earned both his B.S. and his Ph.D. at the University of Utah.

After completing postdoctoral training at the Institut de Biologie Physico-chimique in Paris, Harvey joined the faculty at Rutgers Medical School, where he stayed for 33 years until his retirement in 2000.

In retirement, Harvey remained a part of the Rutgers community as a professor emeritus of biochemistry. He was a beloved member of the faculty, and Rutgers Medical School established the Richard A. Harvey Excellence in Teaching Innovation Award in his honor.

Harvey also was author, illustrator and editor of the Lippincott's Illustrated Reviews series, which served as a concise and illustrative educational tool on a number of scientific topics.

He is survived by his wife, Marilyn; two sons, Tristin and Todd; and five grandchildren.

Bill Sullivan takes post at PLOS blogs network


SULLIVAN

Bill Sullivan, Showalter professor of pharmacology and toxicology, and professor of microbiology and immunology at the Indiana University School of Medicine, is joining the Public Library of Science Blogs Network as a science writer and editor.

The PLOS Blogs Network is an online forum focused on science communication, connecting scientists with the general public.

Sullivan's research focuses on gene expression in protozoan parasites that cause toxoplasmosis and malaria.

Sullivan has published more than 70 academic articles and written for various publications, including ASBMB Today. He co-founded the science blog THE 'SCOPE in 2014 (thescopepopculturescience.blogspot.com).

ACS fellows: Larsen, Sampson


LARSEN


SAMPSON

Barbara S. Larsen and Nicole S. Sampson have been named to the 2017 class of fellows at the American Chemical Society.

Founded in 2008, the ACS Fellows Program was established to honor distinguished ACS members who have made significant contributions to science and the society.

Larsen is a senior technology fellow in the corporate center for analytical chemistry at DuPont. She developed a novel process to produce safer fluorinated polymer products and an analytical method to confirm consumer safety.

Sampson is a professor and former chair of chemistry at Stony Brook University. Through her research, she helped translate the mycobacterial cholesterol metabolism pathway into drug targets.

The 2017 class was recognized during the society's 254th National Meeting and Exposition, Aug. 20-24 in Washington, D.C.

Rao receives UTenn Malloy professorship


RAO

Gadiparthi Rao, distinguished professor in the department of physiology in the College of Medicine at the University of Tennessee Health Science Center, has received the George and Elizabeth Malloy Professorship.

The endowed Malloy professorship recognizes an outstanding scientist and will support research conducted at the College of Medicine.

Rao is a leading expert in the field of cardiovascular biology. His research explores vascular cell remodeling and injury as it relates to angiogenesis or the forming of new blood vessels from pre-existing blood vessels.

Stapleton named interim provost and VP


STAPLETON

Susan Stapleton, dean of the Western Michigan University Graduate College, has been selected to serve for a year as interim provost and vice president for academic affairs.

Stapleton, who holds a joint appointment as professor of both chemistry and biological sciences, has been a faculty member at WMU since 1990. She previously served as associate dean of the College of Arts and Sciences before becoming dean of the Graduate College in 2012.

Her research focuses on understanding the regulation of carbohydrate and fatty acid metabolism.

Stapleton has garnered numerous awards throughout her career for her distinguished research and administrative leadership.

She assumed her new role in July.

Blackburn, Greider win Morani award

Elizabeth Blackburn and Carol Greider are joint winners of the 2017 Alma Dea Morani M.D. Renaissance


BLACKBURN


GREIDER

Woman award.

Presented by the Women in Medicine Legacy Foundation, the award recognizes outstanding women who have had a profound impact upon the scientific community.

Pioneers in the fields of molecular biology and genetics, Blackburn and Greider shared the 2009 Nobel Prize in physiology or medicine with Jack W. Szostak for their discovery of how chromosomes are protected by telomeres and the enzyme telomerase.

Blackburn is a professor at the University of California, San Francisco, and president of the Salk Institute for Biological Studies. Greider is a professor and a director of molecular genetics and biology at Johns Hopkins University.

Blackburn and Greider will receive their awards in November.

Cissé honored as Pew Scholar


CISSÉ

Ibrahim Cissé, the Class of 1922 Career Development Assistant Professor in the department of physics at the Massachusetts Institute of Technology, has been named as a 2017 Pew Scholar in the biomedical sciences.

The Pew Scholars program provides funding to support early-career scientists in conducting innovative research in the biomedical sciences.

Cissé is among 22 honorees who will receive $240,000 each in financial support over four years to fund their research.

Cissé's research explores the fundamental processes in gene activation. At his lab, he uses a combination of techniques to study biological interactions within living cells.

In memoriam: Kenneth David Gibson

Biochemist Kenneth David Gibson passed away April 6. He was 90.

Born in the Federated Malay States in 1926, Gibson earned his bachelor's degree at Trinity College at Cambridge and his Ph.D. in biochemistry at the University of London.

Gibson began his career as a Leverhulme research fellow in the department of chemical pathology at St. Mary's Hospital in London. In 1965, he joined Harold Scheraga's research group at Cornell University, predicting protein structure based on mathematical calculations of energy states.

He joined the Roche Institute of Molecular Biology in 1968, where his research centered on glycoprotein formation and collagen structure.

Gibson returned to Scheraga's team at Cornell in 1984, resuming his previous work developing mathematical algorithms to model protein structure.

He retired in 1994 but remained active within the Cornell community. He is survived by his three sons and three grandchildren.

Stahelin takes position at Purdue


STAHELIN

Robert V. Stahelin recently moved to Purdue University, where he was appointed as the Retter professor of pharmacy in the department of medicinal chemistry and molecular pharmacology.

Stahelin previously served as adjunct associate professor of pharmacology and toxicology at Indiana University School of Medicine and as an adjunct associate professor in chemistry and biochemistry at the University of Notre Dame.

He received his undergraduate degree and Ph.D. from the University of Illinois, Chicago, where he studied the structural basis of lipid–protein interactions.

Stahelin also serves as co-director of the Lipid Research Division at the American Society for Biochemistry and Molecular Biology.

Cristea, Overall win HUPO awards


CRISTEA


OVERALL

Ileana Cristea, professor of molecular biology at Princeton University, and Christopher Overall, lab head and principal investigator at the Centre for Blood Research at the University of British Columbia, are among the winners of the 2017 Human Proteome Organization awards.

Presented annually, the HUPO awards recognize outstanding achievements in the field of proteomics.

Cristea and Overall are co-recipients of the Discovery in Proteomic Sciences Award, which recognizes a single discovery in the field.

Cristea's research lies at the interface between proteomics and virology, with the goal of understanding viral infection from a proteomics perspective.

Overall's lab founded the field of "degradomics," a term they coined to describe the application of genomic and proteomic techniques to study proteases on a cell-, tissue- and organismwide scale.

The awards will be presented in September at the 16th HUPO World Congress in Dublin, Ireland.

Kopchicks give $10.5M endowment to UTHealth

John J. Kopchick and Charlene Kopchick are presenting the University of Texas MD Anderson Cancer

KOPCHICKS

Center UTHealth Graduate School of Biomedical Sciences with a $10.5 million endowment.

The John J. Kopchick and Charlene Kopchick Endowed Fellowships will fund up to 15 students at the graduate school, where John Kopchick earned his Ph.D. in 1980.

The Kopchicks' gift also will fund the Dr. John J. Kopchick Research Symposium as well as student research awards, which further will support and benefit young scholars.

John J. Kopchick is a distinguished professor and the Goll–Ohio professor of molecular and cellular biology and is a principal investigator in the Edison Biotechnology Institute at Ohio University.

A molecular endocrinologist, Kopchick's research explores the molecular structure of a growth hormone, a protein produced in the pituitary gland at the base of the brain.

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

Upcoming ASBMB events and deadlines

SEPT

12: Webinar: Compensation negotiation
14: Emerging Roles for the Nucleolus registration deadline
14–17: Membrane-Anchored Serine Proteases, Potomac, Md.
18–22: National Postdoc Appreciation Week
25: The Art of Science Communication online course registration deadline
29–30: Workshop: Preparing Science Professionals, Lexington, Ky.

OCT

2: The Art of Science Communication online course begins
15: Fall accreditation deadline
19–21: ASBMB exhibits at the 2017 SACNAS National Diversity in STEM conference, Salt Lake City, Utah
21–22: Workshop: Catalyze Your Career, Tucson, Ariz.
26–29: Emerging Roles for the Nucleolus, Kansas City, Mo.

NOV

1–4: ASBMB exhibits at Annual Biomedical Research Conference for Minority Students, booth #801, Phoenix, Ariz.
8–9: Workshop: Catalyze Your Career, Portland, Ore.
11–15: ASBMB exhibits at Neuroscience 2017, booth # 613, Washington, D.C.

DEC

7: Abstract submission deadline for the 2018 ASBMB Annual Meeting, San Diego
14: Travel award deadline for the 2018 ASBMB Annual Meeting, San Diego

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Schlebach wins Tabor award for protein-folding work

By Lauren Borja

Jonathan Schlebach, assistant professor at Indiana University, Bloomington, has won a 2017 Journal of Biochemistry/Herbert Tabor Young Investigator Award. His work is devoted to understanding the molecular mechanisms of disease, which describe how genomic mutations lead to the formation of misfolded proteins that disrupt cellular function.

Schlebach was selected for this award by JBC Associate Editor Karen Fleming of Johns Hopkins University. She presented the award to Schlebach at the Membrane Protein Folding Gordon Research Conference held from June 4–9 at Stonehill College in Easton, Mass. According to Fleming, "Jonathan's work represents the best of many multiscalar approaches to cellular biochemistry, because it bridges rigorous biophysical measurements on protein stability to the phenotypic consequences in the cellular context."

Schlebach's current research targets proteins associated with autism and cystic fibrosis. He hopes to combine the next generation of genetic tools with his experimental methods to identify how modifications are borne out in the conformation of proteins in the cell.

Schlebach's recent work focuses on how the fundamentals of protein folding manifest themselves in the molecular basis for diseases. Recent innovations in genetics have brought forth inexpensive genome sequencing, which allows researchers easily to identify mutations in DNA. However, the identification of new mutations only raises more questions about how these variations in genetic information lead to potentially harmful changes in protein structure. "That's where we're hoping to come in," Schlebach said, "providing tools and other experiments that will help us interpret the effects of mutations (on proteins)." In a recent publication, Schlebach and colleagues correlated increases in the free energy of membrane folding with different phenotypes for muscular dystrophy.

In his laboratory at Indiana University, Schlebach's research targets proteins associated with autism and cystic fibrosis. He hopes to combine the next generation of genetic tools that allow researchers to scan simultaneously hundreds of mutations with his experimental methods to identify how these modifications are borne out in the conformation of proteins in the cell. Doing so "allows us to test both protein folding and evolutionary hypotheses in disease," Schlebach said, which he finds very exciting.

Born in Springfield, Ill., Schlebach attended the University of Illinois, Urbana–Champaign. He graduated in 2007 with a bachelor's degree in biochemistry. His interest in the kinetics and thermodynamics of protein folding took him to Chiwook Park's laboratory at Purdue University for his Ph.D. Upon completing his Ph.D. in 2012, Schlebach traveled to Vanderbilt University for a postdoctoral fellowship in the laboratory of Charles R. Sanders. He became an assistant professor at Indiana University, Bloomington, in 2016.

PHOTO COURTESY OF JONATHAN SCHLEBACH

Tabor award winner Jonathan Schlebach is an assistant professor at Indiana University, Bloomington.

Lauren Borja (laurenjborja@gmail.com) is a science writer with a Ph.D. in physical chemistry from the University of California, Berkeley.

H. Alex Brown (1960–2017)

By Craig W. Lindsley & Lawrence J. Marnett

The scientific community suffered a great loss on July 25, when H. Alex Brown passed away at the age of 56 after a long battle with an aggressive cancer. True to everything that Alex was, he retained his focus on science, his love and pride in his family, and an incredibly positive outlook throughout his treatment.

The Bixler–Johnson–Mayes professor in the department of pharmacology and interim director of the Vanderbilt Institute of Chemical Biology at Vanderbilt University School of Medicine, Alex was an exceptional scientist, colleague and mentor. He was a leader in the field of lipidomics, the application of analytical chemistry, mass spectrometry and systems biology to lipid profiling in cells and tissues. He helped define the role that the enzyme phospholipase D, known as PLD, plays in intracellular lipid signaling pathways involved in growth promotion, invasive cancers, viral infection and immunology. Beyond his scientific prowess, Alex forged translational collaborations across disciplines and was a champion for quantitative science.

Alex grew up on the east coast of Florida close to the Kennedy Space Center. He attended Wake Forest University and received his Bachelor of Science with highest honors from Florida Institute of Technology and a master's degree from Syracuse University. Alex received his Ph.D. in 1992 from the University of North Carolina at Chapel Hill working in the laboratory of T. Kendall Harden, where his lifelong interest in the complexities of cell signaling was born. He then pursued postdoctoral training in the department of pharmacology at the University of Texas Southwestern Medical Center with Paul Sternweis.

In 1996, Alex joined the faculty at Cornell University with appointments in pharmacology and biochemistry and molecular and cell biology. There, in 1997, he received the Sidney Kimmel Foundation for Cancer Research Scholar Award. While at Cornell, Alex used electrospray ionization mass spectrometry to develop the field of computational lipidomics in collaboration with Fred McLafferty. Al Gilman, then the director of the Alliance for Cellular Signaling, invited Alex to use this emerging technology to contribute to the AfCS research program.

In 2002, Alex was recruited to Vanderbilt University School of Medicine as the Ingram professor of cancer research in pharmacology, where he served as the director of the glycerophospholipid core for the lipid metabolites and pathways strategy consortium, known as Lipid MAPS, beginning in 2003. Since 2016, Alex had served as interim director of the Vanderbilt Institute of Chemical Biology, known as the VICB, which supports, through research and education, the application of chemical technologies to important biological problems. He was one of the VICB's first recruits and previously a member of the executive committee. At the time of his passing, Alex was in the midst of executing a grand vision for the VICB that would have united chemistry and biology practitioners in translational endeavors.

Alex trained nine Ph.D. students and supervised 13 postdoctoral associates while publishing more than 150 peer-reviewed research articles. He was generous with his time in helping others and in providing service to the research community. He served on editorial boards and publication committees for numerous journals, was an associate editor of the journal Molecular Pharmacology, and organized international conferences on lipid metabolism and signaling. He also served on the editorial board for the Journal of Biological Chemistry and the American Society for Biochemistry and Molecular Biology publications committee.

I, Craig Lindsley, first met Alex when I interviewed for a faculty position in the pharmacology department at Vanderbilt in 2006. I was immediately impressed by Alex's passion for science and his drive to better understand the diverse roles of his beloved lipid signaling enzyme, PLD. After joining the faculty, I had my first of many lunch meetings with Alex, at which he asked if I thought we could develop selective ligands for the two isoforms of PLD, PLD1 and PLD2. That simple question sparked a 10-year collaboration between our labs that resulted in highly selective, allosteric PLD1, PLD2 and dual PLD1/2 inhibitors that enabled Alex to define the roles of the individual isoforms in oncology and infectious disease. Ten years, more than 2,000 compounds synthesized and assayed, and over a dozen manuscripts later, these small-molecule probes revitalized and revolutionized a stagnant field — held captive by a lack of chemical probes to prosecute — with what is now a high-profile target for drug discovery efforts. Throughout, Alex was an exacting scientist with an unwavering eye toward quantitation. The unmasking of the therapeutic promise of PLD is solely due to his pioneering efforts and vision, and if he had been given

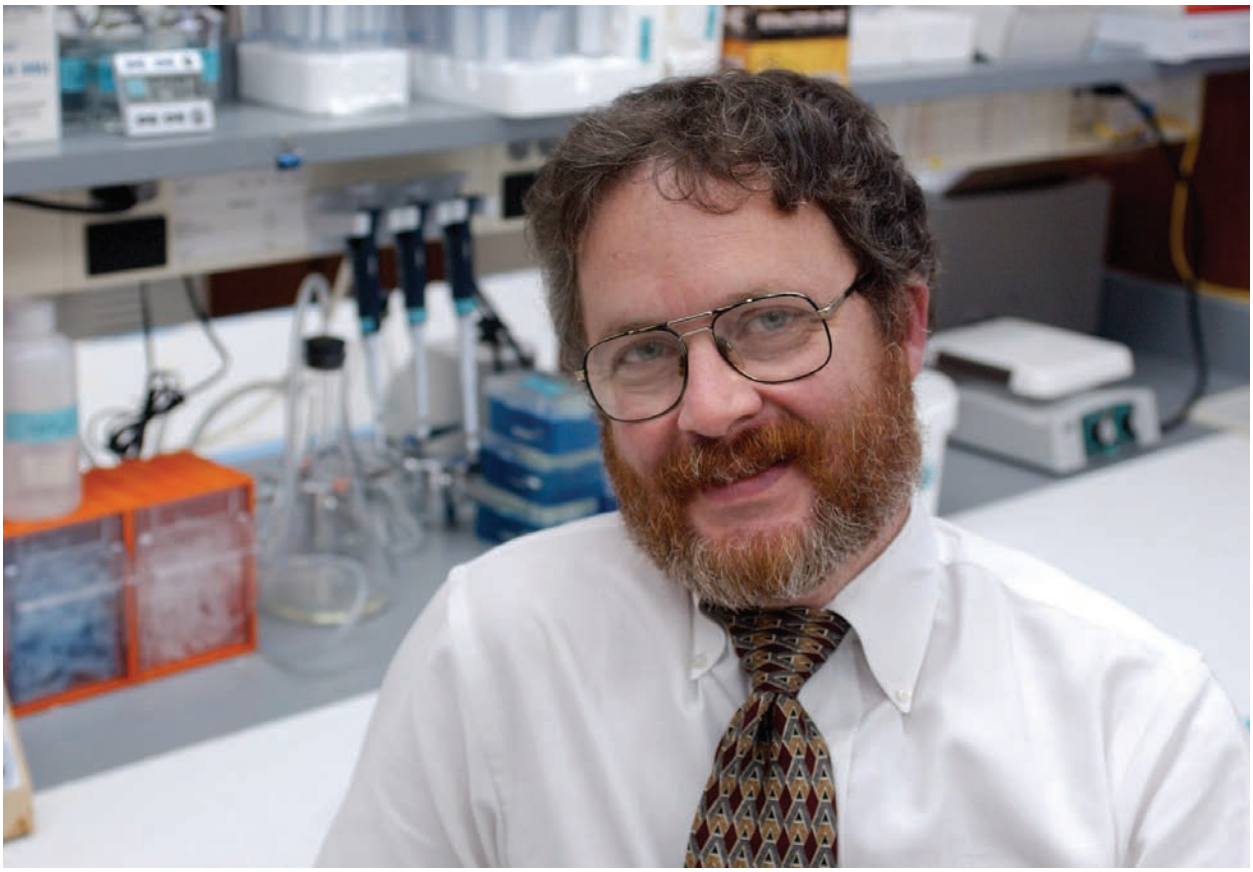


PHOTO COURTESY OF VANDERBILT UNIVERSITY

Alex Brown was featured in a 2003 Vanderbilt Reporter story on the founding of the lipid metabolites and pathways strategy consortium, known as Lipid MAPS.

more time, there is no limit to what he would have accomplished.

I, Larry Marnett, had the pleasure of collaborating with Alex for most of his time at Vanderbilt. We used his lipidomic methodologies to characterize the mobilization and re-esterification of saturated and polyunsaturated fatty acids in the phospholipid pools of macrophages stimulated with inflammatory mediators. Simultaneously monitoring all the fatty acids moving around in all the phospholipids was amazing to me and analogous to removing the curtains from a mysterious world. We published nine papers from our collaboration; the last one appeared June 14 of this year. We had many conversations during and after his recruitment to Vanderbilt. They were always intense and never superficial; Alex valued details. The conversation that really stands out took place about a year ago. Alex had been working hard to regain funding after the support from various consortium grants had run out. He had written many grant applications on the role of PLD in infection and its potential as a target for antibiotic drug discovery. Over lunch, he said it was frustrating to have grants rejected when there was so much research to do but that he was not discouraged. The experience had forced him to look deeply at his results and priorities, which convinced him that he was not only headed in the right direction but was doing the most important work of his career. He said he felt energized, and not long thereafter he obtained an R01 to reboot his PLD program. Alex had a mental toughness and passion for science that few of our contemporaries display.

Alex's long-time friend and colleague Stephen Traynelis of Emory University recalls Alex during his graduate and postdoc years. "I consider it an honor and privilege to have known Alex, who enriched the lives of virtually everyone he interacted with," Traynelis said. "I will always remember the many deep conversations we shared about all aspects of science and life, his unwavering commitment to faith and family, and his impressive work to understand lipid biology. I remember asking Alex late in his postdoctoral fellowship what he planned to do, before he moved to Cornell. Alex replied, 'I feel like the lipid membrane is perhaps the most poorly understood feature of cells yet the most dynamic. I plan to use the various skills I have learned to take apart the membrane, know all if its components and study its capacity for signaling. I think it will be transformational.' And he did just that."

Ken Harden was Alex's Ph.D. adviser at UNC. "This is such a

PHOTO COURTESY OF RENEE BROWN

Alex Brown with his daughter, Lindsey, his wife, Renee, and his son, Kyle.

loss for science and for lipid signaling research in particular," Harden said. "Alex was a uniquely talented and dedicated scientist — and, oh, how we will miss his robust voice, hearty laugh and wonderful sense of humor."

In the past few years, Alex's research program turned toward infectious diseases, and he collaborated with Paul Thomas at St. Jude Children's Research Hospital to uncover a novel role for PLD in influenza and other viruses. "Alex was a thorough and creative scientist who was able to see a problem from many angles," Thomas said. "I was always excited to get a phone call from him, as it meant he had a new idea or new data to share about a project we were working on together. Most importantly, he was a good man who considered mentoring and the integrity of his work as his primary objectives."

Paul Sternweis, Alex's postdoctoral adviser at UT Southwestern, summed up what so many feel. "Alex was one of the best!" he said. "As a postdoctoral fellow in my research group, his creativity, unbounded energy, productivity and cooperativity made him a driving force for the whole group. It was a pleasure to see his willingness to vigorously take on daunting problems move him to the forefront of research fields and feed a thriving career. But more than this, Alex was a friend who brought much joy to those around him, including myself. He is truly missed."

In addition to a research community that mourns his passing, Alex leaves behind his wife, Renee Brown, program chair of the School of Physical Therapy at Belmont University; his son, Kyle, a chemistry graduate student at the University of Wisconsin; and his daughter, Lindsey, an architecture student at Syracuse University.

While his serious demeanor was legendary, outside the lab, Alex was quite possibly the kindest, most generous and family-focused man many of us have ever known. And here is a little-known fact: It took many, many $1 Evan Williams shots at a Keystone meeting to witness it, but Alex had an uncanny ability to impersonate Eddie Murphy. As the whiskey flowed, Alex was transformed, and a large group was privy to a revival of "Saturday Night Live" circa 1979–1982. It was a thing of beauty and completely unexpected.

Rest well — you are dearly missed.

Craig W. Lindsley (craig.lindsley@vanderbilt.edu) is the William K. Warren Jr. chair in medicine, professor of pharmacology and chemistry, and co-director and director of medicinal chemistry for the Vanderbilt Center for Neuroscience Drug Discovery. He develops allosteric modulators of kinases, GPCRs and phospholipases to treat CNS disorders and cancer.

Lawrence J. Marnett (larry.marnett@vanderbilt.edu) is the Mary Geddes Stahlman professor of cancer research; professor of biochemistry, chemistry and pharmacology; and dean of basic sciences of the Vanderbilt University School of Medicine. He studies the role of polyunsaturated fatty acid oxidation in inflammation and cancer.

Sphingolipid metabolism protects kidneys from cisplatin

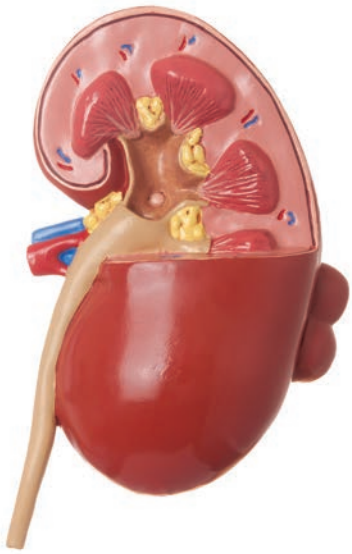
By Lauren Borja

In pursuit of more effective cancer treatment, researchers have uncovered how the kidneys protect themselves or recover from chemotherapy-induced damage. These results, published in the **Journal of Lipid Research**, are a significant step toward improving long-term cancer patient outcomes.

While attacking a cancer in the body, chemotherapy causes disastrous long-term ramifications for noncancerous organs. Cisplatin, a common chemotherapeutic agent, is used to treat many different tumors, including those caused by testicular, breast and brain cancers. Its dosage is limited due to its adverse side effects on the kidneys: 30 percent of patients treated with cisplatin experience a sudden loss of kidney function or acute kidney injury. "If we could use it at an effective level for treating cancer, we would obliterate the kidney," said Leah Siskind, a professor at the University of Louisville and corresponding author for this study.

Developing a cisplatin treatment regimen that attacks cancerous cells without damaging healthy ones has been problematic. Cisplatin interferes with normal cellular functions, causing inflammation and cell death while disrupting the migration and proliferation processes associated with regeneration. Protecting healthy cells from these cisplatin-induced effects can cause the cancerous cells to become chemotherapy-resistant.

Sphingolipids, bioactive lipids in cellular membranes, could be used to protect the kidney during cisplatin treatment because of their role in cell inflammation, migration, proliferation and death responses. Researchers, including Siskind, have focused on a specific sphingolipid, ceramide,



because its levels increase in cancer and kidney cells in response to cisplatin treatment.

Ceramide's role in the cancer-cell response to cisplatin has been well-studied. Cancer cells that increase the conversion of ceramide to glucosylceramide and sphingosine-1-phosphate become resistant to chemotherapy and metastasize. Inhibiting the enzyme glucosylceramide synthase, however, reduces ceramide's conversion to glucosylceramide and sensitizes the cancer cells to cisplatin.

Ceramide's involvement in acute kidney injury during cisplatin treatment is not understood. It is unknown if it is the presence of ceramide alone or its metabolism to a secondary sphingolipid species that is most toxic to cells within the kidney. Studies have shown that glucosylceramide plays a role in the pathology of different kidney diseases.

Perhaps inhibiting glucosylceramide synthase could protect the kidneys from cisplatin, Siskind's group hypothesized. They partnered with James Shayman of the University of Michigan. Shayman developed a Food and Drug Administration–approved glucosylceramide synthase inhibitor to treat Gaucher's disease, a genetic disorder that prevents the proper metabolism of glucosylceramide. Siskind compared the kidneys of mice treated with cisplatin alone versus the kidneys of those treated with cisplatin and one of Shayman's glucosylceramide synthase inhibitors.

"We didn't know at the time that the kidney was actually using this (ceramide metabolic) pathway the same way the cancer cells do," Siskind said. The results showed their hypothesis was wrong. Treatment with both the glucosylceramide synthase inhibitor and cisplatin led to an increase in kidney injury in mice over those treated with just cisplatin. These results indicated that the kidneys converted ceramide to glucosylceramide to protect themselves from cisplatin-induced acute kidney injury.

Results contrary to an initial hypothesis are hardly a reason to be discouraged and often lead to more interesting future studies. Siskind and her lab plan to target other enzymes in the ceramide regulatory pathways to alleviate cisplatin-induced acute kidney injury. Beyond developing a better treatment for cancer, however, "these data suggest that glucosylceramide might still play a role in other forms of acute kidney injury and chronic kidney diseases," Siskind said, and she plans to "look at this drug in other contexts."

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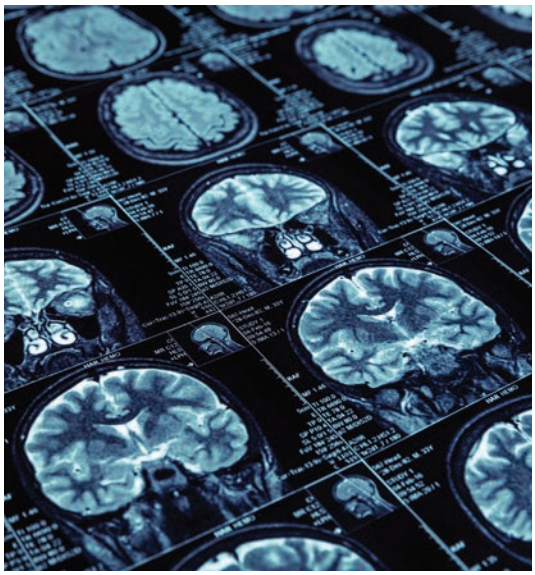
Thematic series highlights Alzheimer's greatest genetic risk factor: ApoE

By Courtney Chandler

Alzheimer's disease is the chief cause of dementia in adults in the U.S., accounting for up to 80 percent of all cases. While it is commonly known that age is the biggest risk factor of Alzheimer's, the next major risk factor is less well known: a protein called apolipoprotein E, or ApoE.



ApoE is the main lipid-carrier protein in the brain and has a role in the transport and metabolism of many lipid classes. This is important because the brain is a fatty, lipid-rich organ. ApoE can take three different forms, and the consequences of these differences can profoundly affect processes like lipid homeostasis and neurodegeneration. One specific form, ApoE4, increases one's risk of developing Alzheimer's by as much as eightfold. A recent thematic review series in the **Journal of Lipid Research** includes eight articles that explore the connections between brain lipids, ApoE and Alzheimer's disease.

"Lipid abnormalities are closely associated with various neurodegenerative diseases," said Ta-Yuan "T.Y." Chang of Geisel School of Medicine at Dartmouth College. He and wife Catherine Chang have been researching cholesterol metabolism and its relationship to neurodegenerative diseases for more than four decades. As the coordinators of the series, they selected experts in their fields to review the current state of Alzheimer's research. "This series of articles describes the recent advances in our knowledge of the roles of ApoE and various lipids in Alzheimer's disease," T.Y. Chang said.

The articles highlight the multifaceted nature of ApoE in both healthy brains and those with Alzheimer's. "ApoE is a versatile protein and plays many roles," T.Y. Chang said. One of its roles is clearing a specific peptide called amyloid beta, or Abeta, from the brain. "ApoE affects the clearance of Abeta peptides from the brain, and ApoE4 is much less capable of doing so than ApoE3," he said. Without proper clearance, Abeta peptides can accumulate to form amyloid plaques, a hallmark of Alzheimer's. In his article in the series, David Holtzman of Washington University delves into this connection.

ApoE is linked to Alzheimer's by more than plaque accumulation. "ApoE4 itself adversely affects brain function in ways independent of Abeta," T.Y. Chang said. Studies using young, healthy brains to study ApoE, lipids and inflammation in the brain are also critical, as many Alzheimer's cases are detected only after symptoms are present. William Rebeck of Georgetown University summarizes this topic. Recent insights into the complex relationship between ApoE, Abeta and Alzheimer's disease have come from improved animal models of Alzheimer's, which historically has been hard to study due to key differences between the factors involved in humans and in mice. Mary Jo LaDu of the University of Illinois at Chicago writes how a novel transgenic mouse line that expresses human rather than mouse ApoE greatly increases the potential for preclinical drug testing in Alzheimer's research.

The series also focuses on cholesterol as a key lipid class in the brain. "The brain contains 23 percent of the body's total cholesterol, though it constitutes only 2 percent of the total body weight," Catherine Chang said. Chang and Chang discuss the complex relationship between cholesterol homeostasis, ApoE and Alzheimer's in their article.

Low-density lipoprotein receptors, or LDLRs, key players in cholesterol transport and metabolism, also are implicated in Alzheimer's. Furthermore, ApoE is a ligand for a handful of different receptors in the brain, including several in the LDLR family. Articles by Joachim Herz of the University of Texas Southwestern Medical Center and Mitsuru Shinohara of the Mayo Clinic explore the specific roles some of the LDLR family proteins play in Alzheimer's pathogenesis and highlight how conflicting reports on similar topics have led to debate within the field.

Alzheimer's has no cure, despite efforts to understand the disease and develop effective treatments. Gary Landreth of Indiana University

highlights one potential therapeutic target: nuclear receptors. These ligand-induced receptors are involved in various facets of Alzheimer's progression. Landreth describes how agonists are being developed to increase the capacity of these receptors to mitigate disease progression.

Tobias Hartmann of the Universität des Saarlandes in Germany discusses the pitfalls and merits of multinutritional prevention approaches, specifically how they may affect ApoE transport of various lipid classes in the brain. This article discusses in detail disease-prevention approaches focused on intake of a variety of healthy fats, vitamins and proteins.

Collectively, these articles cover a few selective aspects of the connection between ApoE, healthy brain function and Alzheimer's disease. Each article highlights specific areas of research that must continue for better understanding of Alzheimer's and discusses discrepancies in the field to provide a snapshot of the research as it stands right now.

"Alzheimer's disease is the sixth-leading cause of death in the U.S., and no cure is available at present," T.Y. Chang said. "The research in this series has the potential to lead to new therapies to treat Alzheimer's."

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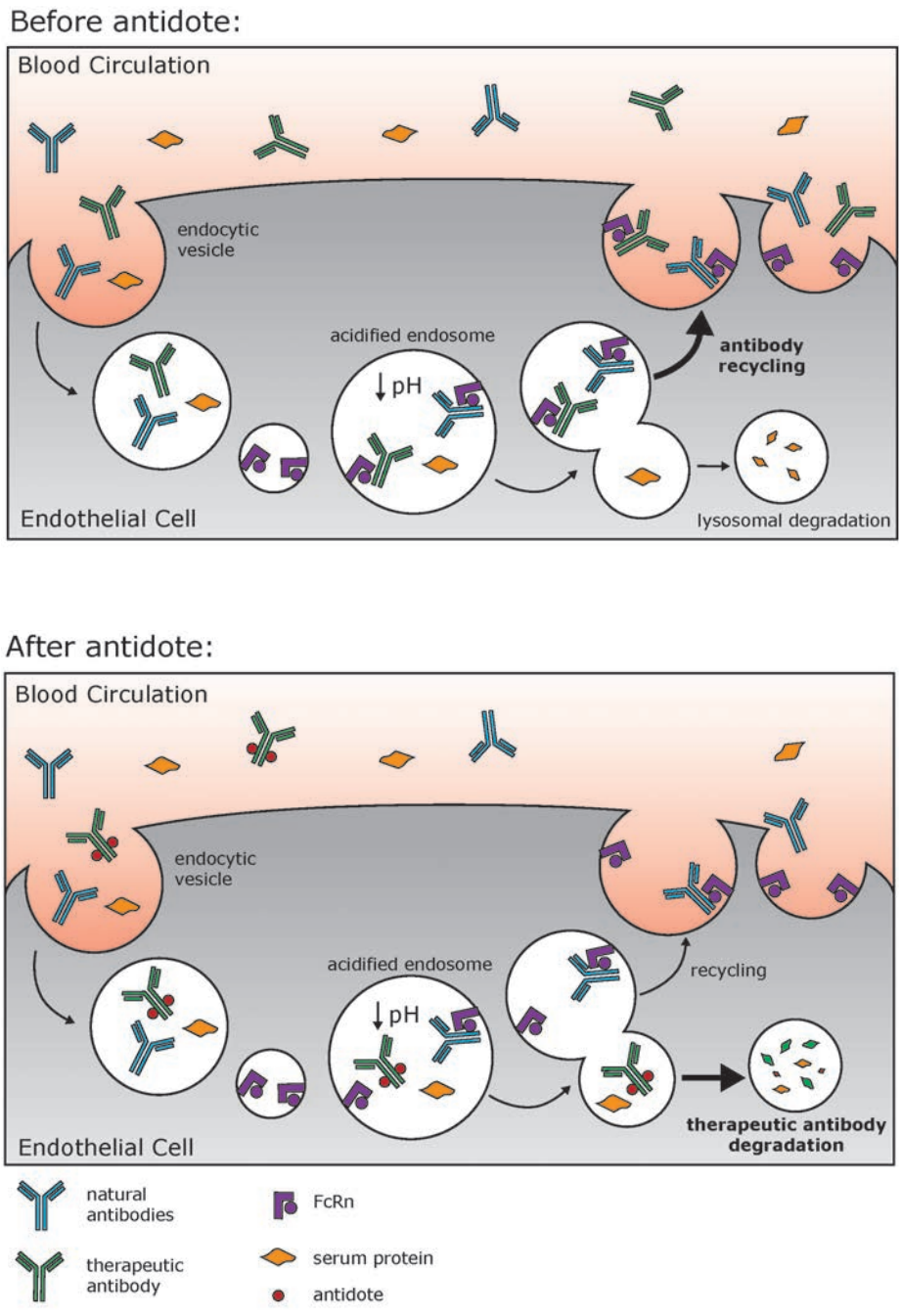
Antidote tested for biologic therapy side effects

By Mariana Figuera–Losada

About 120 years ago, Paul Ehrlich proposed a revolutionary idea, the side-chain theory, to explain immune response in cells. We now know the process he described is the binding of antigens to receptors on the surface of immune cells. Ehrlich compared this process to a key fitting in a lock and had the foresight to coin the term "magic bullet" in reference to the precision and lethality of immune cells reacting to specific targets. Fast forward to 1975, when George Köhler and Cesar Milstein developed a method to produce monoclonal antibodies and custom-made "magic bullets" were born as therapeutic antibodies.

Adapting monoclonal antibodies to be used as therapeutic agents involved solving problems with large-scale production and immunogenicity, fine-tuning their specificity and harnessing their molecular and cellular mechanisms as therapeutic tools. Now, monoclonal antibodies are an important part of the physicians' arsenal to treat cancer, organ transplant rejection, and autoimmune and infectious diseases.

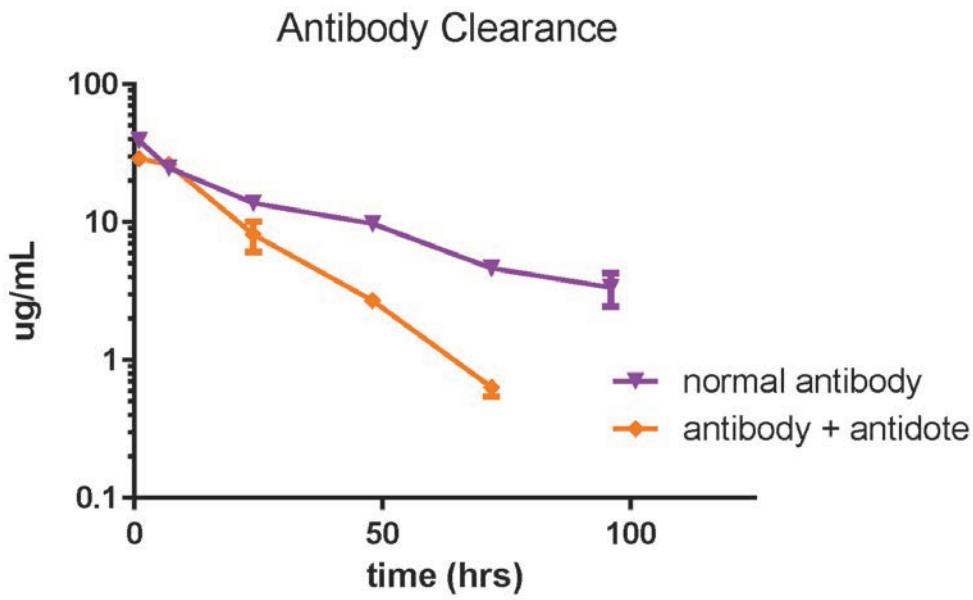
However, new issues have emerged, such as the inherent risks of treating a patient with therapeutic antibodies that remain in circulation for extended periods, exercising long-lasting effects. Alyse Portnoff, a postdoctoral fellow in the Antibody Discovery and Protein Engineering



FIGURES COURTESY OF ALYSE PORTNOFF

Schematic of the antidote mechanism

The role of FcRn recycling for circulating antibodies (top): Proteins in circulation are taken up by fluid phase pinocytosis by endothelial cells, where the majority of antibodies bind FcRn in the mildly acidic early endosome. Then proteins bound to FcRn are trafficked to a recycling endosome and returned to the cell surface, where they dissociate and return to circulation at the near-neutral pH of the serum. After antidote (bottom): The antidote blocks FcRn binding, and the therapeutic antibody follows the default fluid phase endocytic path to the lysosome for degradation.



Antidotes that block FcRn binding profoundly impact antibody pharmacokinetics in huFcRn transgenic mice
Antibody serum concentration curves for the therapeutic antibody containing a nonnatural amino acid (purple) and for the antibody after antidote conjugation (orange) in huFcRn transgenic mice.

group at MedImmune, explained that "because every patient responds to a medicine differently," she and her colleagues needed to create "safety mechanism(s) for their (therapeutic) proteins, such that they could be removed from a patient in the event of an adverse reaction — much like a safety net for patients undergoing treatment." Portnoff and her colleagues provide proof of principle for this concept in a **Journal of Biological Chemistry** paper.

For this study, the researchers took advantage of the mechanism responsible for the naturally long half-lives of antibodies in circulation, on average about 21 days. This mechanism involves the pH-dependent interaction of the crystallizable fragment of an IgG antibody, Fc region, with the neonatal Fc receptor FcRn. The binding of an antibody to FcRn allows the former to escape lysosomal degradation, return to circulation and continue its function.

Borrowing the tRNA for the amber codon, UAG, from the anaerobic archeabacter Methanosarcina mazei and its pyrrolsyl-tRNA synthetase, the researchers designed and produced variants of a therapeutic antibody. These variants were modified with a nonnatural amino acid, which was strategically positioned in different regions of the antibody–FcRn interface. Binding of these mutant antibodies to FcRn and in vivo half-life and clearance rate appeared roughly unaltered despite having the nnAA substitution. However, addition of a small-molecule antidote covalently modified the nnAA by click chemistry, negatively affecting antibody affinity for FcRn and significantly increasing in vivo clearance in a mouse model.

The authors acknowledge the need to improve in vivo click chemistry reaction efficiency and antidote size and structure, but they point out that this preliminary study represents an important first step toward developing safety switches for therapeutic antibodies, potentially broadening the population of patients that could benefit from these novel therapies. A good example would be patients suffering from autoimmune diseases such as rheumatoid arthritis, lupus or psoriasis, Portnoff said. These are chronic diseases often treated with immunosuppressive therapies involving antibody therapeutic treatments for the rest of the patients' lives, she said. "While a patient may respond well to his or her medicine, immunosuppressive therapies can sometimes prevent the body from healing unrelated infections," she said. "Our research into turning off binding to the FcRn receptor may create a way to temporarily suppress treatment, enabling the patient to fight the infection and then return to his or her regular course of immunosuppressive treatment."

Mariana Figuera–Losada (fmariana@hotmail.com) is a research consultant at Montefiore Medical Center.

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**.

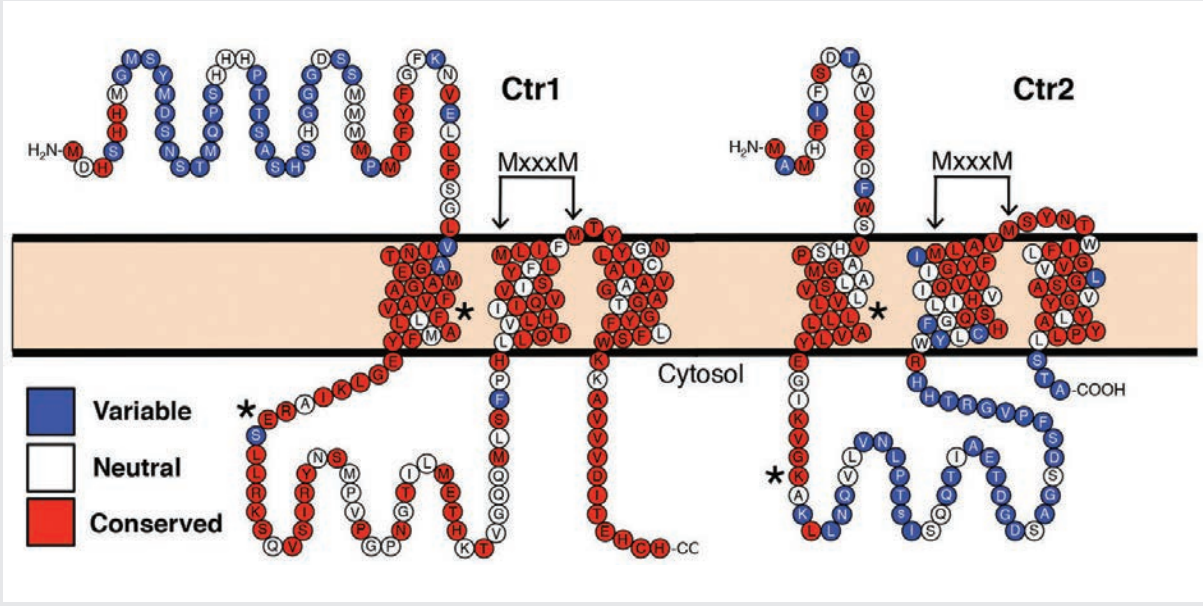
Why the immune system needs a breath of fresh air

In lung disorders such as chronic obstructive pulmonary disease, elevated carbon dioxide in the blood (hypercapnia) is associated with suppressed immune function. A paper in the **Journal of Biological Chemistry** describes how the connection between hypercapnia and immunosuppression is mediated by the NF-kappaB signaling pathway. Eoin P. Cummins and colleagues investigated the basis of the CO_2-sensitivity of NF-kappaB signaling and found that "noncanonical" transcription factors RelB and p100 were translocated to the nucleus in response to CO_2. They also identified a mechanism of CO_2-dependent cleavage of RelB.

jbc.org/content/292/27/11561

Enzymatic surprises from cow stomach fungi

Because the microbial communities in the rumens of cows and other large herbivores efficiently process large amounts of plant matter, they are a potential source of new enzymes that can be used in biofuels and other applications. In a paper in the **Journal of Biological Chemistry**, D. Wade Abbott and colleagues describe how they investigated family 39 glycoside hydrolases from rumen fungi and found that these hydrolases release



Protein sequences from metazoan Ctr1 and Ctr2 were aligned and analyzed for conservation with the ConSurf server using a Bayesian evolution method. Shown are the human Ctr1 and Ctr2 proteins with amino acids that represent variable (blue), neutral (white), or conserved (red) positions. Arrows point to the highly conserved MXXXM motif necessary for copper transport. Asterisks denote residues Phe-77 and Glu-91 in human Ctr1 as well as Leu-34 and Lys-47 in human Ctr2.

A tale of two copper transporters

Copper is an essential cofactor for enzymes involved in many different biological processes. The mammalian copper transporter Ctr1 plays essential roles in embryonic development, whereas the homologous protein Ctr2 lacks transporter activity but regulates Ctr1. In a paper in the **Journal of Biological Chemistry**, Dennis J. Thiele and colleagues describe their finding that Ctr1 and Ctr2 arose as a result of an ancient gene duplication and that copper-dependent cell growth in Ctr1-lacking cells could be rescued by mutations in Ctr2 generated via random mutagenesis that restored its copper transporter activity.

jbc.org/content/292/27/11531.abstract

rare arabinosyl-containing glycans from plant hemicelluloses and pectins, revealing new functional diversity in this enzyme family.

jbc.org/content/ 292/30/12606

How calmodulin captures K-Ras in cancer

The calcium-binding protein calmodulin promotes cell proliferation in some cancers by selectively binding to the oncoprotein K-Ras and extracting it from cell membranes, leading to the creation of an oncogenic signaling complex. In a paper in the **Journal of Biological Chemistry**, Ruth Nussinov and colleagues describe how they carried out molecular dynamics simulations that suggested that the hypervariable region of K-Ras4B wraps around calmodulin's flexible linker region in a stable but highly dynamic interaction necessary for K-Ras release.

jbc.org/content/292/30/12544

Omega-3s make sperm flexible and viable

DHA is an essential omega-3 fatty acid that increases the flexibility of cell membranes. Takao Shimizu and colleagues write in the **Journal of Biological Chemistry** about how they discovered that knocking out an enzyme required for incorporation of DHA-containing phospholipids into cell membranes leads to male infertility in mice. Observations of spermatogenesis in these mice suggested that DHA-induced membrane flexibility is necessary for sperm maturation. In a companion paper, Shimizu and colleagues examined DHA's role in the retina.

jbc.org/content/292/29/12065

Dissecting reactions in miniature membranes

Hydrogen sulfide is a signaling molecule that is toxic at high concentrations. The first step of detoxification of H2S in mitochondria is catalyzed by sulfide quinoneoxidoreductase, or SQR. In a paper in the **Journal of Biological Chemistry**, Ruma Banerjee and colleagues describe how they analyzed the kinetics of this reaction using SQR embedded in nanodiscs (synthetic soluble membranes) rather than solubilized in detergent, simulating an environment more similar to the enzyme's natural membrane-embedded state. Using this approach, they identified the rate-limiting step and sulfane sulfur acceptor in this reaction.

jbc.org/content/early/2017/05/16/jbc.M117.788547

Knocking out DOCK2 revs mouse weight loss

There's still much to be learned about the connections between inflammation and obesity. In a recent paper in the **Journal of Lipid Research**, researchers created mice deficient in the protein DOCK2 to see what effects the deficiency might have on weight gain and metabolism. DOCK2 is short for dedicator of cytokinesis 2. It ordinarily is expressed in white blood cells. Compared with normal mice, the mice deficient in DOCK2 gained less weight and had more active metabolisms when they ate a high-fat chow. They also had less adipose tissue and lower inflammation than wild-type mice. DOCK2, it seems, might end up a target worthy of pursuit in the search for therapies for obesity. The work was overseen by Shi-You Chen at the University of Georgia.

jlr.org/content/early/2017/07/17/jlr.M073049.abstract

Method helps visualize lipid-based PTMs

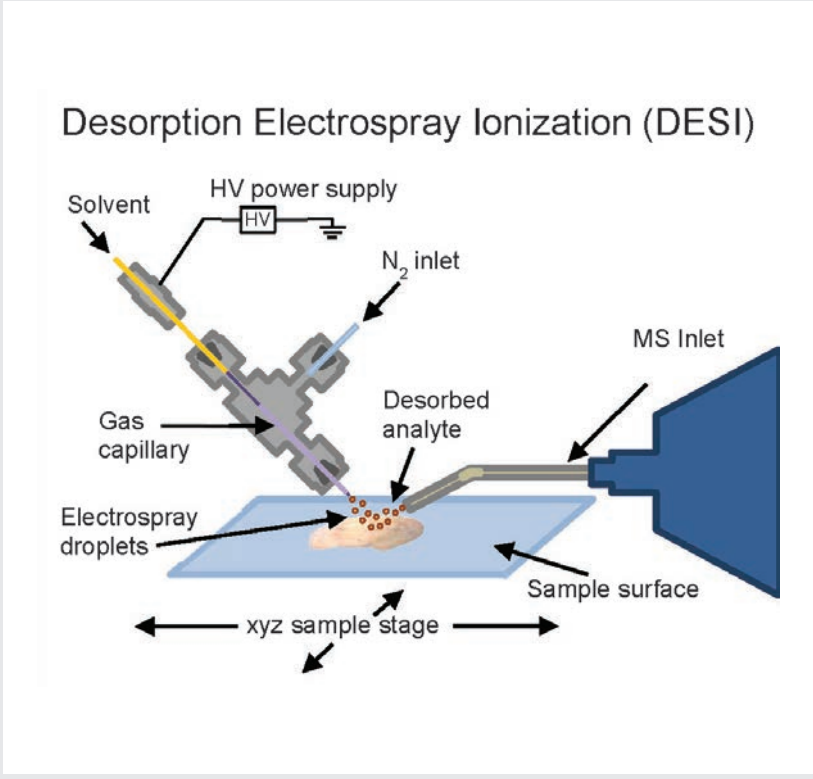
Lipidation is the covalent binding of a lipid group to a peptide chain. It's one form of post-translational modification that contributes to the diversity of the proteome. In a paper in the **Journal of Lipid Research**, a team of researchers led by Tamara L. Kinzer–Ursem and Sarah Calve at Purdue University report the development of a new method of imaging proteins, both in vitro and in vivo, that have been modified by the addition of myristic acid at the N-terminus. The researchers report that the distribution of these proteins varies dramatically between undifferentiated and differentiated muscle cells in zebrafish. Their study indicates that this fluorescent detection method can help those studying the roles that myristoylation and other lipid modifications play in disease.

jlr.org/content/early/2017/07/28/jlr.D074070.abstract

Bacterial cellulose preserves native cellular phenotype

Conventional culture of primary cells on rigid and hydrophobic plastic surfaces may cause phenotypic alterations, contributing to the discrepancy between in vivo and in vitro biological models. In a paper in **Molecular & Cellular Proteomics**, Gerhard Feil and colleagues describe how they developed a bacterial cellulose cell culture support called Xellulin, which they showed to preserve important features of the native phenotype of primary cells. Transcriptomic and proteomic analyses revealed that the gene expression of cells propagated on Xellulin resembled native cells significantly more than cells grown on plastic, demonstrating the potential of Xellulin as a tool to promote an in vivo-like phenotype in cell culture.

mcponline.org/content/early/2017/06/21/mcp.RA117.000001.abstract



Desorption electrospray ionization (DESI) is an ambient ionization mass spectrometric imaging technique. Electrospray droplets are formed when high voltage is applied to the solvent. Desorbed analyte is vacuumed into the mass spectrometer inlet, separated by m/z, and detected. After the sample is slowly rastered beneath the DESI source and mass spectrometer inlet, an image of the sample surface can be re-created from the mass spectral data.

Imaging lipid metabolism in the mouse brain

At any given moment, myriad reactions occur in a cell and, on a larger scale, in a tissue. Each reaction type has its own requirements, and so the cell has specialized compartments to establish those conditions. A new paper in the **Journal of Lipid Research** describes the use of DESI-MS (short for desorption electrospray ionization mass spectrometry) to measure lipid metabolism in different parts of mouse brain. The researchers, led by John C. Price at Brigham Young University, showed that lipid turnover rates vary from region to region. They note that their study is the first to image metabolism of specific lipids (they picked four for this work) but that their techniques could be applied to any identifiable molecule.

jlr.org/content/early/2017/07/25/jlr.M078170.abstract

Understanding a new tuberculosis vaccine

Mycobacterium vaccae has been shown to be a promising vaccine against tuberculosis; however, the mechanisms by which it exerts immunomodulatory effects in humans are not fully understood. In a paper in **Molecular & Cellular Proteomics**, Jianhua Zheng and colleagues describe how they performed a proteogenomic analysis of M. vaccae in which they identified the expression of 3,387 proteins, including 581 hypothetical proteins and 38 novel proteins that previously were unannotated. Further investigation revealed 35 candidate antigen proteins, a few of which show highly immunogenic activity, providing insights into the physiology and mechanisms of M. vaccae immunotherapy.

http://www.mcponline.org/content/early/2017/07/24/mcp.M116.065813.abstract

Protein dynamics in brain development

Resolving protein expression patterns throughout tissue development in specific anatomical regions remains technologically challenging. Ugljesa Djuric and colleagues tackled this issue in understanding neurodevelopment by profiling proteins isolated from formalin-fixed, paraffin-embedded cerebral regions at different fetal developmental stages using mass spectrometry. In a paper in **Molecular & Cellular Proteomics**, they describe how they found dynamic changes in protein abundance throughout brain development and identified a number of novel region-specific protein expression patterns. This spatiotemporal proteomic profiling strategy offers the potential for understanding development of other tissues and pathogenesis of diseases.

http://www.mcponline.org/content/early/2017/07/07/mcp.M116.066274.abstract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Worms, too, slow down in old age

By John Arnst

In efforts to stave off death, unicellular and multicellular organisms constantly are recycling proteins, breaking down those that are damaged to provide building blocks for fresh copies that can carry out cellular functions. The process is an uphill battle with an inevitable end: The recycling and refreshing slow down, causing cellular damage to continue accruing until the organism dies and ultimately is broken into biochemical materials for other life. This progression, known as senescence, occurs in nearly every organism on Earth and has been studied extensively in the model organism Caenorhabditis elegans.

The roundworms' decrease in protein turnover doesn't occur evenly, however. Researchers at Ghent University in Belgium recently determined that two families of proteins involved in intracellular movement and reproduction are especially hard-hit in the worms.

"It's not a uniform slowdown of the whole set of proteins," said Ineke Dhondt, a postdoctoral researcher in the university's Laboratory for Aging Physiology and Molecular Evolution. Dhondt and colleagues at the Pacific Northwestern National Laboratory in Washington recently described their findings in the journal **Molecular & Cellular Proteomics**. Previous papers in the field had determined that protein turnover in C. elegans decreases with age but hadn't examined how significantly the effects varied between different families of proteins. "There are proteins that keep or retain their turnover," Dhondt said. "That might be quite a different insight from other studies that only focus on the bulk protein turnover."

C. elegans are widely used to study aging due to their short lifespan and well-characterized genomes. To examine which proteins were being turned over, the researchers fed subpopulations of the worms alternating samples of the bacteria Escherichia coli grown with either heavy or light nitrogen isotopes, characterizing the worms' protein production with mass spectrometry before and after each meal over several days. The difference in isotope weights causes a slight weight difference in proteins that are subsequently synthesized, which can yield information about changes in protein production when compared with the previous spectrometer readings.

Dhondt and her colleagues found that the worms were decreasing their turnover of proteins in the tubulin and vitellogenin families, which are involved in cytoskeletal movement and production of eggs, respectively. They also found that ribosomal proteins, which are responsible for protein synthesis and all generally have a similar half-life, ended up varying widely in their turnover rates.

"We saw that these protein-turnover values really fan out over time," Dhondt said. "That was an indication that this group might be important to dysregulation of the protein synthesis phenomenon, and that actually can be a key component to underlie aging."

They also found that proteins responsible for protein degradation, such as the ubiquitin system, tended to continue their turnover throughout aging. "It's like (the worms) want to keep up their function, so by refreshing these proteins, they want to make sure that these proteins keep functioning," Dhondt said. "But in the end they're fighting a battle that they can't win, because the whole proteome will ultimately collapse."

Dhondt and colleagues plan to continue studying aging in roundworms, with a new focus on the quality of health the worms exhibit into old age. "An important parameter for us is to look at the ability of the worms to move," she said. "We are checking not only if the worms are living longer from a certain treatment but whether they are also exhibiting better health."

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Meet Russell DeBose–Boyd

A new Journal of Lipid Research associate editor, he has a passion for the construction of cholesterol

By John Arnst

For Russell DeBose–Boyd, a professor of molecular genetics at the University of Texas Southwestern Medical Center at Dallas, the lab and the kitchen are both carefully controlled canvases. A native of Boswell, Oklahoma, a town with a population of 700, Debose–Boyd attended Southeastern Oklahoma State University as an undergraduate and received his Ph.D. from the University of Oklahoma Health Sciences Center in Oklahoma City before taking a position at UT Southwestern. He joined the ranks of associate editors at the Journal of Lipid Research in January. DeBose–Boyd spoke with John Arnst, ASBMB Today's science writer, about his lab's work and his longtime interest in cholesterol synthesis. The interview has been edited for clarity and length.

What is your group focused on?

For almost my entire career, I've studied the feedback regulation of an enzyme called HMG-CoA reductase. It's the rate-limiting enzyme in the synthesis of cholesterol as well as a number of what we call nonsterol isoprenoids that play a variety of roles in cells. It turns out that because the reductase is the rate-limiting enzyme in the pathway, it's subject to an enormous amount of feedback regulation at the level of transcription, translation and protein degradation. Importantly, each one of these regulatory mechanisms is controlled by sterol and nonsterol isoprenoids that are produced in the cholesterol biosynthetic pathway.

My ultimate goal, when I started my lab, was to understand, in molecular detail, every single mechanism for feedback regulation of HMG-CoA reductase. The transcriptional regulation of HMG CoA reductase has been elucidated through the work of my postdoctoral advisers, Michael Brown and Joseph Goldstein (author's note: Brown and Goldstein were awarded the Nobel Prize in physiology or medicine in 1985 for their discoveries concerning the regulation of cholesterol metabolism, which would lead to the development of statin drugs), in a well-recognized manner. Thus, the initial goal upon starting my own laboratory was to understand how sterol and nonsterol isoprenoids combine to regulate the degradation of HMG-CoA reductase. We largely continue to focus on that, and we've discovered the pathway by which it occurs. Using cultured cells and in vitro assays, we've discovered that certain types of sterols cause HMG-CoA reductase to become polyubiquitinated, marking the enzyme for recognition and degradation by 26S proteasomes. The laboratory now is focused on determining mechanisms by which a specific nonsterol isoprenoid, called geranylgeranyl pyrophosphate, augments degradation of ubiquitinated HMG-CoA reductase and how this augmentation becomes disrupted in a rare human eye disease

called Schnyder corneal dystrophy. In addition, we've recently embarked upon an area of investigation to understand how sterol-accelerated degradation contributes to the overall regulation of the reductase and cholesterol synthesis in whole animals.

What is your background and research training?

My interest in research really stems back to my time as an undergraduate at Southeastern Oklahoma State University. I was involved in a National Institutes of Health-supported program that at the time was called the Minority Biomedical Research Support Program, or MBRS. What was really nice about the MBRS program was that, each year, our entire lab would attend a national symposium at which several well-known scientists presented their latest research. At the first meeting I attended during my freshman year in college, I was in awe over some of the cool things scientists from great universities were doing, and that really sparked my interest. I decided at that time that I wanted to pursue a career in research.

After my undergraduate career, I moved to the University of Oklahoma Health Sciences Center in Oklahoma City, where I worked with Richard Cummings on glycosylation in parasitic worms.(Author's note: Cummings is one of the co-founders of the fields of glycomics and glycobiology.) We were looking at enzymes that generated parasitic antigens in Schistosoma mansoni (author's note: one of the major contributors to the neglected tropical disease schistosomiasis). I also dabbled in looking at the glycosyltransferases in C. elegans as kind of a model for some of the enzymes that the parasite made. During that time, I gained an interest in cholesterol metabolism. Once I finished defending my thesis at OU, I decided to move here to Dallas to work with Brown and Goldstein, and I've been here ever since.

Russell DeBose-Boyd, whose lab currently includes an assistant professor, two postdoctoral fellows, three graduate students and two lab technicians.

What was your involvement with the JLR prior to becoming an associate editor?

I've been an avid reader of articles published by the JLR since my postdoctoral years when my research began to focus on the regulation of cholesterol metabolism. My group has been fortunate enough to publish several articles in the JLR, and on many occasions I served as an ad hoc reviewer of JLR manuscripts. My formal association with the JLR began in 2013 when I was invited to serve on the editorial board, and my role was expanded in January, when I was invited to become an associate editor of the journal.

What was your reaction when you were asked to become an associate editor?

I was actually surprised, but it was an honor because I felt that it gave me another level of responsibility, and it actually is helping me as far as broadening my perspective. Two areas I really focus on are cholesterol metabolism and isoprenoid metabolism in cultured cells, but as an editor, I see a wide variety of papers that all have something to do with lipid metabolism. I think it really forces me to become more knowledgeable about areas I'm familiar with but don't know in great detail. I think that's the most exciting aspect of being an associate editor.

Have you been surprised by anything during your time so far as an associate editor?

I never realized the level of commitment that reviewers have, which is amazing considering that all of us have very busy schedules. The editorial board members also seem like they all take this job seriously; they really accommodate my requests in a timely manner. So far, it's been a really smooth transition from editorial board member to associate editor.

What do you do outside of the lab? Do you have any hobbies?

I work out with my boys. I have two sons — they're actually grown now, they're 22 and 20 — and we hang out quite a bit riding bikes and working out. I also love to cook. It took me a while to realize why I like to cook on the weekends. My wife wonders, "Why are you cooking so much?" Well, I think it's because over the years, as I've risen through the ranks, I just have no time whatsoever to work in the lab, and I miss that. I used to love to work in the lab — nothing is more satisfying than getting that result and evaluating data fresh off the press, if you will. I think cooking may help replace that. It's not the same as doing experiments, but there are similarities. When I follow a particular recipe, I try to be very meticulous about putting dishes together, and the end result is that it's good or bad. Like my experiments, I tend to learn more when my dishes turn out bad. This forces me to re-evaluate my efforts, correct them the next time and ultimately create a near-perfect dish.

My absolute favorite recipe is spaghetti from scratch. I love to experiment with the recipes. For example, I use canned tomatoes in my sauce, which kind of makes me feel like I'm cheating. My next goal is to gain enough confidence to fire-roast fresh tomatoes, garlic and onions to use in my sauce.

Do you have any advice for scientists in training for balancing life within the lab with life outside it?

I tell students and postdocs that the work in the lab is very important, but equally important is your life outside of the lab. As scientists in the academic setting, we're always under pressure to produce, perform and progress. Fortunately, many of us find science fun and extremely gratifying; we're willing to give it our all and work as hard as possible. However, it is equally important that we take time out for ourselves and spend quality time with our families and significant others. This helps to prevent that burned-out feeling and gives us time to relax our minds.

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

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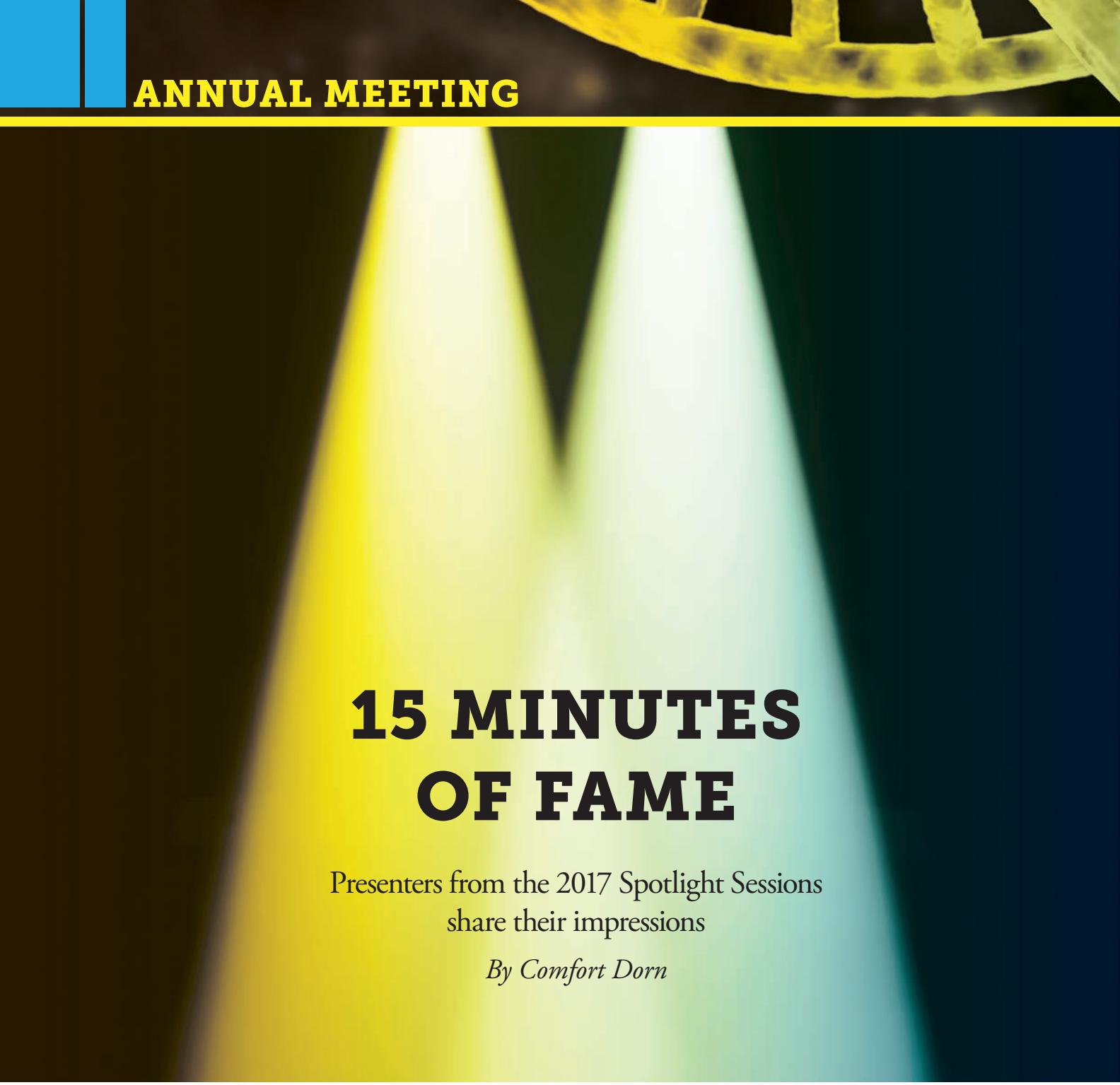


15 MINUTES OF FAME

Presenters from the 2017 Spotlight Sessions share their impressions

By Comfort Dorn

In making his very first scientific presentation at the 2017 American Society for Biochemistry and Molecular Biology Annual Meeting, Matthew Wickersham also made connections that helped with his research. "People came up to me after the meeting," he said, "and we've been in contact about potential collaborations."

Wickersham, a research technician in pediatrics at Columbia University, shared his research on metabolic stress driving keratinocyte defenses against S. aureus as one of 235 scientists — from undergraduates to senior investigators — who took part in the meeting's Spotlight Sessions, a new opportunity to highlight recent scientific findings.

To find out more about the presenters' experience in these first Spotlight Sessions, ASBMB Today sent a questionnaire to all the participants. We share some highlights of the responses here. Maybe you'll feel inspired to submit your abstract by the Dec. 7 deadline so you can share your science in San Diego next April.

Wickersham was not the only


MILLER

presenter to make valuable connections during the sessions, which ran over three afternoons in multiple rooms during the Chicago meeting. James Miller, a graduate student in biochemistry at the Medical College of Wisconsin, gave a talk on glycolipid storage and phenotypes in a new rat model of Fabry disease and met a graduate student who was doing similar research. "He recommended that I use a certain reagent to stain my rat tissues for histological analysis," Miller said.


CORNETT

After making his presentation on annotating the lysine methylome, Evan Cornett, a postdoctoral fellow in the center for epigenetics at the Van Andel Research Institute, made several productive connections. "I connected with another researcher studying lysine methyltransferases, and we have now started a collaboration to screen the enzymes they are studying on our platform," he said. "I also connected with another researcher who had some reagents and experiment ideas to help determine what the methylation on one of the new methylation targets we discovered is doing to regulate that protein."

Emily Roncase, a fourth-year graduate student in molecular and experimental medicine at The Scripps Research Institute, gained new insight after her presentation on substrate selectivity of clostripainlike proteases secreted from commensal gut bacteria. "I met another graduate student that works in enzymology who was able to give me great insights into other assays I can perform to determine how these proteases are being activated," she said.


BONHAM

Andrew Bonham, an associate professor of chemistry at the Metropolitan State University of Denver, made a productive connection after his talk on algorithmic techniques for designing electrochemical DNA biosensors. "My presentation was noticed by a start-up biotech company that is now collaborating with me," he said.

The Spotlight Sessions scientists are at all stages of their careers. Not every presenter who responded to the questionnaire wanted to share their age, but those who did ranged from 23 to 51 years old, with almost half under the age of 30. Participants came from all over the U.S. and as far away as Australia and Japan.

The majority of those who answered the questionnaire, 86 percent, had presented their research previously, but that didn't stop them from preparing and honing their delivery for the new Spotlight Session format, which required that they condense their work into 15 minutes (a 12-minute talk and a three-minute Q and A) for an audience that was not as "intimately familiar with all the nuances and details as my lab mates are," as Cornett described it.


BRODERSEN

"I made slides and went through them in a natural pace two to three times, thinking about what I would say," said Ditlev Brodersen, an associate professor in the department of Molecular Biology and Genetics at Aarhus University, who spoke about how discrete structural dynamics of pseudo-palindromic motifs control DNA binding of bacterial toxin-antitoxin complexes.


NOE–GONZALEZ

Melvin Noe–Gonzalez, a fifth-year graduate student at the Stowers Institute for Medical Research, said he prepared a script of everything he was going to say in his talk on the mechanism of co-transcriptional RNA capping — "not for memorization, though, but for remembering the key points I needed to get across … It was challenging trying to find a shorter way to present something or decide what data had to go," he said, but "not going over shows that you respect everyone's time."


LANGLEY

Gareth Langley, a fourth-year Ph.D. student in chemistry at the University of Oxford, agreed on the importance of not running over his allotted time. He practiced with his research group to fix his timing and said the most memorable moment of his talk on demethylases was "seeing the clock hit zero (for the presentation section) just as I was about to hit my acknowledgements slide."

A number of the presenters said they practiced their talks in front of their friends, family and lab colleagues. Miller turned some heads when he was caught "doing a quick run-through in a quieter hallway of the McCormick Place a few hours before my presentation," he said. "Passers-by gave me perplexed looks when they saw me talking to myself."

In addition to the valuable experience of making a presentation, a number of the Spotlight Session participants noted how much they valued hearing what their fellow sci-

Put your science in the spotlight

By Yan Jessie Zhang

The annual meeting of the American Society for Biochemistry and Molecular Biology can seem like the Grammy Awards for biological sciences. It's hard not to be dazzled by the roster of award winners and symposium speakers, many of whose names appear in textbooks conducting the classical experiments.

At the Grammys, however, a true music lover might miss the music festival experience of an event such as Austin City Limits, where you can rendezvous with the music you grew up with or meet the newest bands — or even be one of the performers who take the stage. Well, you don't have to make the difficult choice at the ASBMB annual meeting, because we want you to enjoy the best of both worlds. While maintaining the high profile of plenary and symposium speakers, we have added a platform called Spotlight Sessions to the annual meeting program for new ideas, fresh discoveries and rising stars.

The Spotlight Sessions at the 2018 ASBMB Annual Meeting in San Diego will include more than 200 scientific talks — and you could be one of the presenters. These talks will be selected from abstracts submitted by meeting attendees who opt to be considered. The criterion for selection is simple: Is the science exciting?

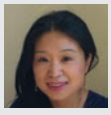
The platform is designed to create an optimal experience for speakers and audience. The sessions are held during the afternoon prime time in our full-day programs with no competing seminars scheduled. A cornucopia of scientific themes are covered, with concurrent sessions in multiple meeting rooms to guarantee your scientific curiosity is satisfied.

Each session consists of five 15-minute talks, each with three minutes for Q and A. After a 15-minute break, another Spotlight Session on a related topic is held in the same room so the audience doesn't need to relocate to search for their favorite scientific topics.

The Spotlight Sessions were introduced at the 2017 annual meeting in Chicago. Out of 1,604 voluntary abstracts submitted by the deadline, the authors of 752 were interested in making an oral presentation. A panel of organizers consisting mostly of junior faculties selected 235 talks for the 42 spotlight sessions over three afternoons (a selection rate of 31 percent). More than half the speakers were trainees. For many, especially the 139 who were postdocs and graduate students, this was their first talk in a national forum. Of those who held faculty positions, 77 percent were early-stage investigators with assistant or associate professorship.

Do you want your colleagues to be inspired by your passion for your project at next year's annual meeting in San Diego? Due to the well-received Spotlight Sessions in Chicago, we will expand the session topics in 2018. To be considered for a short talk, submit your abstract to an ASBMB topic category, those with a 2,000-series topic number (see list on page 27), by the Dec. 7 deadline. Your submission will be evaluated by members of the Spotlight Session Committee, and if selected to give a talk, you will receive preliminary notification in January. Don't forget to register for the meeting, which has a heavily discounted rate for trainees, by Feb. 27, 2018.

We look forward to hearing your exciting story.



Yan Jessie Zhang (jzhang@cm.utexas.edu) is an associate professor in the department of molecular biosciences at the University of Texas, Austin, and a member of the ASBMB Meetings Committee.

ROZOVSKY

entists had to share. Sharon Rozovsky, an associate professor in chemistry and biochemistry at the University of Delaware who spoke on the intrinsically disordered membrane enzymes selenoprotein S and selenoprotein K, said she had discussions with all the "excellent speakers" in her session. "It was a great panel," she said.

BOURNE

Christina Bourne, an assistant professor in chemistry and biochemistry at the University of Oklahoma who presented on toxin-antitoxin modules, said she enjoyed "meeting the other presenters and going out for a drink after the session — it was a great informal way to meet a few big names in the field, as well as some up-and-coming investigators."

BLIND

At his presentation on lipids, Ray Blind, an assistant professor of medicine, biochemistry and pharmacology at Vanderbilt University School of Medicine, said he "met some good PhD students that I am trying to recruit as postdocs to my lab."

PHOTO COURTESY OF DI ZHANG

Di Zhang, a University of Chicago postdoc, poses beside the annual meeting sign. Zhang gave his first scientific talk during the 2017 Spotlight Sessions.

2018 ASBMB Annual Meeting Abstract Topic Categories

2000 Genome Dynamics: DNA Replication, Repair and Recombination

2010 Chromatin Structure, Remodeling and Gene Expression

2020 RNA: Processing, Transport, and Regulatory Mechanisms

2030 Protein Synthesis, Structure, Modifications and Interactions

2050 Enzyme Chemistry and Catalysis

2060 Chemical Biology, Drug Discovery and Bioanalytical Methods

2070 Genomics, Proteomics and Metabolomics

2080 Signal Transduction and Cellular Regulation

2110 Bacteria and Parasites: From Microbiome to Antibiotics

2120 Metabolism and Bioenergetics

2130 Lipids and Membranes

2150 Organelles and Trafficking

2160 Glycans and Glycobiology

2180 Education and Professional Development (General BMB)

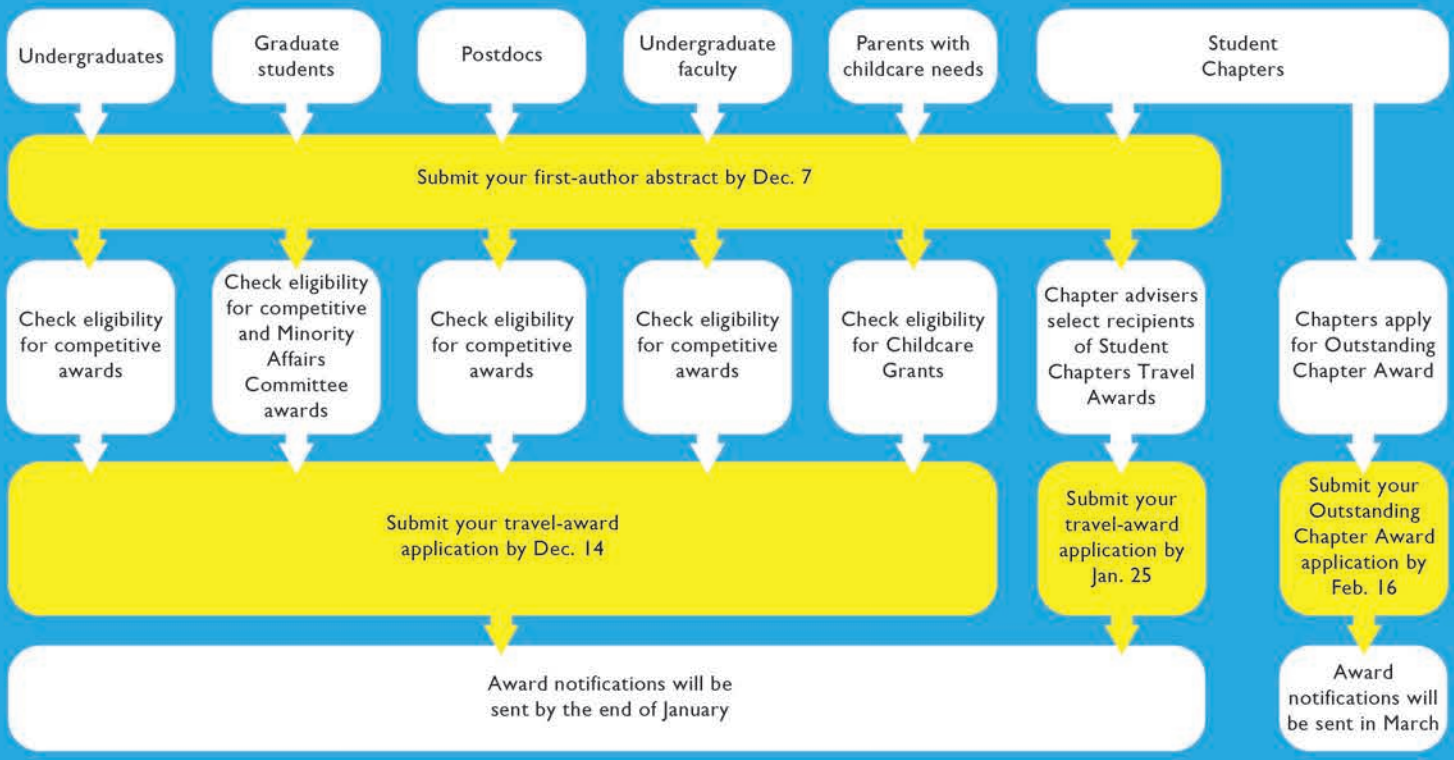
MILTON

Morgan Milton, a postdoc in discovery sciences at RTI International, said she used what s had learned in the ASBMB Art of Science Communication online course (see related story on page 34) to build her presentation on inhibition and dispersion of biofilms. "I began by focusing on what story I wanted to tell and thinking about what the ASBMB audience would be interested in learning," she said. "It was challenging to pick through all of our data to piece together a cohesive story; interesting things had to be cut simply because there was just so much to tell. I would practice almost daily, fine-tuning my message and the delivery and getting feedback from co-workers." Milton said it was memorable to watch her presentation morph from the original draft to its final version. "Sometimes you fall in love with a particular slide or data set but in the end have to cut it because it just doesn't fit in with the rest of the presentation." In making the presentation, she said she learned that "How you say something is just as important as why you want to say (it). Finding a clear way to present information to your audience is vital for a successful presentation."

The Spotlight Sessions offered a new opportunity to share science and make connections at the ASBMB annual meeting. For some, it was an experience not to be forgotten. Di Zhang, a postdoc in the University of Chicago's department for cancer research who was making his first research presentation on metabolic regulation of gene expression by histone b-hydroxybutyrylation, said, "It would be great if the presentations can be recorded, since it would be a memory for the speakers, especially for beginners like me."

Comfort Dorn (cdorn@asbmb.org) is managing editor of ASBMB Today.

TRAVEL AWARDS FOR THE ASBMB ANNUAL MEETING



$275,000+ IN TRAVEL AWARD GRANTS

2017 ASBMB award winners

Don't miss their lectures at the annual meeting in San Diego


WINZELER

Alice and C. C. Wang Award in Molecular Parasitology

Elizabeth A. Winzeler
University of California, San Diego


CRAIG

ASBMB Award for Exemplary Contributions to Education

Paul A. Craig
Rochester Institute of Technology
Promoting hypothesis-driven thinking in the undergraduate biochemistry lab


ORTH

ASBMB-Merck Award

Kim Orth
University of Texas Southwestern Medical Center
Black spot, black death, black pearl: tales of bacterial effectors


VOELKER

Avanti Award in Lipids

Dennis R. Voelker
National Jewish Health
Phospholipid regulation of inflammatory processes and viral infection


DE LANGE

Bert and Natalie Vallee Award in Biomedical Science

Titia de Lange
Rockefeller University
How telomeres solve the end-protection problem


EVANS

Bert and Natalie Vallee Award in Biomedical Science

Ronald Evans
Salk Institute for Biological Studies
Targeting the pancreatic cancer ecosystem


SANDER

DeLano Award for Computational Biosciences

Chris Sander
Dana Farber Cancer Institute and Harvard Medical School


KOROSTELEV

Earl and Thressa Stadtman Young Scholar Award

Andrei Korostelev
University of Massachusetts
Visualizing translation by ensemble cryo-EM


HART

Herbert Tabor Research Award

Gerald Hart
Johns Hopkins University
Nutrient regulation of signaling and transcription


JOSHUA-TOR

Mildred Cohn Award in Biological Chemistry

Leemor Joshua-Tor
Cold Spring Harbor Laboratory
The origin recognition complex: where it all begins


TSIN

Ruth Kirschstein Diversity in Science Award

Andrew Tsin
University of Texas Rio Grande Valley
Biochemistry of ocular diseases


BURKE

Walter A. Shaw Young Investigator Award in Lipid Research

John Burke
University of Victoria
Probing the structure, dynamics and regulation of lipid signaling enzymes


CLARKE

William C. Rose Award

Steven Clarke
University of California, Los Angeles
What can protein methylation tell us about biology?


MAQUAT

FASEB Excellence in Science Award

Lynne Maquat
University of Rochester
Nonsense-mediated mRNA decay and human disease: genome guardian and executor

Surviving the question session

By Dani Rabaiotti & Jeff Clements

Picture this: You are at a conference; you have come to the end of your talk and turned to the audience. "Any questions?" you ask. Hands go up, and an audience member is chosen. They proceed to ask a question completely unrelated to your talk. Potentially, they are quite rude. Or maybe they launch into a monologue that isn't actually a question.

Most people who have attended conferences either have found themselves in this situation or have seen it happen to others (and inevitably cringed). We have gathered together the advice of hundreds of scientists on how to (a) avoid asking those awkward questions and (b) respond to them when you find yourself on the receiving end.

Interaction guidelines

We came up with a list of ways to interact and give feedback at a conference that will ensure a positive experience for everyone:

- Be polite at all times.
- Offer constructive advice and help.
- Listen carefully to the person speaking, and base your question on the content of the talk.
- Ask politely for references or figures. If the speaker doesn't have these at hand, speak to them later at the conference to discuss and exchange details.
- Ask concise questions, and feel free to follow up with presenters after the talk for further details about their presentation and wider information on the work they do.
- Approach a presenter over coffee/tea or at evening receptions to discuss their work in more detail and any conflicting literature you may have read. This is a great way to network and build collaborations.
- Compliment people on their presentations and give constructive criticism, or ask if they have considered certain literature or methodologies.
- Make allowances for the career stage of the speaker — go a bit easier on master's students than you would on a professor.
- Speak clearly, slowly and loudly, and be patient if you need to repeat the question. Odds are if the speaker didn't understand, others in the room will also benefit from you repeating the question.

What if someone still asks an awkward question?

Inevitably, not everyone will have read this article or have good conference etiquette. Unfortunately, you are likely to find yourself having to deal with these kinds of questions (or nonquestions) at some point. How you deal with a question depends on the nature of the question asked.

In the case of a rude or irrelevant question, you can always do your best to answer; however, one of the easiest ways to deal with this is to defer answering and invite the audience member to catch up with you during the break. Sometimes it can be easier to deal with these issues in a smaller group setting than in front of an audience. If someone is asking a very long question or has launched into a monologue, cutting them off with "Do you have a question?" is perfectly acceptable. If you don't feel comfortable interrupting them, then allowing them to finish before responding, "Interesting point!" is a good way of moving the discussion along. Ultimately, it depends on you and what you feel comfortable doing. Don't feel you have to ask them to join you over coffee if the last thing you want to do is speak to them further. (If it's a big enough conference, you can always avoid them.)

Ultimately, however, it should be up to the session chair to prevent and shut down inappropriate questions during a conference session. In our discussions with other scientists, we found that many people, particularly early-career researchers, stressed that they may feel uncomfortable calling out or even interrupting inappropriate questions — especially if the questioner is senior to them. Guidelines given to all conference attendees on what is expected of session chairs would help chairs do their job effectively as well as helping improve question sessions in general.

Overall, while there are certainly nuances around the points raised here, if conferences provided guidelines along these lines for chairs, speakers and attendees, it would result in a much more constructive, positive conference environment for everyone involved.

This article was adapted from a series of blogs published by Dani Rabaiotti (@DaniRabaiotti) and Jeff Clements (@biolumJEFFence) resulting from conversations they had on Twitter.

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Jeff Clements (jefferycclements@gmail.com) is a marine invertebrate ecologist working as an NSERC postdoctoral fellow with Fisheries and Oceans Canada in Moncton, New Brunswick. You can find his blog at marineecologistmusings.wordpress.com/.

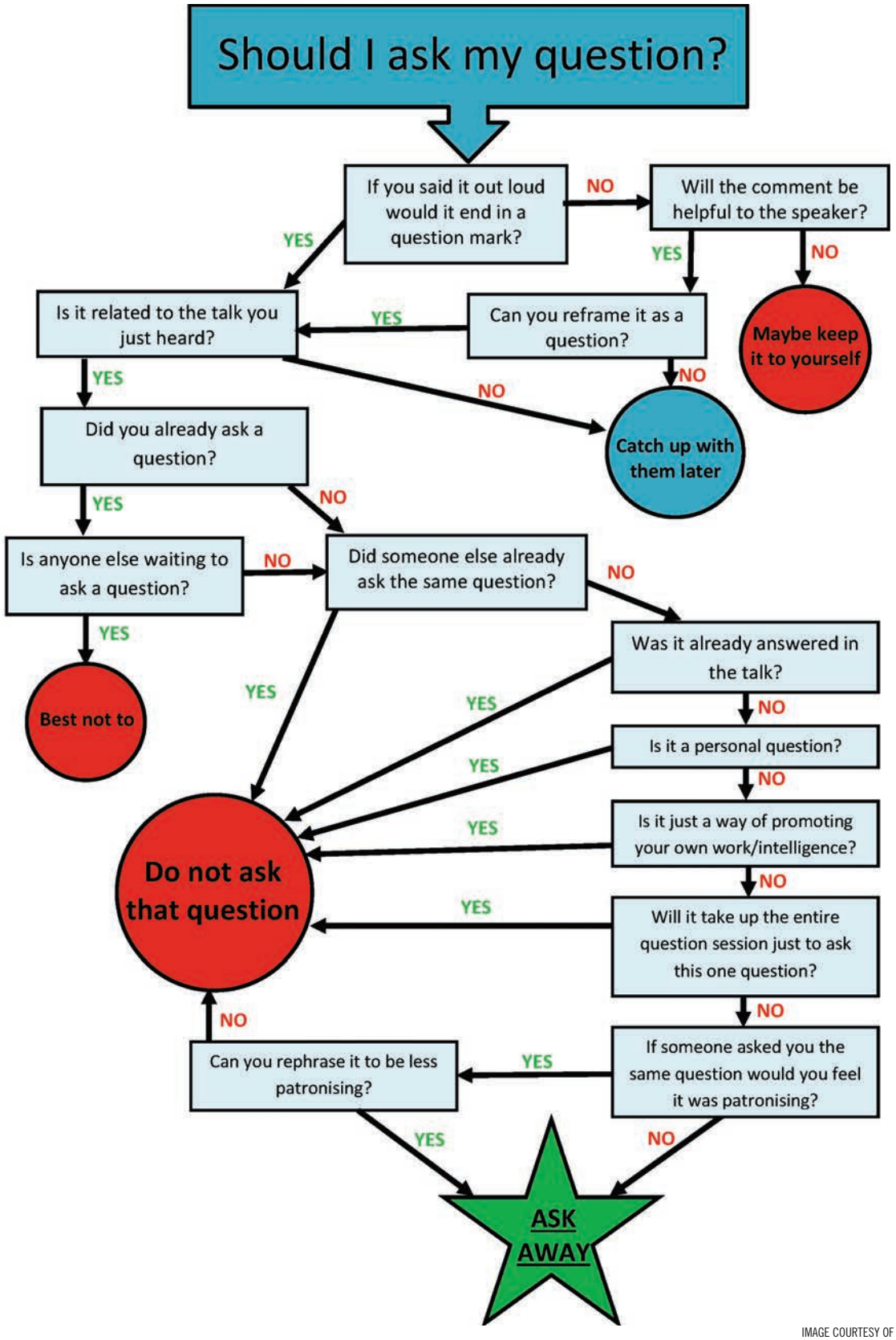

IMAGE COURTESY OF DANI RABAIOTTI

Should I ask? Based on the feedback of many conference attendees, this diagram addresses whether it's a good idea to ask that burning question you have during a post-talk question session.

Tips and tricks for writing great conference abstracts

By Martin Spiering

Attending a conference has many perks: You can catch up with the newest research, make new friends, connect with potential employers and, perhaps most importantly, showcase your own work with a talk or poster. To that end, you usually have to submit a short abstract making a case for why you should be given the opportunity to present.

Given that you have only about 100 to 300 words to ingratiate yourself with busy readers, you have a fine needle to thread. Here are some ideas for how best to do that.

Get (it) organized

A well-organized abstract is to readers what a well-drawn map is to navigators. It will help them get to where you want them to be — in your session or at your poster. Rather than following by rote the typical organization of introduction, methods, results and discussion, think of these sections as elements of storytelling:

Opening: Introduce the topic and your motivation for this work (usually in two to three sentences).

Challenge: State the research challenge/hypothesis (one to two sentences).

Action: Describe methods and report results (four to six sentences).

Resolution: Summarize key insights and their place in the broader picture (one to two sentences).

This idea, based on a proposal by Joshua Schimel (1), follows the classic story arc, playing to readers' expectations. Some authors think their audience may want to follow their personal path to discovery, which likely had many false leads and dead ends. Few readers appreciate such an approach. You also don't want to just "throw it all out there." Instead, lay out your text logically (not necessarily chronologically) and succinctly — which brings us to the next point.

Keep it short and simple

Use short words and simple language to tell a simple story (see figure). If this strikes you as odd — after all, science usually requires sophisticated language — consider how often you have read a confusing piece of research. You probably found that keeping track of arcane acronyms, indecipherable jargon and a tangled storyline consumed all your attention, causing you to abandon the document. You don't want to put readers through that experience.

The abstract usually consists of a single paragraph, and readers expect a single idea in a paragraph. So think about the one finding or approach you want to highlight and then hang your abstract around it. Resist the urge to cram in as many methods, results and conclusions as space allows — even if you don't get lost in the inevitable maze of piecemeal information, your readers will. If you're working on a new project that hasn't yet yielded many results, don't pad out the abstract with longwinded sentences or redundant reporting.

Brevity is even more important for the title, because shorter titles help capture and engage more readers. The same goes for sentences and words. Cut or break up long sentences and use simple words.

Choose the right words

Abstracts and titles are short, so every word has to do hard work. Common words do that job best. Not loaded with double meaning, they help explain the technical terms you absolutely cannot do without. After you've drafted your abstract, scan it for long or uncommon words that can be converted to shorter, everyday ones: "utilize" or "employ" to "use," "methodology" to "method," "terminate" to "stop" and so on.

To check for technical gobbledygook, give your draft to friends or colleagues outside your immediate field and ask them to mark words and expressions they cannot understand. Then revise until you have a piece that can be understood by a wide audience.

Get active

If you want to add extra brio, get rid of two slouches: the passive voice and nouns standing in for verbs. The passive "A study of the effects of constrained residues on protein folding was conducted" is much harder to unpack than "We conducted a study of the effects of spatially constrained residues on protein folding" (or even better, "We investigated the effects of spatially constrained residues on protein folding"). Similarly, using nouns to express an action robs a sentence of its energy. For instance, rewording "An increase in catalytic rate occurred at 37°C" to "The catalytic rate increased at 37°C" converts the noun "increase" to a verb performing the main action and also makes the sentence shorter.

Original:

Activation of factor X by pulsating electrical fields: Influence on chloride currents induced by calcium ions and reduction of cell growth

Here we demonstrate electrical field activation of factor X, a sizeable protein that is a chloride channel dependent on activation by calcium ions. In HeLa cells subjected to a 100-ns pulse (20.0 kV/cm), factor X expression knockdown led to a decrease in Ca^{2+}-dependent chloride currents activated in response to nanoporation. In cells overexpressing factor X, a sequence of 100 pulses (100 ns, 10 kV/cm) led to a reduction in cell survival to 5% compared with 50% in control samples.

The title is quite long and lacks a clear focus

The abstract has no introductory section that would help readers understand the purpose of this work and familiarize them with uncommon terms.

The reader is also left wondering what methods were used.

The text is littered with "big" words and lengthy phrases (colored).

A conclusions section helping readers understand the main insights is missing.

Revised:

Pulsed electric fields stimulate chloride currents via the calcium-activated channel protein factor X

Permeabilization of biological membranes by electric fields (EFs), known as nanoporation, enables intracellular delivery of drugs, plasmid DNA, and RNA. However, some of the effects of EFs in nanoporation remain to be identified. Here, using patch-clamp techniques and confocal microscopy, we found that EFs activate factor X, a large, calcium-activated chloride channel protein. In HeLa cells receiving a 100-ns pulse (20.0 kV/cm), knockdown of factor X decreased Ca^{2+}-dependent, nanoporation-induced chloride currents by 95% compared with control cells. We also observed that in factor X–overexpressing cells, a series of 100 pulses (100 ns, 10 kV/cm) reduced cell survival to 5% compared with 50% in controls. In conclusion, our results indicate that factor X mediates nanoporation-induced chloride currents and that increased factor X levels decrease cell survival after nanoporation. These findings will be of value for researcher seeking to optimize membrane permeabilization.

A shorter, more focused title clearly outlines the topic

A brief introductory section now gives a brief primer on the topic, defines the uncommon term *nanoporation*, and states the research question.

The methods are briefly described to help orient readers on the approach.

Words and phrases have been shortened (colored).

A conclusion section now summarizes the main insights and highlights the general implications of this work.

Unlock the power of keywords

Many attendees search abstracts for keywords when deciding which sessions to visit, so you want to use words your potential audience may be looking for. If you work on a neurological disease, insert some alternative words and phrases, such as "neurodegeneration," "nerve damage," "neuron damage" and so on. If your work involves genome sequencing, include "whole-genome sequencing," "high-throughput sequencing" and "genomics." Don't overdo it, though — your abstract should still be readable. And don't squeeze in words that don't reflect your work.

REFERENCES

1. Schimel, J. "Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded." Oxford University Press (2012).

Martin Spiering (mspiering@asbmb.org) is the Journal of Biological Chemistry's technical editor; you can follow him on Twitter at twitter.com/Spieringmj.

There are many ways to skin this course

Blending an online science communication course into existing classroom programs increases participation

By Comfort Dorn

Makenzie Mabry has been talking science to nonscientists.

Mabry, a third-year graduate student in the Division of Biological Sciences at the University of Missouri, recently gave a presentation at Science On Tap, a program designed to communicate science to adults in a relaxed and fun environment. She also led children ages 5 to 10 through a laboratorylike presentation about DNA at a local elementary school.

"With each of these programs, I learn new ways to excite the public about science and why they should care about it," Mabry said. "This, in turn, rejuvenates me to remember why I do what I do."

As part of a mandatory graduate survival skills class, Mabry and other incoming Missouri graduate students took the Art of Science Communication, or ASC, an online course developed by the Public Outreach Committee of the American Society for Biochemistry and Molecular Biology. "Taking the course allowed me to develop insight to the importance of presenting to different types of public audiences," Mabry said.

That's exactly what the committee had in mind when it launched the new blended version of the course it developed three years ago. "The original online-only version, which was designed for small groups, is

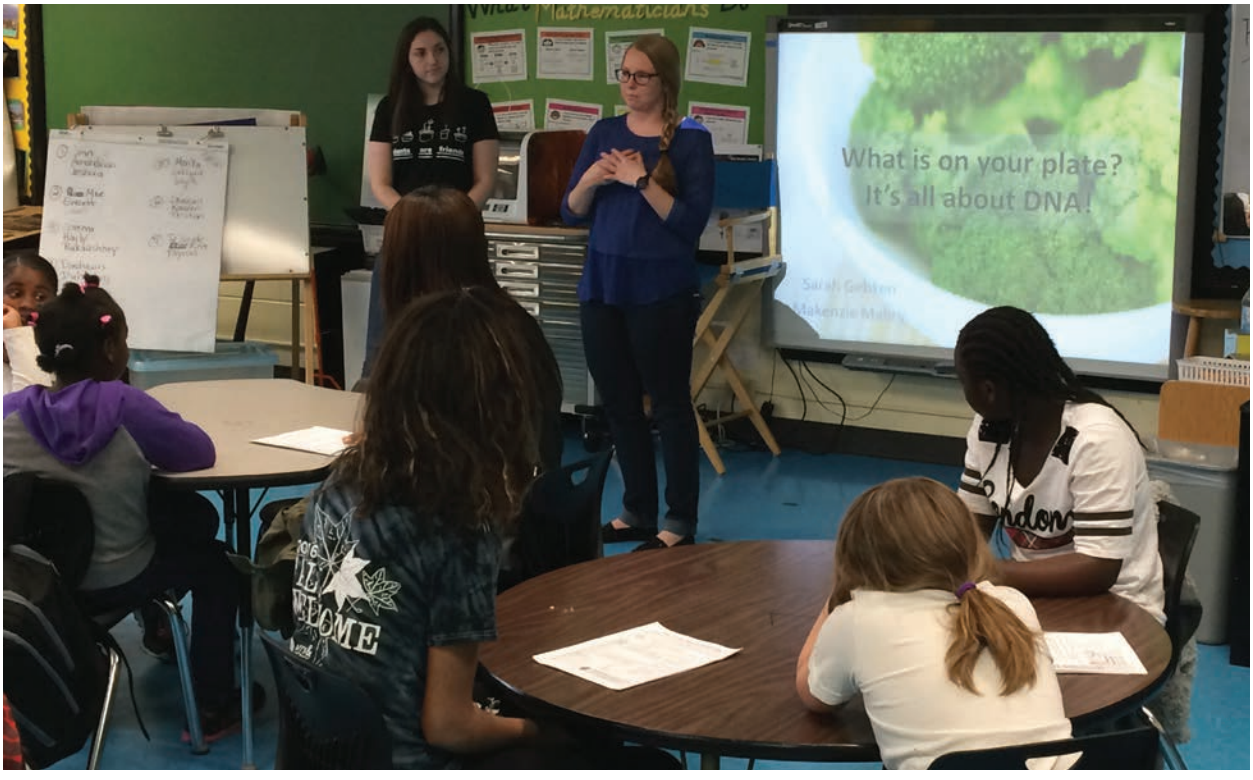

PHOTO COURTESY OF MAKENZIE MABRY

Makenzie Mabry, a third-year graduate student in the Division of Biological Sciences at the University of Missouri who completed the Art of Science Communication course, talks to students at Benton Elementary School about DNA in broccoli.

The origins of the Art of Science Communication

By Hannah Alexander

Whether we're trying to discuss our work with the person sitting next to us on an airplane, our family and friends, a news reporter, or a political figure, we soon realize that explaining science to people with no experience or prior knowledge of science is not an easy job. For all our expertise, we often find ourselves at a loss for the right words, and we quickly realize that relaying science to lay audiences requires thought, special skills and a whole lot of practice.

This realization motivated the Public Outreach Committee of the American Society for Biochemistry and Molecular Biology to develop a course that would instruct scientists — young and old — on how to talk science to wider audiences. The result is the Art of Science Communication, an interactive online course.

The course introduces general communication skills and offers tips, techniques and ample practice opportunities for participants. It consists of online lectures and seven weekly online discussions with a mentor. Discussion groups are kept at four to five students to allow effective interaction. Feedback is given in class and online on the course site. Each session provides additional material to augment the lectures and includes weekly homework assignments.

Students come to the course with a pre-course video, a five- to seven-minute talk explaining the science of their own work to a lay audience. During the weekly meeting, these videos are deconstructed and then reconstructed to craft a post-course video. With help and feedback from the mentor and from other members of the class, we examine the name of the talk (Is it clear, simple and intriguing, and would it catch one's attention while running down the hall late for class?), the introductory sentences (Are they engaging, informative, yet un-threatening, and do they break the barrier between the speaker and the audience and promise a good and understandable talk?), and the body of the talk (losing jargon, simplifying concepts, employing effective analogies, framing the topic differently for particular audiences, and learning simply to tell a story).

Course mentors were initially outreach committee members versed in teaching science communication. We continually expand our mentor pool by identifying course participants who are advanced enough to become mentors. The new recruits go through our mentors guide, and they usually work with an experienced mentor for one or two cycles before getting a group of their own.

To date, the course has been offered online six times to a total of 167 participants representing 17 countries. Ninety-four percent of participants feel better prepared to give a presentation to a nonexpert audience, and 90 percent would recommend the course to a colleague or a friend.

The positive responses from students, as well as the immensely improved quality of the post-course videos, have been our reward.

Hannah Alexander (alexanderh@missouri.edu) is a retired associate research professor in the Division of Biological Sciences at the University of Missouri. In recent years, she developed science communication courses at the University, initiated the "Science and Me" program, and participated in developing and teaching the online Art of Science Communication course through the ASBMB.

successful," said Hannah Alexander, a committee member and online course mentor who taught the Missouri course with Kathleen Newton. "The rate of completion is satisfactory, the responses from the students are overwhelmingly positive and we have quite a few post-course documented outreach actions by the students," she said. "But we constantly strive to expand our reach, and doing it with four to five students per group, ten groups per session, is not changing the world."

To increase participation, committee members experimented with offering the ASC course to larger groups at four locations in four different formats, promoting a tool that helps scientists improve their skill in communicating science to all audiences.

"The course prepares students to present their science to any audience, be it scientific, lay or an audience in between," said Susanna Greer, chair of the outreach committee and an ASC mentor. "Feeling comfortable adjusting our presentations to our audience is an essential skill set for all scientists, and the earlier in one's career that skill set is sharpened, the better."

In addition to the graduate students at the University of Missouri, the course was offered to senior undergraduates in the biochemistry and molecular biology program at the University of Richmond as a way to prepare for giving talks about their hands-on research projects. Pre-doctoral fellows at the University of Georgia took the class as part of a National Institutes of Health T32 training-grant program, and graduate students at Sanford Burnham Prebys Medical Discovery Institute in La Jolla, Calif., have taken the blended ASC course as a science communication class taught by Hudson Freeze.

"Watching these students zoom from uncertainty to comfort in front of a camera or any nonscientific group was jaw-dropping," Freeze said. "I'm confident that the future of science communication will be in skilled and enthusiastic hands. We just need more folks to join the party."

Aditi Mishra became a mentor for the online ASC course after taking the blended version at the University for Missouri. "The Art of Science Communication was a very insightful course," she said. "The class was easy to follow, and I learned techniques for presenting to diverse audiences without doing away with the scientific aspect of my talks. I have used my knowledge from the course to teach undergrads and give talks to scientific and lay audiences, and it has worked really well."

By bringing the course into existing classroom programs, instructors are able to tailor the curriculum to their students' needs. The seniors at the University of Richmond were preparing to deliver a talk to students and faculty members who had science backgrounds but no expertise in the presenters' particular fields of research, which ranged from protein chemistry to organismal evolutionary biology. "Over seven weeks, using the online materials, the students prepared and delivered their talks and gave each other feedback," said Jon Dattlebaum, a committee member and course mentor who taught the course at Richmond. "The in-class portion of the course gave them the structure to focus their presentations and to learn from peer critiques."

Similarly, the course filled a void at the University of Georgia. "The response to an initial poll of 14 predoctoral fellows about their interest in the course was very positive," said course mentor Michael Pierce, "and encouraged the establishment of the course."

The grad students at the University of Missouri each prepared a 10-minute talk about their work for the rest of the class. Their individual expertise covered a variety of disciplines, including molecular and cell biology, neurobiology, plant biology, ecology and conservation biology, making the class effectively a lay audience. The online ASC lectures were available to students, and weekly follow-up sessions were conducted in class. Post-course talks were presented to and critiqued by the entire class.

Olha Kholod, who took the ASC course at Missouri, enjoyed being able to discuss homework assignments with her peers. "The discussions were quite informal," she said, "which erased barriers between instructors and students and provided freedom for self-expression and creativity." Like Mishra, Kholod became a mentor for the online ASC course. "I adore talking about biology to … my family members, my friends and even to complete strangers," she said. "My acquaintances always refer to me as an expert in biology, and it's so important for me to be able to communicate my knowledge in a comprehensive way."

A number of professors at other institutions — including ASBMB President Natalie Ahn at the University of Colorado, Boulder — have taken the online ASC course as students, with plans to integrate it into their curriculum.

The outreach committee hopes the four successfully tested models for a blended version of the course will help others incorporate science communication into their institutions' curricula. "The quality of the post-course presentation, in all of these venues, serves as testimony to the notion that one's science communication skills can be improved, whether you are an undergraduate, a graduate student or an established scientist," Alexander said. "The basic online ASC course lends itself to many different iterations and can serve as an excellent tool to enrich existing programs in any institute."

The ASC course is available for use by ASBMB members at their own institutions. "We call on members to get in touch with us to find out about it, explore it and try it," Alexander said. "We promise that you will feel rewarded."

Thanks to Hannah Alexander, John Dattlebaum, Michael Pierce, Hudson Freeze, Susanna Greer and Geoff Hunt for their contributions to this article.

Contact us

Would you like to learn more about bringing the Art of Science Communication to your institution? The people who have taught the course would be happy to share ideas, impressions and advice.

Hannah Alexander (alexanderh@missouri.edu) and **Kathleen Newton** (newtonk@missouri.edu) taught Graduate Survival Skills at the University of Missouri.

Jon Dattelbaum (jdattelb@richmond.edu) taught the Seniors-Year Research Project at the University of Richmond.

Michael Pierce (hawkeye@uga.edu) taught the T32 Glycoscience Training Grant Program at the University of Georgia.

Hudson Freeze (Hudson@sbpdiscovery.org) and **Thomas Baldwin** (tbaldwin@ucr.edu) teach Science Communication at the Sanford Burnham Prebys Medical Discovery Institute.

Susanna Greer (Susanna.greer@cancer.org) is the Public Outreach Committee chair and a seasoned mentor and instructor of science communication.

Comfort Dorn (cdorn@asbmb.org) is managing editor of ASBMB Today.

You can make a difference

By Squire J. Booker

Of the many interventions used to encourage underrepresented minorities, or URMs, to pursue biomedical research careers, undergraduate research experiences appear to be among the most effective. These experiences typically culminate in symposia where participants present their research findings in poster and/or oral presentations.

The Annual Biomedical Research Conference for Minority Students, or ABRCMS, is among the largest and most comprehensive biomedical conferences in the U.S. that target URMs at the undergraduate and postbaccalaureate levels. The theme for the 2017 conference, to be held Nov. 1–4 in Phoenix, is "Promoting Change and Transformation."

At ABRCMS, undergraduate students present their research findings in a supportive and enriching environment. In addition to inspirational talks by celebrities, dignitaries and notable scientists, the conference offers opportunities for learning, networking and professional development. In 2016, ABRCMS hosted more than 4,050 attendees in Tampa, Fla., of which 2,150 were undergraduate students and postbaccalaureates; 400 were graduate students and postdoctoral scientists; and 1,500 were faculty members, program directors and administrators.

Some ABRCMS participants have the opportunity to travel to national scientific society events to present their findings in settings such as the undergraduate poster session at the American Society for Biochemistry and Molecular Biology annual meeting. In these larger venues, they can gain a broader perspective on the scientific enterprise and how they fit into it; they can formulate goals and then strategies to achieve them.

To remain successful and grow in this endeavor, ABRCMS needs strong support and buy-in from the biomedical community and beyond, especially from URM scientists who serve as role models. This support can be in the form of judging posters and/or oral presentations in any of a number of scientific disciplines, such as biochemistry and molecular biology, cancer biology, cell biology, chemistry, computational and systems biology, developmental biology and genetics, engineering, physics and mathematics, immunology, microbiology, neuroscience, physiology, social and behavioral sciences, and public health.

Organized judging is a key component of ABRCMS, but simply attending is critical to creating a nourishing atmosphere and sense of community. For minority scientists in particular, ABRCMS has the potential to be that one not-to-be-missed conference each year, where they can assemble, irrespective of scientific discipline, to meet each other, network, mentor, motivate and cultivate the next generation of scientists. Indeed, many URM students report a sense of pride when they see large numbers of minority scientists who look like them and with whom they share cultural ties.

You can help ABRCMS make a difference. Your presence is all we need. Together, we can continue to create a biomedical workforce that is more reflective of the great diversity of our society. Visit abrcms.org to learn more. Direct your questions to Irene Hulede, ABRCMS project manager, at ihulede@asmusa.org.

ASBMB PHOTO

The ASBMB booth attracts visitors at the Annual Biomedical Research Conference for Minority Students.

Squire J. Booker (squire@psu.edu) is a Howard Hughes medical investigator at Pennsylvania State University and an ABRCMS steering committee member.

NIH funding inequities: sizes, sources and solutions

A quarter-century after the NIH officially recognized the problem, there are still strong biases in research grant funding to states

By Wayne P. Wahls

What would happen if the Social Security Administration gave 11 cents to each beneficiary in Texas for every dollar given to each beneficiary in Massachusetts? What if the Federal Highway Administration allocated, per mile of interstate, 20 percent as much to Indiana as to Maryland? What if per-student funding to Mississippi from the Department of Education was only 8 percent of that to Pennsylvania?

The populace would light their torches, grab their pitchforks and march off to slay the monster. Agency officials would scramble to avoid culpability and to write new policies, however ineffectual, to demonstrate their noble intentions. Public servants would draft legislation to establish a more equitable distribution of taxpayers' dollars.

National Institutes of Health data (available to the public through the NIH RePORTER database) on research project grant funding over a 10-year period show that the scenarios above actually apply for where the NIH sends our tax dollars (1). Massachusetts was given about nine times more funding per capita than Texas, Maryland was awarded five times more than Indiana, and Pennsylvania got 12 times more than Mississippi.

The mind-boggling disparity can be seen by plotting funding to the 50 states plus the District of Columbia and Puerto Rico (Figure 1). There was a greater than 100-fold range in per capita funding between states. The top 10 states were awarded, on average, 19 times more funding per capita than the bottom 10. Fifteen states were overfunded, and 37 were underfunded relative to the national per capita value. Nearly two-thirds of all grant dollars were allocated to one quartile of states.

The prestige factor

Through a Freedom of Information Act request for NIH award data, I discovered proximate causes of the disparities. State-by-state differences in per-application success rates, per-investigator funding rates and average award sizes each contributed to the disparities in per capita funding (1). For example, investigators in the top-funded quartile of states were, on average, 73 percent more likely to get each grant application funded than investigators in the bottom quartile, and when funded they received on average $106,000 more each year per award. The impacts of differences in success rates and award sizes are multiplicative, giving the geographically privileged investigators about a 230 percent advantage in funding.

The preferential allocation of funding might be justified if investigators in favored states were more productive scientifically, but this is not the case. The overfunded quartile of states was less productive (scientific publications per dollar of grant support) than each of the three underfunded quartiles (1). It thus seems clear that the funding process is biased strongly by the investigator's state (1) as has been reported for investigators grouped by race (2) and by institution (3).

Most bias is subconscious, and pervasive implicit biases affect the actions of individuals who are not overtly biased (4). Allocations of resources also are affected by social prestige mechanisms that encompass nonmeritocratic factors such as the wealth, reputation and selectivity of institutions (5, 6). Moreover, bias can occur during administrative funding decisions as well as in peer review. Small differences in reviewers' scores for preferred and nonpreferred applicants translate into large differences in likelihood of funding (7). We can quantify the net impact of all sources of bias by measuring the differences in success rates and award sizes versus productivity (Figure 2).

Failed policies

Officials at the NIH have been aware of these problems for more than a quarter-century. In response to congressional concerns about differences in funding for research and scientific education to states, the NIH and other federal agencies implemented programs intended to promote a more equitable distribution of funding. However, a congressionally mandated

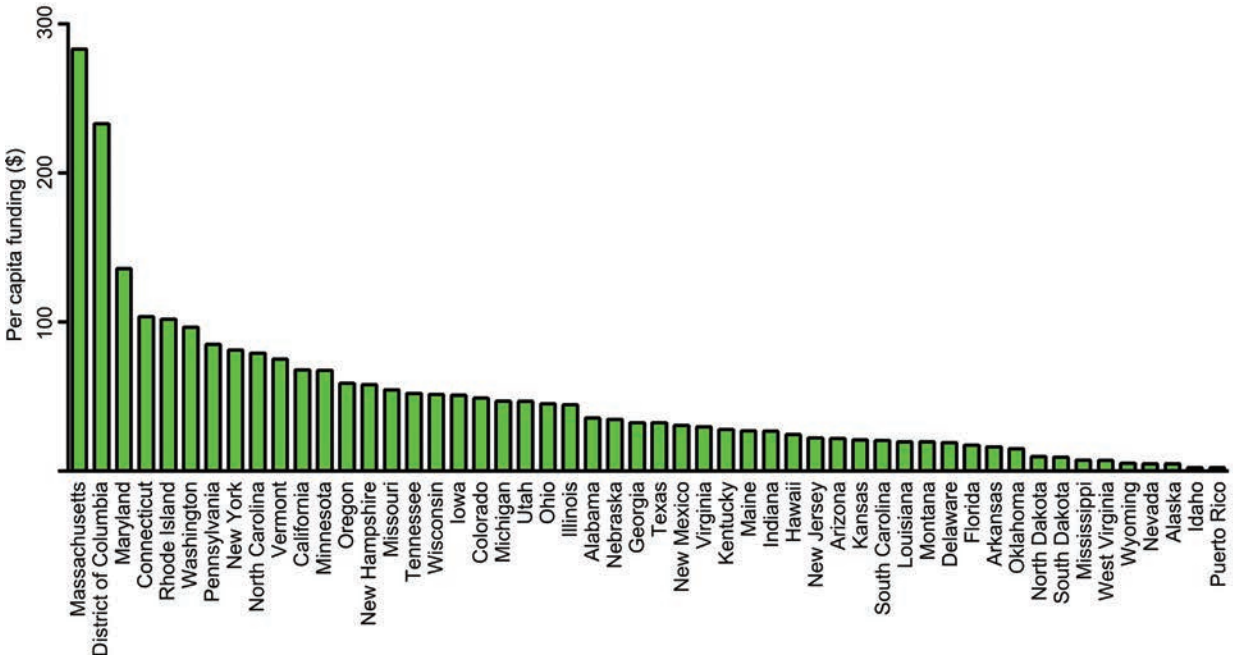

IMAGE BY WAYNE P. WAHLS

Figure 1. Disparities in NIH research project grant funding to states. Plot displays annual funding per capita to states sorted in descending order by per capita funding. Data are mean of values for fiscal years 2004 to 2013 (1).

study of the programs since their inception (8) revealed they have not reached this goal. Grant application success rates of program-targeted states have remained consistently lower than those of other states, and the aggregate share of funding to advantaged and disadvantaged states has not changed significantly.

Why have policies intended to promote a more equitable distribution of federal grant funding failed? The answer is obvious (1). None of the programs address directly the proximate causes of the regional disparities in funding, such as the strong biases in NIH grant application success rates and award sizes for investigators grouped by state (see Figure 2).

The talent to carry out research resides throughout the U.S., and the value of a scientist to the nation's research enterprise is largely independent of location (8, 9). There is no scientific basis for the differences in success rates and award sizes among states.

Reducing bias and discrimination is the right thing to do. The NIH should establish parity of research project grant application success rates and mean award sizes among states. The former could be achieved by the next round of funding decisions; the latter could be phased in over about five years without affecting any active grants. Mechanisms to do so can be understood if we consider the NIH process and the points at which bias can occur.

Points of bias

Each grant application is assigned to a scientific review group, known as an SRG, composed primarily of nonfederal scientists. The SRG generally has about 25 peer reviewers and evaluates about 60 to 70 grant proposals per cycle. There are three cycles per year.

In most cases, each application is assigned to two or three primary reviewers who evaluate its scientific merit. They consider five criteria and assign a single, aggregate score for overall scientific impact (1 is best; 9 is worst). Therein lies the first opportunity for bias. Moreover, with two or three reviewers evaluating each application, the biases of a single reviewer can affect greatly the final impact score.

The SRG then convenes to discuss the applications and refine their impact scores. Only those with stronger scores are discussed — often for as little as 15 minutes each. The reviewers can revise their impact scores, and other SRG members then submit anonymously an impact score for the application; unless they publicly state their intent to do otherwise, they must assign a score within the range of the reviewers'.

Only about 15 percent of NIH research project grant applications are funded per cycle, so a successful proposal must be championed by its reviewers and endorsed by the panel. One negative comment can sink an application. Panel discussions and score refinements therefore provide a second opportunity for bias, and many who have served on SRGs recognize that social prestige mechanisms have a role in the process.

Once overall impact scores are available, NIH officials pool the scores from three cycles of the SRG and rank

the proposals by score. From that ranking, applications are given a percentile priority score, which spreads the scores over a continuum. Biases in peer review and at the SRG affect these priority score distributions.

Officials in NIH institutes use priority scores to make funding decisions. The fraction of applications that can be funded (the priority score payline) varies among institutes according to the number of proposals being considered and the amount of money available. Paylines are not strict cutoff points; officials can fund or deny funding out of priority-score order, which provides a third opportunity for bias. Evidence for this can be found in published data: When institutions were placed in bins based on their amounts of NIH funding, the mean success rate for bin 1 (the 30 top-funded institutions) was up to 66 percent higher than those of the next three bins — even though there were no significant differences among impact scores from peer review (10).

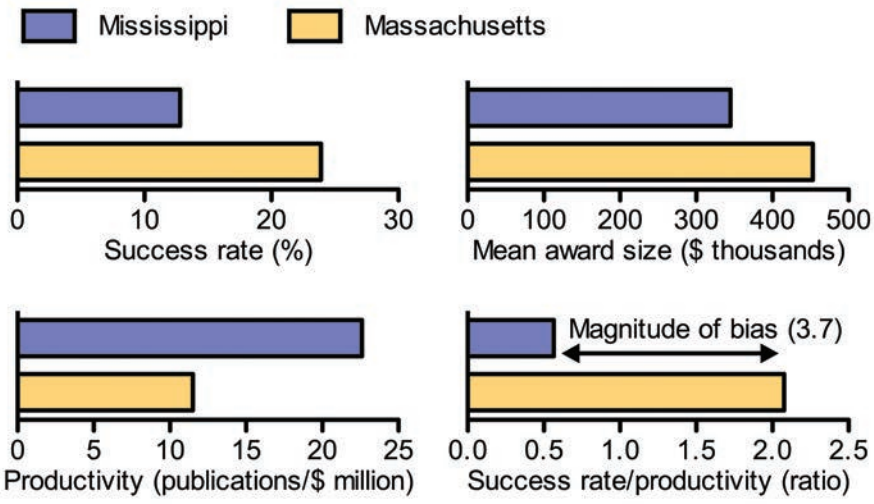

IMAGE BY WAYNE P. WAHLS

Figure 2. Quantitative measures of bias. This example, from published data (1), illustrates the nature of the problem. The differences in grant application success rates and annual award sizes reveal that the NIH strongly favors investigators in Massachusetts relative to those in Mississippi. This occurs even though scientists in Mississippi provide a superior return on taxpayers' investments (scientific publications over three years per dollar of funding in year one). The success rate/productivity ratio provides a straightforward, robust metric for the funding amount–normalized, scientific output–normalized magnitude of bias. If scientists in each state had equal, merit-based access to funding, then these ratios would be equivalent between states.

Once a decision has been made to fund a project, NIH officials often modify the award size. For example, the total budget of my R01 grant (my sole source of research funding) was cut administratively by 36 percent, relative to the amount of support recommended by the SRG. The administrative decisions to modify the SRG-recommended budgets provide a fourth opportunity for bias.

The impacts of even minor biases at each of the four consecutive opportunities for bias can multiply exponentially through the process. However, we do not need to quantify each type of bias to measure the net impact (see Figure 2) or to take corrective action. It is sufficient to recognize that implicit biases and social prestige mechanisms affect allocations of funding to states, that talented scientists are found in every state and that the NIH is obligated to distribute federal research dollars equitably.

Practical solutions

The funding process also provides three straightforward ways to remediate the biases that occur during peer review and administrative decisions.

First, to address scoring bias in peer review, the NIH should correct for its effects on priority score distributions. The simplest way to do this would be to assign percentile priority scores for applications grouped by state, using the entire cohort of applications from each state and adjusting, if necessary, for differences between SRGs. For example, applications from Ohio would be rank-ordered and assigned percentile priority scores relative to other applications from Ohio. This would ensure that the distribution of priority scores is similar among states: each state would have the same fraction of applications that fall below the payline and get funded.

Second, to address decision bias in administrative review, NIH officials no longer should be allowed to fund applications or deny funding out of priority-score rank order. Paylines would still vary among institutes, but all applications of a given type within the auspices of a given institute would be treated fairly with regard to the decision whether to fund them.

Third, to address biases in award sizes, the NIH should establish interstate parity of mean total award size for all research project grants. This would be easy, because institute officials routinely modify award budgets. The sizes of individual awards still could vary greatly, but there no longer would be regional favoritism in dollars per grant overall.

While these approaches would help remediate regional funding bias, competition for grant support would

remain fierce, and the vast majority of applications would remain unfunded. The process still would fund only projects highly rated by peer review. However, the diversity of perspectives, tools and creative ideas would increase, along with the return on taxpayers' investments (1).

States with high population densities of scientists, which is arguably a legacy of unbalanced allocations made in the past, would continue to secure a disproportionate share of NIH grant funding. The majority of funding for biomedical research and scientific education still would be concentrated in a minority of states. But at least scientists would be allowed to compete on equal footing with scientists in other states for the grant dollars that taxpayers put into the system.

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Problem-solving chemist got her start half a world away

Omowunmi A. "Wunmi" Sadik is a professor of chemistry and director of the Center for Research in Advanced Sensing Technologies and Environmental Sustainability, known as CREATES, at the State University of New York at Binghamton. Her interest in chemistry has carried her across the globe, from teaching and research in Nigeria to a Ph.D. in Australia and to her current position in upstate New York. Her answers, originally published on the minority affairs page of asbmb.org, have been edited.

What are the key experiences and decisions you made that have helped you reach your current position?

After I graduated at the top of my class in chemistry at the University of Lagos in Nigeria, my professors suggested that I should enter a Ph.D. program. I decided to earn my master's degree first, because I was actually unsure of whether the career paths that came out of doctoral study appealed to me, despite my love of chemistry itself. After completing my master's degree at the University of Lagos, I worked briefly as a high school chemistry teacher and then later joined the Nigerian Institute for Oceanography and Marine Research as a research scientist. I never planned to go into academia, even though I enjoyed my job as a research scientist. I eventually decided to pursue a Ph.D. after realizing that one could not be a successful researcher without one. I resigned from NIOMR about two

years later, after winning a scholarship to pursue a Ph.D. at the University of Wollongong in Australia.

How did you first become interested in science?

My parents never made any distinction between me and my brothers. My father was the first person to teach me the multiplication tables. He also taught me how to read a clock and a host of other basic things. He emphasized the basic sciences as a pathway. In fact, one of my brothers, Yomi, was the first to teach me stoichiometry! He had learned this in school, and we always studied together when we were young. He loved chemistry, physics and math but did not like biology and hated to draw.

Yomi taught me science trivia. He would rattle off things like "Why does ether disappear on your skin?" I was a very curious learner, and I asked lots of questions. Yomi became a civil engineer, and three of my siblings are medical doctors. One sister is an OB-GYN, and another brother is in the same profession. All of my sisters are in the medical profession as doctors, nurse practitioners or nurses. One brother went into accounting. We all were encouraged to try our best and always to try to be in the top tier of our class.

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 at many things in my life, but I don't give up.

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

I would tell them to be persistent, to have a true love for what they do and to develop the ability to see beyond their limitations. I believe that perseverance, risk-taking and luck play important roles in discovery and that, as scientists, they should not be afraid of challenging the conventional wisdom. For me, I have found out that the enduring desire to know is much more compelling than the short-lived excitement of discovery. If this is your goal, your passion and what you love, stick with it. But remember that you will need a lot of good time management and guts. You can do it.

What are your hobbies?

I enjoy swimming.

Do you have any heroes, heroines or role models?

My dad.

What is it that keeps you working hard and studying science every day?

I enjoy applying my knowledge of chemistry to solve real-life problems. I want to find ways to apply my research experience to address the problems at hand. This was my main motivation for enrolling in a chemistry Ph.D. program, and this has continued to form the basis of the research that I do to this day.

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.

It's the journey that counts

By Isha Dey

Ph.D.: These three letters evoke a wide range of emotions and opinions among people who have been through the process, successfully completed it or are still in graduate school. You can find many blogs talking about things you should keep in mind before choosing a Ph.D. program, rules you should follow as a graduate student and so on and so forth. When I was a master's student, all the advice and opinions overwhelmed me. So I took a year off after my master's degree and worked in a lab to figure out if I liked research. I did. I got some data, so I was included as an author in a publication within a year! This boosted my confidence, so I thought I definitely could do a Ph.D. I started graduate school that fall with very high ambitions; little did I realize the actual struggle ahead of me.

After joining a lab, I started working toward purifying a kinase to study its in vitro functions. This required a lot of biochemical experiments, something I had not done before. It was a difficult protein to start with, as it is membrane bound. So I started learning different ways of expressing it and then sequentially purifying it using various chromatographic and other methods. I was having a really tough time with my experiments. Gradually, I was turning into a lab rat. I had no life outside of lab. I hung out with my friends less because I worked almost every weekend. I knew my lifestyle was not healthy, but I was so determined to get a pure functional protein that I ignored the warning signs. In the meantime, two of my colleagues quit the graduate program. Terrified that the same fate awaited me, I started working even harder because I did not want to fail as a Ph.D student.

PHOTOS COURTESY OF ISHA DEY

Isha Dey (second from left) poses with fellow graduate students from the Rosalind Franklin University of Medicine and Science (left to right) Nicole Woitiwich, Kalpit Shah, Sahithi Pamarthy and Jiaju Wang at the 2016 American Society for Biochemistry and Molecular Biology Annual Meeting in San Diego.

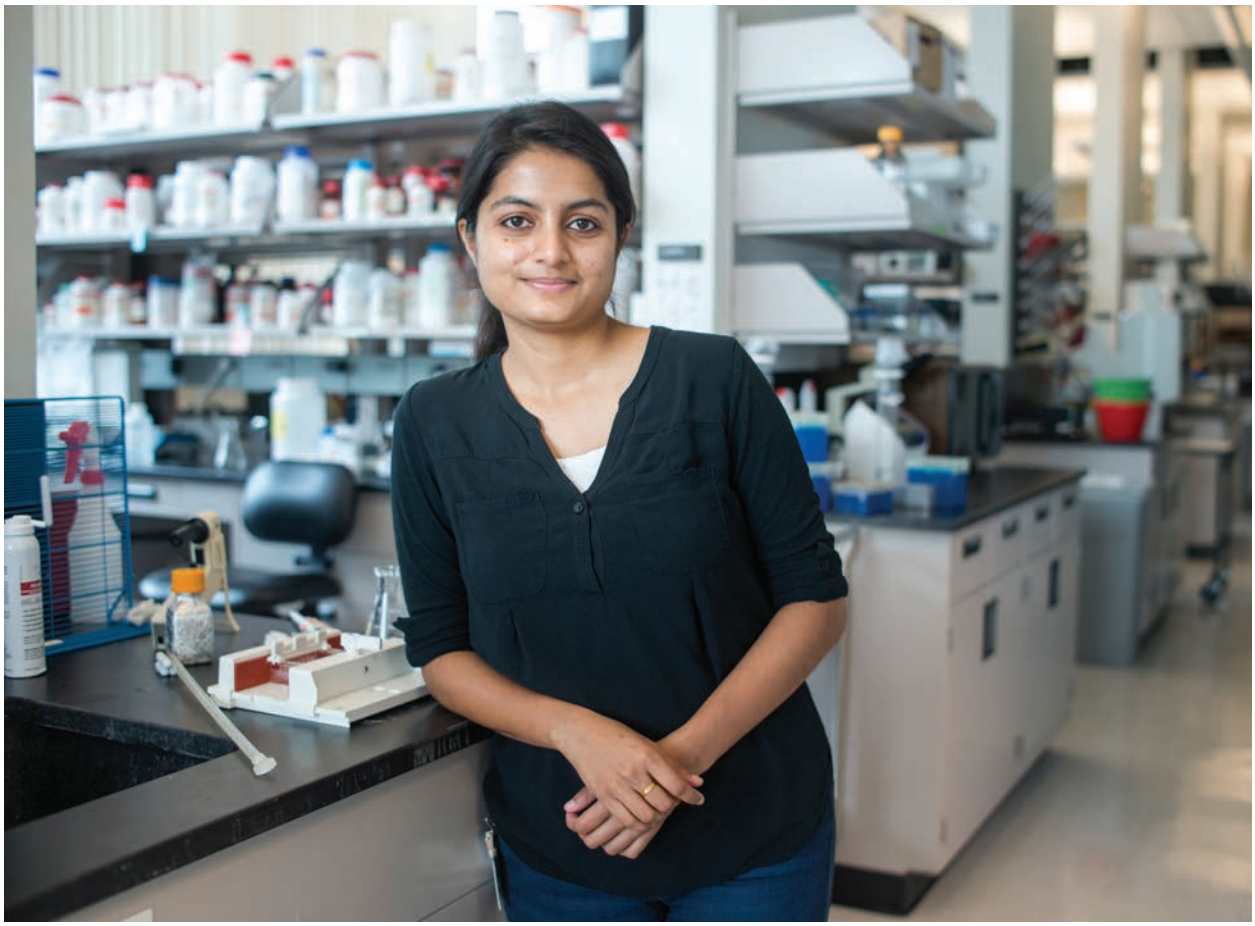
After three years, the unexpected happened — my project failed.

I had no idea what to do next. All I could think of was how all my effort had been in vain and what a complete failure I was as a graduate student. I thought maybe I should just quit the program.

That's when my adviser had a discussion with me. First he gave me a new project to work on, for which I was to learn molecular biology and cell biology techniques. Then he encouraged me to engage in extracurricular activities, asking me to mentor a high school student who was to work in the lab that summer. And he explained one thing that has been a driving force for me since then: He said a project might fail, but that does not mean the student is a failure. Graduate school is a training phase; it is more important to learn new things and gain as much expertise as possible, both technical and intellectual, than it is to succeed with some experiments. It was then I realized that even though my project had failed, I had learned quite a few chromatography techniques well enough to teach others to perform them.

Thus started what I like to call phase two of my Ph.D. I decided one thing at the very beginning of this phase: I would not be confined to the lab at all times. I would have a life outside of research. At that time, three senior graduate students were spearheading community science outreach programs outside their lab work. I thought to myself, if they can manage so many things, why can't I?

I figured that I needed to be more organized and disciplined with my work. In fact, mentoring summer students in the lab was a good experi-



Isha Dey in her lab at the Rosalind Franklin University of Medicine and Science in North Chicago, Ill.

ence. I realized that I had to know my subject very well in order to simplify it for high school students to understand and that I enjoyed teaching. Moreover, I got more involved in extracurricular activities through our graduate student association and through other avenues. Slowly, I was beginning to develop multitasking skills. I was starting my project from scratch and, at the same time, had other activities going on. But with proper time management and planning, all my work and activities did not seem overwhelming. Surprisingly, I started to enjoy my research more. Yes, not all my experiments worked, but I could handle the situation much better than before.

As I look back to the past 4 ½ years, I wish I had known a few things before starting graduate school. I wish I had known that a Ph.D. is not just about doing experiments and getting meaningful data. In this era of "publish or perish," the more papers we publish, the better our CVs stand out in academia. But it's research, and things might not always turn out the way we expect. No matter how many blogs we read or how many rules we follow, there will be unexpected outcomes. Experimental failures (big or small) are part and parcel of research. The more important thing is to train oneself as a researcher. This includes independent thinking and designing experiments, understanding the rationale behind experiments, gaining technical expertise and troubleshooting, and learning to analyze data and give good presentations, as well as learning to teach, to do scientific writing, to network — overall, to strive to become an independent researcher.

Had I known this from the beginning, maybe the failure of my first project would have not been so demoralizing. Also, I would have made the time to focus on other important things like building up my networking skills, learning better presentation methods and nurturing my hobbies. I would have led a healthier life.

Thus, my journey so far in graduate school has also been a personal training phase. It has helped me build resilience; I feel I am better prepared to face challenges now. Moreover, I have learned the importance of work-life balance; as a graduate student, my research and its outcome definitely should be a priority, but I should not make it the sole purpose of my life.

Isha Dey (isha.dey@my.rfums.org) is a Ph.D. candidate at Rosalind Franklin University of Medicine and Science.

WHEN SCIENCE MEETS SICKNESS

For an upcoming essay series, ASBMB Today is asking readers to send in essays about their experiences as scientists or science students 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 can be sent to asbmbtoday.submittable.com. Submit under "Science meets sickness." Please include a title and complete contact information.

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

Play by the rules — and spot the error

By Kaoru Sakabe

Over the course of this year, I've offered advice on figure presentation and assembly. For this month's installment of Due Diligence, I thought it would be helpful to discuss the American Society for Biochemistry and Molecular Biology's expectations for creating technically and ethically sound figures as well as caution against some common image adjustment errors. I'm also letting you, the reader, play reviewer by showing you several figures (below) to see if you can spot the presentation error. Answers are on page 48.

To ensure the integrity of the papers they publish, many journals provide guidance for acceptable practices when it comes to image manipulation. These standards were

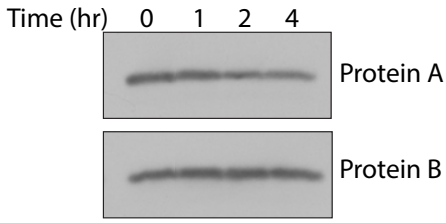
introduced in response to an increase in inappropriate adjustments of images in figures. Most journals have adopted the Journal of Cell Biology's stance on image manipulation because it's thorough and rigorous:

"No specific feature within an image may be enhanced, obscured, moved, removed, or introduced. The groupings of images from different parts of the same gel fields or exposures must be made explicit by the arrangement of the figure (e.g., using dividing lines) and in the text of the figure legend. Adjustments of brightness, contrast, or color balance are acceptable if they are applied to every pixel in the image and as long as they do not obscure, eliminate, or misrepresent any information present in the original, including the background. Nonlinear adjustments (e.g., changes to gamma settings) must be disclosed in the figure legend."

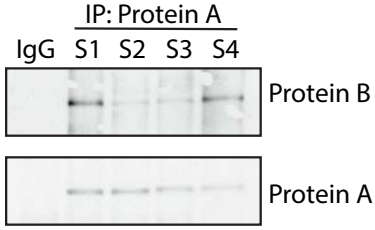
The nuts and bolts of this policy are that authors should limit the beautification or touch-up work they apply to an image. Here are the key points:

What's wrong with these figures?

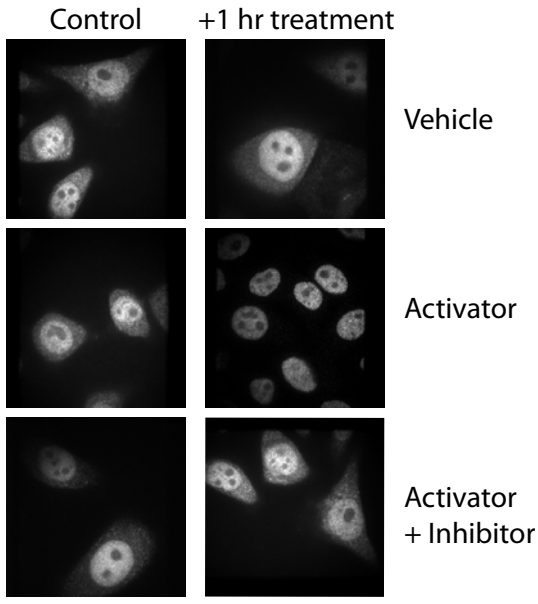
Example 1



Example 2



Example 3



• Your figure should look like the original capture of the image. Changing portions of the image to make it aesthetically pleasing or to enhance your data improperly is not allowed.
• If an adjustment is absolutely necessary, it must be applied to the entire image and not just a selection.
• Along the same lines, while authors most commonly think of the brightness and contrast tools to tweak a blot or micrograph, resizing should be applied to images with the same care as these other adjustments. If an image size needs to be adjusted, make sure you maintain the aspect ratio. If you stretch or compress an image in just one direction, you are not treating the pixels in the image equally.
• If you make any nonlinear adjustments, such as changes to the gamma setting, you should declare these adjustments in the figure legend. These types of adjustments do not increase or decrease pixel intensity levels evenly across the image. The low and high tones are adjusted at a different rate than the midtones, meaning that, again, not all pixels in the image are treated equally.
• The image background is part of the data and never should be removed or misrepresented in the figure. Remember, background is a hallmark of authentic data.
•Finally, you should be as transparent as possible in the figure and figure legends. Disclosing gel splices, reuse of control data and image acquisition settings allows readers and reviewers properly to assess your data.

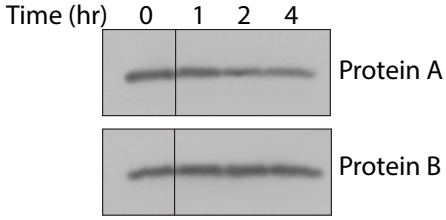
Now that you have the rules of the game down, let's see how well you do with spotting a presentation error. See if you can figure out what each author has done wrong.

These examples, as well as many other types of manipulation, are caught easily by a trained eye and imaging software. Depending on the severity of the manipulation, these alterations could be damaging not only to your reputation but to those of all the co-authors on your paper. Make sure you are preserving the integrity of the scientific record by playing by the rules of the game.

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

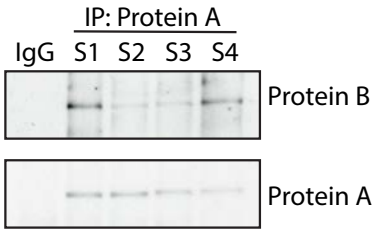
Answers

Example 1



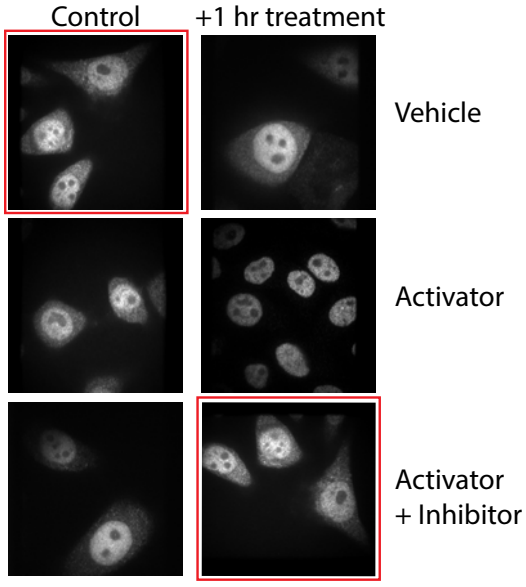
In this instance, the authors omitted the dividing lines to indicate that different sections of an immunoblot were spliced together to create the final image.

Example 2



Here, the authors removed some background spots in the immunoblot for Protein B to beautify the image. To show a true representation of the original capture, the authors should have left the spots in the final figure.

Example 3



In this example, the authors rotated the control, vehicle-treated panel and inadvertently inserted it into the activator-plus-inhibitor panel. Be sure to label your data effectively so that when you are assembling your figures later, you can determine which image goes with which experimental condition. Simple 1, 2, 3 labels can be hard to decipher a year or even a month after you've generated the data. Be sure to check the final figure against the original data to ensure that nothing was switched inadvertently during assembly.

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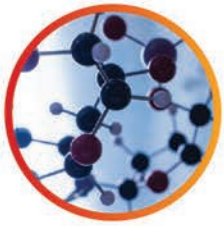
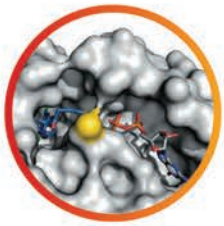


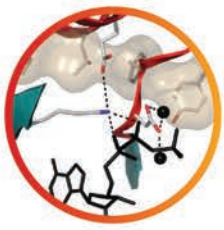
Building Inclusive Excellence in Science
June 14–17, St. Louis, Mo.



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.

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