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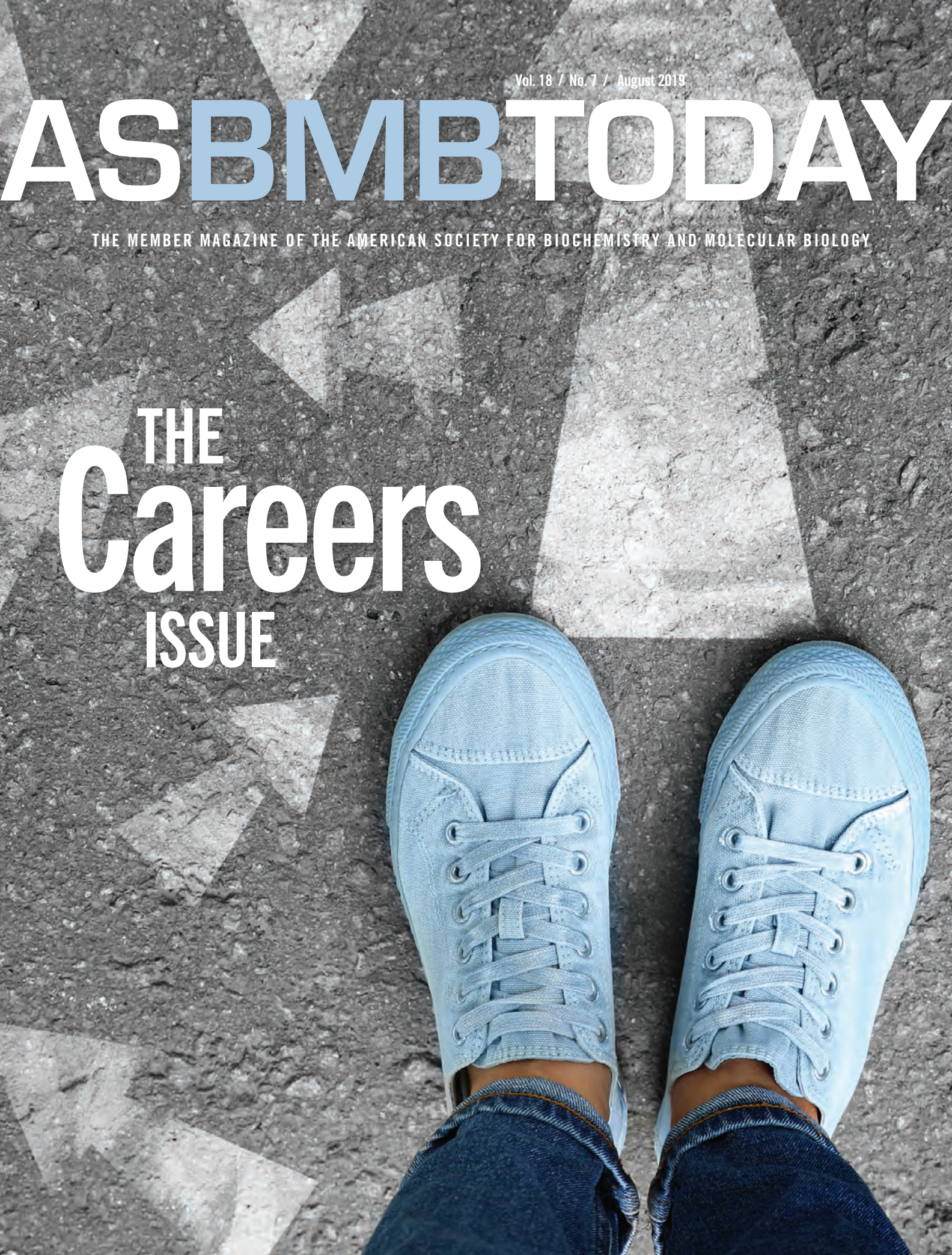
ASBMB TODAY

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

THE Careers ISSUE



FAST-TRACK YOUR ABSTRACT

HATE WAITING MONTHS TO HEAR IF YOUR MEETING ABSTRACT HAS BEEN ACCEPTED?

The ASBMB's priority consideration program is for you!

Submit your abstract for the 2020 ASBMB Annual Meeting in San Diego by Oct. 15 — you are guaranteed a decision within two weeks.

International researchers are encouraged to participate and get an early start on the visa process.

The Experimental Biology submission system will open in September.

MARK YOUR CALENDAR:

The priority consideration deadline is Oct. 15.
All early birds are eligible!

WWW.ASBMB.ORG/MEETING2020

ASBMB
American Society for Biochemistry and Molecular Biology

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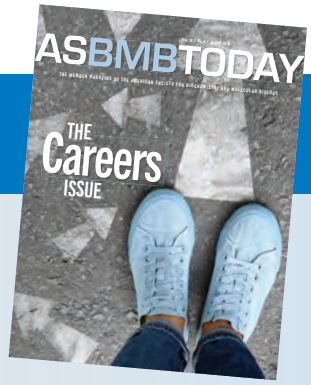

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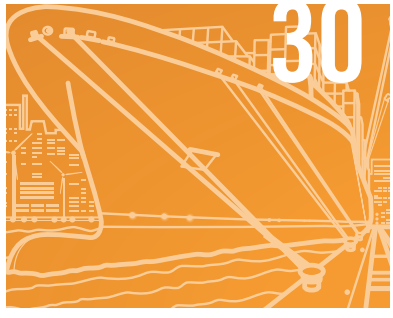

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Early birds get rapid responses on meeting abstracts

By Gerald Hart

Three days before the start of the 2019 American Society for Biochemistry and Molecular Biology Annual Meeting in Orlando, the society headquarters received an urgent request.

"I am writing to you to beg for your help. My visa is still under administrative processing as of today," wrote a graduate student in the Philippines who'd won one of our travel awards. "Your intervention just might be the needed thing to take this arduous process to its end."

This is a common story. Visa processing times vary wildly around the globe. Many prospective international attendees spend months worrying that they won't make it through all the hoops in time to present their work in the U.S. Some don't make it at all.

It is my hope that a new ASBMB program will help alleviate some of the stress associated with securing visas for our annual meeting and will make our meeting more accessible.

Here's how it works: The Experimental Biology abstract-submission system opens in September. If you submit an abstract in an ASBMB category by Oct. 15, we'll let you know within two weeks of your submission date whether it has been accepted. That should give you about six months to make travel arrangements.

The regular abstract deadline won't be until November, as it is every year. Those who submit abstracts after the Oct. 15 priority-decision cutoff will have to wait until early 2020 to find out if they've been chosen to present their work.

If your abstract is accepted early through the priority-decision program, you still will need to wait until early 2020 to find out what type of presentation you'll be giving (either a talk or a poster). But at least you'll be able to start making travel plans.

You don't have to be a researcher from outside the U.S. to benefit from the priority-decision program. Indeed, all early-bird scientists are welcome to participate.

As for the graduate student I mentioned above, I am glad to report that he did make it to Orlando to present his research, and he says he plans to be at the 2020 meeting.

The priority-decision program won't solve everyone's visa-related problems, but I'm hopeful that it will open the door for more scientists from around the world who want to present their important biochemistry and molecular biology research at our meeting.

(Editor's note: To help get you started, we've published the list of abstract categories in this issue on page 68.)

Gerald Hart
(gerald.hart@uga.edu) is a professor and Georgia Research Alliance eminent scholar at the University of Georgia and president of the ASBMB.

Your voice does matter

By Benjamin Corb

In June, the Public Affairs Advisory Committee urged all members of the American Society for Biochemistry and Molecular Biology to contact their congressional representatives about three pieces of legislation that would broaden participation of underrepresented groups in STEM.

These bills direct federal agencies to increase opportunities for underrepresented minorities, women and veterans pursuing degrees in science, technology, engineering and mathematics. They improve transparency and accountability of existing programs that aim to broaden STEM participation. While this sounds bureaucratic, increased transparency is necessary to evaluate and improve these programs and ensure they are an effective use of taxpayer dollars.

All told, ASBMB members sent almost 800 messages to members of Congress in support of the legislation. You educated your representatives on the issue, and two of the three bills gained nearly a dozen additional co-sponsors from seven states.

You educated your representatives on the issue, and two of the three bills gained nearly a dozen additional co-sponsors from seven states.

Eight hundred is an impressive number, but with some 10,000 ASBMB members, we had hoped for more.

Politics in America today can leave anyone feeling exhausted. A deep partisan divide and bitter political discourse might make you think advocacy is a waste of time.

I understand why you'd feel that way.

Issues such as tax cuts, abortion rights and immigration are now so deeply partisan that your lawmakers' stance seems predetermined by whether there is a "D" or an "R" next to their names. They seem to have no flexibility to consider an alternate view. This can make you question the value of those advocacy campaigns that ask you to "click here to send a letter to your representative."

All is not lost, however, if you back away from hot-button topics and focus on less risky and divisive issues that are vital to the scientific community, such as investments in research, STEM education policies and legislation focused on improving and diversifying the scientific workforce. On these topics, you — as a subject matter expert — can have an effect and nurture support by educating your member of Congress.

Grassroots advocacy does work. A 2017 report by the Congressional Management Foundation found that direct constituent interactions have more influence on lawmakers' decisions than other advocacy strategies. The report stated that citizen advocates "are more influential and contribute to better public policy when they provide personalized and local information to Congress."

Emily Hulobowich, executive director of the nonprofit Coalition for Health Funding, agrees. "There's an old saying in Washington: If you're not at the table, you're on the menu," she told me. "Lawmakers must hear directly from those they care the most about — their constituents — about their priorities and concerns to move issues forward. If constituents aren't willing to speak loudly and often, it's unlikely their priorities and concerns will rise to the top of the agenda."

We want to engage more ASBMB members in future advocacy campaigns. We know you're busy going to class, conducting research, teaching and applying for grants. We know your time is valuable, and this may not be a top priority for you.

But if you didn't get involved this time because you think it won't make a difference or you believe your representatives won't listen, we want you to know that they hear you; we saw that with the added co-sponsors following our spring campaign. Advocacy works, and representatives are listening. Don't assume others will deliver the message for you. Make sure your voice is heard.

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

Member update

By Erik Chaulk & Angela Hopp

Bumpus receives pharmacology award


Bumpus

Johns Hopkins University School of Medicine associate professor Namandjé Bumpus has received the 2019 John J. Abel Award in Pharmacology from the American Society for Pharmacology and Experi–mental Therapeutics.

Named in honor of the ASPET's founder, the award was established in 1946 to support fundamental research in pharmacology and experimental therapeutics by young investigators.

Bumpus is being honored "for her research on the impact of drug metabolites of HIV drugs on their pharmacology and toxicology and on the effect of genetic variation in drug metabolism on anti-HIV drug disposition," the society stated.

Bumpus is an associate professor of medicine and pharmacology as well as the associate dean for basic research at Hopkins.

She received a $5,000 honorarium and gave keynote lecture at the ASPET annual meeting at Experimental Biology 2019 in April titled "Drug metabolism, pharmacogenomics and the quest to personalize HIV treatment and prevention."

Davis named UMass chair


Davis

Roger J. Davis has been appointed chair of the Program in Molecular Medicine at the University of Massachusetts Medical School.

Davis came to the UMass Medical School as a Damon Runyon–Walter Winchell Fund fellow in 1984 and was appointed assistant professor in the department of biochemistry and molecular biology in 1985.

In 1990, Davis became a founding member of the Program in Molecular Medicine, a group that conducts biomedical research through applying novel techniques and approaches to the study of molecular mechanisms that underlie physiological processes.

An investigator with the Howard Hughes Medical Institute, Davis studies the role of the c-Jun NH2-terminal kinase family of stress-activated MAP kinases.

Davis has received numerous accolades for his work. He was elected to the Royal Society in 2002 and to the National Academy of Sciences in 2018. Thomson Reuters identified him as the most cited scientist in the world for 1995–1996.

DuBois honored for cancer research


DuBois

Raymond DuBois has received the American Association for Cancer Research's Margaret Foti Award.

Established in 2007, the award recognizes leadership and extraordinary achievements in the field of cancer research.

DuBois was recognized for his leadership in the early detection, interception and prevention of colorectal cancer. According to an AACR press release, DuBois "discovered the mechanistic function of prostaglandins (PGs) and cyclooxygenase in colon cancer initiation and progression and clarified the role of PGs in the tumor microenvironment, spearheading the consideration of aspirin and other non-steroidal anti-inflammatory mediators for cancer prevention."

He is dean of the college of medicine at the Medical University of South Carolina, where he serves as professor in the departments of biochemistry, molecular biology and medicine.

DuBois is chairman and president of the AACR Foundation and is a fellow of the AACR Academy. He served as president of the AACR in 2008.

He was recognized formally and presented an award lecture at the AACR's annual meeting this spring.

Proteomics award named for Costello


Costello

Catherine Costello has received the inaugural 2019 Lifetime Achievement in Proteomics award from the U.S. Human Proteome Organization, or US-HUPO.

After the presentation in March, the award was renamed the Catherine E. Costello, Ph.D., Award for Lifetime Achievement in Proteomics, the first time an award has

been named after a female scientist in the field of proteomics.

Costello is a William Fairfield Warren distinguished professor at Boston University with her primary appointment in the school of medicine. She served as president of the American Society for Mass Spectrometry from 2002 to 2004, president of the international HUPO from 2011 to 2012 and president of the International Mass Spectrometry Foundation from 2014 to 2018.

Costello's research focuses on understanding the structures and functions of biologically important polymers. She has authored or co-authored more than 375 scientific papers and has received numerous awards for her proteomics research, including the 2009 Thomson Medal from the IMSF, the 2010 Field and Franklin Award from the American Chemical Society and the 2017 Distinguished Contribution Award from the ASMS.

Genetics society honors Snyder with George W. Beadle Award


Snyder

The Genetics Society of America has honored Michael Snyder of Stanford University with the 2019 George W. Beadle Award.

Snyder was recognized for his pioneering role in the application of omics technologies and big data to personalized medicine. Over the years, he has developed and made freely available several tools that now are considered central for genetics and systems biology research.

Snyder, an associate editor for the American Society for Biochemistry and Molecular Biology journal Molecular & Cellular Proteomics, received the award at the Allied Genetics Conference in April.

Snyder earned his Ph.D. at the California Institute of Technology, did a postdoctoral fellowship at Stanford University, began his faculty and administrative career at Yale University and later became a department chairman at Stanford, where he remains. He is a fellow of the American Association for the Advancement of Science and the American Academy of Arts and Sciences.

The GSA award was established in 1999 in recognition of George W. Beadle, who once served as president of the society and received the 1959 Nobel Prize in physiology or medicine.

Giasson wins UF research award


Giasson

Benoit Giasson has won a University of Florida Research Foundation professorship.

Giasson, a professor in the neuroscience department at UF, will receive a $5,000 annual salary supplement and a one-time $3,000 grant.

Giasson earned his bachelor's and Ph.D. in biochemistry at McGill University before completing postdoctoral research fellowships with Virginia Lee and John Trojanowski at the University of Pennsylvania. He has been a faculty member at UF since 2012.

The UFRF professorships program recognizes tenured faculty, nominated by their departments, with distinguished research programs and the promise of continued excellence. Up to 34 faculty members are chosen annually.

Wu receives Milstein award for cytokine research


Wu

Hao Wu has won the International Cytokine & Interferon Society's Seymour and Vivian Milstein Award.

Wu is a professor of structural biology at Harvard Medical School and Boston Children's Hospital. She was selected, the awards committee said in the statement, "in recognition of her unparalleled contributions to the molecular mechanisms of cytokine signaling."

The Milstein award was established in 1988, two years after interferon first was approved for the treatment of hairy cell leukemia. Wu will receive her award at the society's meeting in October in Vienna, Austria.

SEND US YOUR NEWS

Email items to asbmbtoday@asbmb.org — and don't forget to include a photo!

Members elected to the American Academy of Arts and Sciences

Five ASBMB members were among the 200 new inductees to the American Academy of Arts and Sciences this spring.


Butler

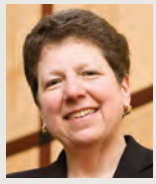
Alison Butler is a distinguished professor in the department of chemistry and biochemistry at the University of California, Santa Barbara. Just last year she won the American Chemical Society's Alfred Bader Award in bioinorganic chemistry. She previously served as president of the Society for Biological Inorganic Chemistry.


Green

Rachel Green is a distinguished professor at the Johns Hopkins University School of Medicine department of molecular biology and genetics and a Howard Hughes Medical Institute investigator. She was elected to the National Academy of Sciences in 2012 and the National Academy of Medicine in 2017. She is a former member of the ASBMB council.


Klionsky

Daniel J. Klionsky is a professor in the college of literature, science and the arts and a research professor at the University of Michigan Life Sciences Institute. He won the Director's Award for Distinguished Teaching Scholars from the National Science Foundation in 2003 and was named an education mentor by the National Academies in 2006. Two years ago, he received a Distinguished Faculty Achievement Award from the University of Michigan.


Kahn

Barbara B. Kahn is the George R. Minot endowed chair and professor of medicine at Harvard Medical School. She is also vice chair for research strategy at the Beth Israel Deaconess Medical Center Department of Medicine. Kahn won the Federation of American Societies for Experimental Biology's 2019 Excellence in Science Award. She was elected to the National Academy of Medicine in 2005 and the National Academy of Sciences in 2017.


Wolberger

Cynthia Wolberger is a professor of biophysics and biophysical chemistry at the Johns Hopkins University School of Medicine. She is a fellow of the American Association of the Advancement of Science and is the recipient of Protein Society Dorothy Crowfoot Hodgkin Award. Wolberger was elected this year to the National Academy of Sciences.

Oldach, Rubin win EXCEL awards


Oldach

Laurel Oldach and Byron Rubin have been honored by Association & Media Publishing for work published in ASBMB Today in 2019.

Oldach, a science writer for the American Society for Biochemistry and Molecular Biology, won a gold EXCEL award for her feature article, "Not one more generation: Women in science take on sexual harassment," published in September. Over the past 18 months, she has written news articles and features for the magazine on a variety of topics, including Parkinson's disease, antibody patents and proteomics.


Rubin

Rubin, an adjunct professor in the department of biochemistry and biophysics at the University of Rochester School of Medicine, won a bronze award for his essay, "Up the creek without a sequence?" which closed out the series "When science meets sickness" in December. This was Rubin's first essay for ASBMB Today. He also creates metal sculptures of biological macromolecules for museums, universities and pharmaceutical companies.

Association & Media Publishing is a membership organization serving the needs of association, nonprofit and alumni publishing teams. The awards were presented in June.

Members elected to the National Academy of Sciences

Seven ASBMB members have been elected to the National Academy of Sciences. They were among 100 new members and 25 foreign associates recognized for their research.


Booker

Squire J. Booker is a professor at the Pennsylvania State University and a Howard Hughes Medical Institute investigator. In 2017, he was elected to the American Academy of Arts and Sciences. He has served as chair of the ASBMB Minority Affairs Committee and is a member of the ASBMB council.


Gierasch

Lila M. Gierasch is a distinguished professor at the University of Massachusetts, Amherst. Last year she won the Ralph F. Hirschmann Award in peptide chemistry from the American Chemical Society. She is editor-in-chief of the Journal of Biological Chemistry, an ASBMB publication.


Regev

Aviv Regev is a professor at MIT, a core member and chair of the faculty at the Broad Institute of MIT and Harvard and a Howard Hughes Medical Institute investigator. She was an HHMI early-career scientist from 2009 to 2014. In 2014, she won the ASBMB's Earl and Thressa Stadtman Scholar Award.


Roussel

Martine F. Roussel is a faculty member at St. Jude Children's Research Hospital and the University of Tennessee at Memphis. She heads up the cancer biology program of the SJCRH Comprehensive Cancer Center. Roussel was elected to the American Academy of Arts and Sciences in 2011 and serves on the National Cancer Institute's board of scientific advisors.


Weis

William Weis is a professor and chair of the structural biology department at the Stanford University School of Medicine. He has served as chair of photon science at SLAC National Accelerator Laboratory and as director of the graduate program in biophysics.


Wolberger

Cynthia Wolberger is a professor of biophysics and biophysical chemistry at the Johns Hopkins University School of Medicine. She is a fellow of the American Association of the Advancement of Science and received the Protein Society Dorothy Crowfoot Hodgkin Award. She was elected this year to the American Academy of Arts and Sciences.


Zechner

Rudolf Zechner (foreign associate) is a professor at the Institute of Molecular Biosciences at the University of Graz in Austria. He is director of BioTechMed-Graz and a past winner of Austria's top science award, the Wittgenstein Prize

Those elected this year bring the total number of active NAS members to 2,347 and the total number of foreign associates to 487. The NAS reports that 40% of the newly elected members are women — the most ever elected in any one year to date.

IN MEMORIAM

Boyd O'Dell

Boyd O'Dell, one of the first scientists to reveal the important roles that folic acid and vitamin B12 play in development, died April 21. He was 102.

O'Dell spent about 80 years on the campus of the University of Missouri, and he was a legend there. Indeed, in a 2016 UM article about his 100th birthday celebration, a colleague said, "This man walks on water for people." There's even a bridge dedicated to him.

O'Dell was born in central Missouri on Oct. 14, 1916. He told writer Stephen Schmidt that the doctor present at his birth arrived on horse and buggy. Perhaps fatigued by the 10-mile ride or the delivery itself, the doctor wrote the wrong date on baby Boyd's birth certificate. O'Dell's mother insisted the correct date was Oct. 14, and so it was.

After attending a one-room rural school, O'Dell went to the University of Central Missouri but decided to transfer to UM in 1937 to complete a chemistry degree. He earned master's and doctoral degrees at MU in agricultural chemistry and during that time worked on isolating folic acid. Upon graduation, O'Dell took a job in Detroit as a research chemist. He was recruited to UM four years later.

As an academic researcher, he worked on trace element deficiencies and was particularly interested in zinc and copper. In the late 1950s, he was involved in the discovery of how phytic acid interferes with the absorption and utilization of zinc. All told, O'Dell had more than 200 articles to his name and even in so-called retirement was continuing to investigate how zinc deficiency harms cell function by blocking the signal for calcium uptake.

To learn more about O'Dell's post-retirement research, see "Just like Boyd" in the April 2017 issue of ASBMB Today.

Woon Ki Paik

Professor Woon Ki Paik died Feb. 16 in Evanston, Illinois, of primary bile duct cancer. He was 94.

Paik was born March 2, 1925, in Naju, Chollanamdo, South Korea. He attended high school in Seoul and served in the Republic of Korea's army as a lieutenant during the Korean War.

After the war, he immigrated to Canada, where he received his master's degree from Dalhousie University. He then completed research appointments at the National Cancer Institute, the University of Wisconsin and Ottawa University.

Paik ultimately joined the faculty at Temple University School of Medicine, where he spent 30 years before retiring as a professor emeritus of biochemistry in 1995.

With his wife and co-investigator, Sangduk Kim, Paik conducted significant research on protein methylation, an important area in the field of epigenetics.

He published more than 250 peer-reviewed publications, two books and multiple book chapters.

Late in his career, he returned with his wife to South Korea to help educate the next generation of Korean-born scientists.

Paik is survived by his wife, Sangduk Kim; their three children, Margaret, Dean and David; and six grandchildren.

RETROSPECTIVES

We invite you to honor a recently deceased ASBMB member with a personal retrospective article in ASBMB Today. For details, email asbmbtoday@asbmb.org.

Geoffrey N. Hendy

Former McGill University professor Geoffrey N. Hendy died Aug. 9, 2018. He had cancer.

Born in London in 1948, Hendy received his undergraduate degree at the University of Sheffield before obtaining his Ph.D. at the University of London. He completed his postdoctoral training at Harvard University and the Massachusetts Institute of Technology.

In 1985, Hendy joined the calcium laboratory of the division of endocrinology in the department of medicine at McGill University in Montreal.

Hendy remained on the McGill faculty for 34 years, serving as an assistant professor in medicine, associate professor in physiology, and professor in medicine and human genetics.

His research primarily focused on the genetic causes of mineral metabolism disorders. A highly cited author, Hendy published 248 peer-reviewed papers and numerous book chapters.

Hendy was also a mentor to numerous undergraduate and graduate students.

Elizabeth E. Howell

Elizabeth "Liz" E. Howell, the Charles P. Postelle distinguished professor in the biochemistry department of the University of Tennessee at Knoxville, died April 9.

Howell was internationally recognized for her studies of the biophysics and mechanisms of enzymes in the dihydrofolate reductase family, which includes important anti-cancer targets. She began her faculty career at UT in 1988. She was the first woman hired in the then-25-year-old department. She spent her entire career at UT and is remembered by colleagues for her commitment to helping others launch careers as independent researchers.

Howell also was an artist, working primarily with ceramics and clay. In 2009, the National Science Foundation selected one of her computational models for display at its headquarters. That work previously had been featured on the cover of the Journal of Computationally Aided Molecular Design.

Howell was elected as a fellow of the American Association for the Advancement of Science in 2014.

Angela Hopp (ahopp@asbmb.org) is the ASBMB's communications director and executive editor of ASBMB Today. Follow her on Twitter @angelahopp.

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

Sheereen Abdul Kabir, Kennesaw State University

Adijat Adebola, Bronx Community College

Cynthia Adjekukor, Covenant University

Dennis Akpobire, Delta State Polytechnic Ozoro

Mauricio Alvarez, University of Pennsylvania

Oladayo Apalowo, Obafemi Awolowo University

Camille Atlan, Kennesaw State University

Joseph Autry, University of Minnesota

Stevanya Baho, Wayne State University

Barry Barclay, Planet Biotechnologies Inc.

David Barondeau, Texas A&M University

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Sean Bevis, Wayne State University

Jonathan Billings, Hobart and William Smith Colleges

Michelle Boamah, Emory University

Ankur Bothra, National Institutes of Health

John Bowden, University of Florida

Cheryl Bowie, @Dreamgbutterfly Botanicals

Virginia Brown, North Carolina State University

Allessandra Bryan, Hobart and William Smith Colleges

Caitlin Burke, Tulane University

Matthew Burnett, Hobart and William Smith Colleges

Alicia Byrd, University of Arkansas for Medical Sciences

Mehmet Candas, University of Texas at Dallas

Bo Cao, Tulane University

Tyrell Carr, Saint Augustine's University

Savita Chaurasia, Bellarmine University

Yujue Chen, Tulane University

Joseph Cleland, Vanderbilt University

Alan Cowman, Walter and Eliza Hall Institute of Medical Research

Luz Cumba Garcia, Mayo Clinic Graduate School of Biomedical Sciences

Barbara de la Pena, University of Texas Health Science Center at San Antonio

Mildred Devereux, DePaul University

Anastasia Diolintzi, Rutgers University

Justin Donato, University of St. Thomas

Jasmine Donkoh, Colorado State University

Arnaud Droit, Centre hospitalier universitaire de Québec – Université Laval

Chau Duong, Edmonds Community College

Muhammad Muzzammil Edhi, Brown University/ Rhode Island Hospital

Sarah Fankhauser, Oxford College of Emory University

Demetria Fischesser, University of Cincinnati

Judith Frydman, Stanford University

René Fuanta, East Stroudsburg University

Panalopa Garcia, University of the Incarnate Word

Thomas Gingeras, Cold Spring Harbor Laboratory

Maria Giraldo, Providence College

Michel Kireopori Gomgnimbou, Université Nazi Boni

Tia Gordon, Kennesaw State University

Marina Grossi, University of Delaware

Nikolas Grotewold, The Ohio State University

Feng Gu, Wenzhou Medical University

Shantanu Guha, Tulane University

Laruen Hagerty, Hobart and William Smith Colleges

Jeffrey Han, Tulane University School of Medicine

Tyler Hansen, Vanderbilt University

Stavroula Hatzios, Yale University

Adam Hendricks, McGill University

Grace Hendricks, New Mexico State University

Lauren Heylmun, Texas A&M University

Kristopher Hite, Virginia Tech

Brianna Hodak, West Virginia University

Katherine Hook, Tulane University

Kimberly Horn, Wayne State University

Bri Hurysz, Hobart and William Smith Colleges

Joseph Isa, Management Education and Training Ltd.

Jasmine Jackson, Hobart and William Smith Colleges

Brigitte Jia, Vanderbilt University

Qing Jing, Shanghai Institute of Nutrition and Health

Jacquanette Johnson, Arizona State University

Zakiyyah Jones, Trinity Washington University

Abid Karanghadan, Gulf Medical University

Katey Kellogg, Hobart and William Smith Colleges

Nawal Khadka, University of South Florida

Cindy Khuu, University of California, Davis

Maiko Kitaoka, University of California, Berkeley

Karen Klimek, Saint Mary's College

Liam Knight, Hobart and William Smith Colleges

Victoria Knotts, West Virginia University

Aleksandra Krolak, The Rockefeller University

Dalia Kryksman, Hebrew University of Jerusalem

Renuka Kudva, Stockholm University

Bailey Kurdys, Westminster College

Jeimy Lavandier, Kennesaw State University

Hyemin Lee, Louisiana Cancer Research Center

Caitlin Lewis, Strategies for Engineered Negligible Senescence Research Foundation

Hong Liu, Tulane University School of Medicine

Amanda Lopez, Amherst College

Shangru Lyu, University of Florida

Heather Machado, Tulane University School of Medicine

Nicole Mackenstein, Westminster College

Eran Maina, The College of Wooster

Arian Mansur, Harvard University

Crystal Mendoza, Mayo Clinic Graduate School of Biomedical Sciences

Meryl Ann Mendoza, California State University, Los Angeles

Emily Micheloni, Northeastern University

Ram Mishra, Indian Institute of Science Education and Research, Bhopal

Ahmed Morsy, Texas Tech University Health Science Center

Daniel Moss, Tulane University School of Medicine

Patrick Murphy, University of Rochester

Catherine Musselman, University of Iowa

Parrish Nordan, Mudd, Bolvig, Luke & Wells LLC

Daniela Odle, ICON plc

Ifechukwu Okeke, University of California, Berkeley

Joy Olayiwola, Tulane University

Oluwafunto Oluokun, Brown University

Monserrat Orozco, California State University, Los Angeles

Ododo Osagie, University of Benin

John Pallo, Wayne State University

Claudia Palomino La Torre, University of California, San Diego

Nathalie Pamir, Oregon Health & Science University

Vivian Park, Tulane University School of Medicine

Roslyn Patel, Hobart and William Smith Colleges

Tania Perez, University of Miami

Constantine Petridis, Pfizer

Kelsey Pierce, Hobart and William Smith Colleges

Rachael Piercey, Hobart and William Smith Colleges

Dakota Pinkowski, National University

Gokul Raghunath, Emory University

Dennis Ramos Trinidad, Florida International University

Sonia Rao, Tulane Medical School

Kasun Ratnayake, University of Toledo

Kashawn Robertson, Saint Augustine's University

A**lec Robitaille,** Hobart and William Smith Colleges

Diego Rodriguez, Oregon State University

Michelle Rojo, Tulane University School of Medicine

Nate Ruffle–Deignan, Hobart and William Smith Colleges

Anahi Ruiz, Liberty University

Michael Ryan, Monash University

Manisha Sadar Ahire, Government Dental College and Hospital, Mumbai

Veronica Salau, University of KwaZulu–Natal, Westville Campus

Fern Schrader, University of New Hampshire

Jennifer Schreiber, Loyola University Chicago

Will Schultz, State University of New York at Geneseo

Ashkan Shahbandi, Tulane University School of Medicine

W**amia Siddiqui,** Rutgers University

Theresa Simermeyer, Wake Forest University

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Elsa Soto, University of the Incarnate Word

Ankit Srivastava, Rocky Mountain Laboratories

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Meijuan Sun, Tulane University

Sarah Sveen, Hobart and William Smith Colleges

Cassandra Taber, State University of New York at Geneseo

Yohhei Takahashi, Northwestern University

Zhen Teng, Tulane University

Justine Tigno-Aranjuez, University of Central Florida

Alexis Tivet, private tutor

John Toedt, Eastern Connecticut State University

Lindsey Tolman, University at Albany

Jenna Toohey, Westminster College

Shahid Ullah, Shenzhen University

Steven Verbruggen, Ghent University

Bart Voto, Hobart and William Smith Colleges

Rebecca Wade, Heidelberg University/ Heidelberg Institute for Theoretical Studies

Todd Waldman, Georgetown University School of Medicine

Jieqiong Wang, Tulane University School of Medicine

Abdi Warfa, University of Minnesota

Qiou Wei, University of Kentucky College of Medicine

Diva Whalen, Meharry Medical College

Alisa White, Austin College

Aidan Wiley, Wake Forest School of Medicine

Angela Wilkins, Juniata College

Hezekiah Williams, Jackson State University

Laura Williams, State University of New York at Geneseo

Leonard Williams, Tulane University

Madushika Wimalarathne, University of Alabama in Huntsville

Eric Wu, Tulane University School of Medicine

Jie Wu, University of Oklahoma Health Sciences Center

Lu Yang, Tulane University

Qian Zhang, Tulane University

Nini Zhou, Tulane University

Biochemist wins pageant crown

Miss Virginia lands title with science outreach talent

By Laurel Oldach

The experiment known as elephant toothpaste may not impress many chemists. Depending on your perspective, it may not even qualify as an experiment. But performing it onstage seems to result reproducibly in victory at beauty pageants.

It worked for Alayna Westcom, crowned Miss Vermont in 2015, and again for Camille Schrier, a doctoral candidate at Virginia Commonwealth University's school of pharmacy, who recently won the 2019 Miss Virginia competition.

For the talent portion of the competition, Schrier demonstrated and explained a simple but impressive chemical reaction that relies on iodide to catalyze a decomposition of hydrogen peroxide into water and gaseous oxygen. Onstage, with the addition of a little soap and food coloring, the product was a bubbly, photogenic crowd-pleaser that won Schrier the preliminary talent award.

Criticized for decades as frivolous or antifeminist, beauty pageants have seen declining television ratings and heightened controversy during the Me Too movement. Pageant organizations have tried to change with the times. In 2018, the Miss America Organization rebranded, ending the swimsuit competition and focusing on contestants' professional ambitions and plans for social impact. It was that rebrand that kindled Schrier's interest.

A number of past pageant winners have been scientists. Kára McCullough, a chemist at the U.S. Nuclear Regulatory Commission, was crowned Miss USA in 2017. Nina Davuluri, Miss America 2014, entered pageants to win scholarship money to pursue an advanced degree in medicine and used her spotlight to advocate for science education. Erika Ebbel, Miss Massachusetts 2004 in the Miss America pageant, went on to earn a Ph.D. in biochemistry and start a biotech company and an advocacy nonprofit organization, Science from Scientists.

Schrier graduated from Virginia Tech with a major in biochemistry and systems biology. Now studying for a pharmacy degree, she told Virginia Tech that she hopes one day to work in the pharmaceutical industry on drug or vaccine development. For the next year, though, she'll be on sabbatical from her Ph.D. program, touring the state to promote prescription drug safety and science, technology, engineering and mathematics education.

"I'm trying to be like Bill Nye," she told Virginia Commonwealth University's press team. "I want to get kids excited."

MISS VIRGINIA ORGANIZATION

Camille Schrier performs a chemistry demonstration known as "elephant toothpaste" onstage during the Miss Virginia pageant in June.

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Chapter president's hard work pays off

By Kerri Beth Slaughter

When Anna Fiedler is faced with a new challenge, such as hosting a regional research conference, she sees it as an opportunity to learn and grow. In fact, she thrives on paving the way to help others succeed.

"Because I did something first, someone down the line can benefit from it," she said.

Fiedler is a founding member of the American Society for Biochemistry and Molecular Biology Student Chapter at the University of Texas at Dallas. Noting her work ethic, her fellow members selected her in 2018 as chapter president. Under the previous president, the group had applied for the ASBMB Student Chapters Regional Meeting Award; with Fiedler at the helm, they used the funds to host a research conference for students from seven universities in Texas.

Planning the regional conference was a learning experience. To prepare, Fiedler and fellow chapter members reviewed student abstracts, advertised on campus and invited guest speakers. They also coordinated a career exploration panel with a faculty member, a chemistry graduate student and a medical school student to offer their perspectives about careers in science. Undergraduates can be intimidated by scientists, Fiedler noted, but the relaxed environment of the panel led to an open and honest conversation between the attendees and panelists.

She also had to deal with a few minor problems, such as running out of name tags and posters falling off the walls.

COURTESY OF ANNA FIEDLER

In addition to her love of science, Anna Fiedler has a passion for the Spanish language and culture, sparked when she was a child living in Beaumont, Texas. "If you drove down a street in my town, you would find a lot of people who didn't speak English as a first language," she said. Her study abroad experience in Spain and her Spanish language and culture classes have helped her communicate better with students from different backgrounds.

"You can't always predict what will happen," she said, "but you can learn how to have poise in those situations."

The conference's top three student presenters, including one from Fiedler's chapter, won travel awards to attend the ASBMB annual meeting in Orlando, Florida. Fiedler also attended the annual meeting with the help of an ASBMB Student Chapter Travel Award and a local travel grant she received for her undergraduate research.

At one of the booths in Orlando, Fiedler, who aspires to a career in medicine, was thrilled to test a virtual reality headset that models anatomy dissections. During the meeting, she also presented her work testing properties of organic polypropylene mesh, specifically how E. coli interact with the mesh, resulting in oxidative degradation.

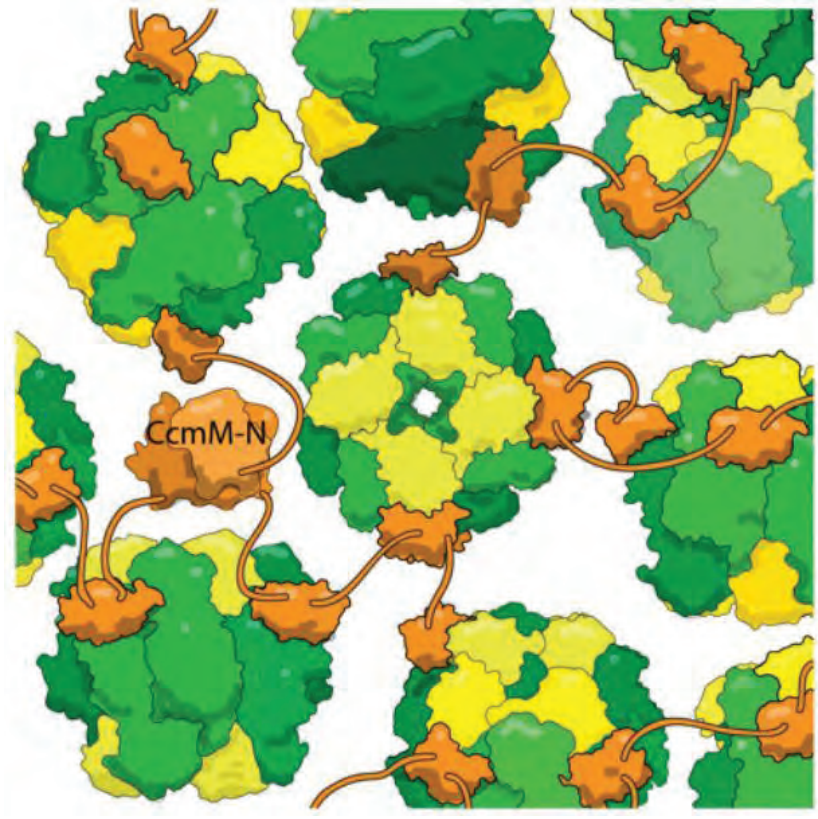
After she graduates from UT–Dallas in spring 2020, Fiedler hopes to attend medical school. She is excited to take on the challenge of working with patients to improve their quality of life.

"No one wants to have surgery done," she said, "but you get to see such a radical difference in the patient's life after surgery."

Kerri Beth Slaughter (kerri.slaughter@uky.edu) is a graduate student in the biochemistry department at the University of Kentucky. Follow her on Twitter @KB_Slaughter.

How bacteria build hyperefficient photosynthesis machines

By Laurel Oldach



MATTHEW KIMBER

This colorful illustration shows how CcmM (orange) binds to RubisCO holoenzymes (yellow and green) without dislodging a yellow subunit. By crosslinking multiple enzymes, CcmM forms the basis of the carboxysome.

Researchers facing a future world with a larger human population and more uncertain climate are looking to photosynthetic bacteria for engineering solutions to improve crop yields.

In the **Journal of Biological Chemistry**, a Canadian research team reports on how cyanobacteria finesse one of the most wasteful steps in photosynthesis. The study investigated the assembly of carboxysomes in which the bacteria concentrate carbon dioxide, boosting the efficiency of a critical enzyme called RuBisCO.

"Essentially everything we eat starts with RuBisCO," said Matthew Kimber, a professor at the University of Guelph in Ontario and senior author on the paper.

The enzyme, which is made of 16 protein subunits, is essential for photosynthesis. Using energy captured from light, it incorporates carbon dioxide into organic molecules from which a plant then builds new sugar. Unfortunately, it's not terribly efficient. Or, from Kimber's point of view, "RuBisCO has a really thankless task."

The enzyme evolved in an ancient world where carbon dioxide was common and oxygen was rare. As a result, it isn't very picky in discriminating between the two gases. Now that the atmospheric tables have turned, RuBisCO often accidentally captures oxygen, generating a useless compound that the plant then has to recycle.

Cyanobacteria make few such mistakes, because bacteria collect their RuBisCO into dense bodies known as carboxysomes. The bacteria pump bicarbonate (simply hydrated CO_2) into the cell; once it gets into the carboxysome, enzymes convert the bicarbonate into carbon dioxide. Because the carbon dioxide can't escape through the protein shell surrounding the carboxysome, it builds up to high concentrations, helping RuBisCO avoid costly mistakes.

Kimber wants to understand the logic of carboxysomes' organization. "They're actually phenomenally intricate machines," he said. "The cyanobacterium makes 11 or so normal-looking proteins, and these somehow organize themselves into this self-regulating mega-complex that can exceed the size of a small cell."

One of carboxysomes' most impressive tricks is self-assembly, which Kimber's lab set out to understand. They looked at a protein, CcmM, that corrals RuBisCO enzymes into

new carboxysomes. They knew that part of CcmM looks a lot like a subunit of RuBisCO — so much so that researchers suspect ancient cyanobacteria created CcmM by duplicating a RuBisCO gene.

Most scientists in the field believed that CcmM binds to the enzyme by usurping that RuBisCO subunit's spot. But when Kimber's lab took a detailed look at CcmM's structure and binding, the results showed that was wrong. True, CcmM was similar in shape to the small RuBisCO subunit. But the complexes it formed still included all eight small subunits, meaning that instead of stealing a spot from a RuBisCO subunit, CcmM had to be binding elsewhere.

"This is very odd from a biological perspective, because if CcmM arose by duplicating the small subunit, it almost certainly originally bound in the same way," Kimber said. "At some point, it must have evolved to prefer a new binding site."

The researchers also found that a linker between binding domains in CcmM is short enough that "instead of wrapping around RuBisCO, it tethers (individual enzymes) together like beads on a string," Kimber said. "With several such linkers binding each RuBisCO at random, it cross-links everything into this big glob; you wrap a shell around it, and this then becomes the carboxysome."

Scientists at another university reported last fall that they had succeeded in making tobacco plants with a stripped-down carboxysome in their chloroplasts. Those plants didn't grow especially well, and the authors concluded that they had taken away too many components of the carboxysome; although it could be built in the chloroplast, it was a drag on the plants instead of a help.

A better understanding of how proteins like CcmM contribute to carboxysome construction and function could help bioengineers leverage carboxysome efficiency in the next generation of engineered plants.

DOI: 10.1074/jbc.RA118.006330

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A promiscuous inhibitor uncovers cancer drug targets

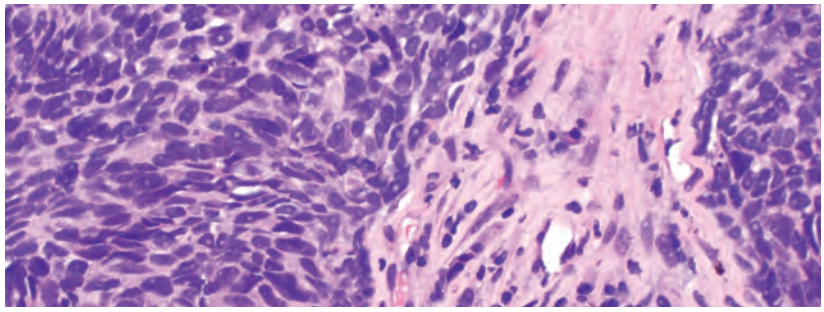
By Jonathan Griffin

When signaling pathways within cells are triggered, proteins activate like a row of tumbling dominoes until the final protein influences some cellular function. In some tumors, multiple signaling pathways drive cell growth and survival; if one pathway ceases activity, another could continue driving cancerous behavior.

Several clinically approved kinase inhibitors originally were designed to block the function of individual signaling kinase proteins. Scientists now know that some of these inhibitors indiscriminately disrupt numerous proteins, which may allow them to kill certain tumors but also may inhibit some proteins unnecessarily, eliciting adverse effects.

To pinpoint the most therapeutically relevant kinase targets in cancer cells, a group of researchers at Harvard Medical School and the Dana Farber Cancer Institute in Boston, led by Nathanael Gray, has developed a method that exploits the multitargeted nature of a chemical inhibitor.

In a study published in the **Journal of Biological Chemistry**, Gray and colleagues identified key molecules that support the survival of a specific type of lung cancer. By analyzing how these cells respond to a cancer-killing kinase inhibitor with numerous targets, they showed that the anti-cancer effects likely were elicited by simultaneous inhibition of two signaling pathways. This approach could lead to development of cancer drugs that attack only the right targets.



LIBREPATH/WIKIMEDIA COMMONS

A micrograph of a non–small cell lung carcinoma shows nuclei in purple and cytoplasm in pink.

While studying various kinase inhibitors, Gray and his lab identified one, known as SM1-71, which binds to dozens of kinases, some of which support cell survival and growth.

"It was sort of like a stick of dynamite and really could hit a lot of different targets," Gray said.

In the JBC study, the researchers exposed several cancer cell types to SM1-71 and found that the drug was highly toxic to a lung cancer cell line with a mutation that activates many signaling pathways that drive cell growth. The inhibitor's ability to kill these mutated cells suggested that targets in several pathways were being hit, Gray said.

To discover which of the many buttons pushed by SM1-71 elicited its anti-cancer effects, the researchers used Western blotting to narrow down which signaling proteins related to survival and growth were being blocked in cancer cells, revealing that proteins in two critical pathways were inhibited.

The authors then applied various kinase inhibitors to see if inhibiting any combination of the proteins in these pathways would replicate the cancer-killing effects of SM1-71. In the end, inhibiting MEK1/2 and IGF1R/INSR proteins at the same time demonstrated similar effects, suggesting that these are crucial targets in this lung cancer line, Gray said.

SM1-71 is likely not viable in humans because it binds to too many proteins and could cause collateral damage, Gray said. But uncovering its most important targets within specific pathways is valuable for designing drugs that can shut down multiple signaling pathways, which is necessary in some tumors.

"The next step would be to try to preserve the efficacy-driving targets while getting rid of targets that may be contributing to the toxicology," Gray said.

DOI: 10.1074/jbc.RA118.006805

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A fatty-liver drug? Not so fast

Biology continues to surprise even experts

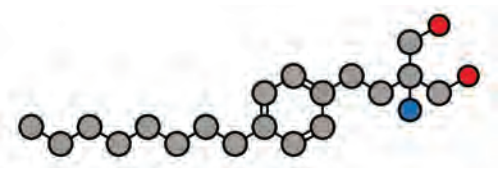
By Laurel Oldach

Sarah Spiegel knows a lot about sphingosine-1-phosphate, or S1P: She discovered the molecule in the 1990s. But she also knows there's a lot still to learn. A study from Spiegel's lab at Virginia Commonwealth University, published in the **Journal of Lipid Research**, highlights the complexities of signaling by this enigmatic lipid — and shows that targeting it may not fix fatty livers as easily as researchers had hoped.

Nonalcoholic fatty liver disease, or NAFLD, the leading cause of liver transplants, is rampant among people who consume a high-fat diet. The disorder starts when excess lipids build up in liver cells and eventually causes inflammation that does lasting harm to the organ.

S1P is higher in the livers of people and mice with the disease. Given that link and the known role of S1P in inflammatory signaling, researchers hoped that blocking S1P signaling might slow NAFLD progression.

And there's a drug that does exactly that. The prodrug FTY720/fingolimod, which is used to treat multiple sclerosis, is a sphingosine analogue that is phosphorylated in the body to an S1P mimic. In MS, it is thought to work by blocking S1P receptors on the surface of immune cells that otherwise would attack healthy tissues. Two years ago, researchers at the Mayo Clinic suggested that the drug could also reduce the symptoms of diet-induced fatty liver disease in mice.



A structural cartoon shows FTY720, or fingolimod, which resembles the lipid sphingosine and is used to treat multiple sclerosis.

"Nonalcoholic fatty liver diseases have a component of inflammation," Spiegel said. "And FTY720 was known to be immunosuppressive."

So the results of that first study made sense. But the dose used in the mice was quite high compared with the final plasma concentration of the drug in human patients. So, with postdoctoral fellow Timothy Rohrbach in charge, Spiegel's lab tested the drug orally at about a third of the dose, a better match for treatment in the clinic.

The finding held up, but not for the reasons they had expected. In mice fed a fatty diet and sugar water, the researchers observed, treatment with FTY720 reduced lipid accumulation and liver size. But it didn't do much to reduce the cytokine and chemokine signaling that are thought to push a fatty liver toward cirrhosis.

"We were surprised that inflammation was not the major component" of the drug's effect, Spiegel said. "Yes, there were some effects on inflammation. But … the effect was mainly through suppressed lipid accumulation."

In other words, the drug affected the first step in the disease, lipid buildup, without much changing inflammatory signals that usually result from that buildup.

By investigating lipid synthesis enzymes with a known connection to NAFLD in the treated mice, the team observed that fatty acid synthase was reduced while other enzymes did not seem to be affected. Of all the enzymes that make lipids, why fatty acid synthase alone?

Though FTY720 is expected to work through S1P receptors, Spiegel said, it may, like the sphingosine it mimics, have many targets. Her lab has shown previously that S1P can work in the nucleus as well. In this paper, they found preliminary evidence that the treated mice may regulate fatty acid synthase levels through histone modification.

"It's a hypothesis at this point," Spiegel said. "But I think it's an intriguing connection. … In science, so many times you have a hypothesis, and the results take you to a different angle."

DOI: 10.1194/jlr.M093799

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Huntingtin through a multiomic lens

Protein–protein interaction network leads to the synapse

By Laurel Oldach

Tracing the effects of a single gene's mutation can be hard. Huntington's disease, for example, is caused by just one mutation — but that change reverberates throughout the brain. Research published in the journal **Molecular & Cellular Proteomics** shows that the mutant protein that causes Huntington's can alter the binding properties of another protein, perhaps accounting for some of the mutation's far-flung cellular effects.

Huntington's disease, an as-yet-untreatable neurodegenerative disorder, is caused by a mutation that affects the protein huntingtin. Huntingtin is large to begin with; in patients, a repeat region in the gene adds an expanding tract of glutamine residues to the protein, making it sticky and prone to aggregate. But how the protein change leads to profound problems in neurons is up for debate.

"Very few proteins act as a monolithic structure," said Joel Federspiel, a postdoctoral fellow in Ileana Cristea's lab at Princeton University. Instead, most act in coordination with other proteins. The same is probably true for huntingtin — but previous interactomics studies turned up thousands of binding partners. Which ones are important for the way the disease develops?

Recent research had shown that reducing neuronal levels of the protein HDAC4, which binds to mutated huntingtin, may reduce Huntington's symptoms, at least in mice. Oddly, however, blocking the enzymatic activity of HDAC4, which belongs to a class of enzymes that alter histone proteins that organize DNA, did not have the same effect.

To Federspiel and Cristea, the data suggested that HDAC4 was contributing to the onset of disease through a binding interaction either with huntingtin or with other proteins. So they hopped one ripple ring away from huntingtin protein itself to study how HDAC4 changes in a brain affected by the disease.

The researchers used immunoaffinity purification followed by mass spectrometry to catalogue all of the proteins that interact with HDAC4 in the mouse brain. In a mouse model of Huntington's, they found major changes to the HDAC4 interactome around the age at which symptoms start to appear.

"You can, in a case like this, have hundreds to thousands of proteins or transcripts that are differentially regulated," Federspiel said. "Trying to home in on just a few of those to focus on can be challenging. However, if you have more lines of evidence, then you start to see what things are common."

To find the significant proteins, they layered in additional data from earlier transcriptome and proteome studies. After they applied what they called a lens of multiomics, a few insights came into focus.

In the mice with huntingtin mutations that were old enough to exhibit symptoms, HDAC4 associated with many huntingtin-binding proteins — more so than in the brains of healthy mice or younger mutants.

Many of the interacting proteins were involved in the organization of synapses and vesicle transport. In the mutant mice, those proteins interact with HDAC4 much more strongly. The effect was most noticeable in cells in the striatum, a brain region that controls movement and is affected greatly in Huntington's disease.

That's good circumstantial evidence that, in Huntington's-affected brains, a changing HDAC4 interactome may contribute to symptoms. Exactly how, the researchers say, remains to be determined.

DOI: 10.1074/mcp.RA118.001253

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From the journals

By Nathalie Gerassimov, Jonathan Griffin & Kerri Beth Slaughter

How an oyster protein drives shell formation

Matrix proteins rich in acidic asparagine and glutamine residues are needed to form biominerals such as bones and shells, with the carboxylates of these residues serving as possible calcium-binding groups. Dong Yang and a team at Tsinghua University have characterized the pearl oyster protein N25, which contains high proportions of proline, serine and basic lysine residues, finding that it also affects biomineral formation, attaching to crystal surfaces and delaying a morphological transition. These results, published in the **Journal of Biological Chemistry**, shed light on biomineral formation mechanisms and raise intriguing questions about potential synergisms among distinct matrix proteins.
DOI: 10.1074/jbc.RA118.007338

A better way to count eicosanoids

Eicosanoids are signaling lipids that play a role in pain and inflammation. They function in diseases such as asthma and cancer, making them clinically relevant biomarkers. In a paper published in the **Journal of Lipid Research**, Cristina Gómez and an international team present an improved method of extracting and quantifying eicosanoids from human urine, suitable for use with groups in large and diverse clinical trials. The included metabolites cover major synthetic pathways, including prostaglandins, leukotrienes and isoprostanes.

The researchers were able to extract 32 eicosanoids rapidly, reliably and precisely from urine, with average extraction recoveries of over 90%, then quantify them by liquid chromatography and mass spectroscopy. Their method includes a faster and more streamlined protocol that is suitable for large-scale studies and small sample volumes (1.4 mL of urine for the complete workflow). This method could be used for numerous types of studies of various populations, including children.
DOI: 10.1194/jlr.D090571

Crystal structures could improve pain meds

COX-2 is a target of the nonsteroidal anti-inflammatory drugs, or NSAIDs, used to manage pain and fever. COX inhibitors containing an indomethacin scaffold are selective for the inflammation-induced COX-2 over the constitutively expressed COX-1, but the basis for this selectivity has not been established definitively. Shu Xu and a team of U.S. researchers have reported in the **Journal of Biological Chemistry** the first crystal structures of COX-2 in which the intact derivatives of the NSAID indomethacin are fully visible, confirming that compound binding extends to a unique lobby of the protein and providing critical details to inform future inhibitor design.
DOI: 10.1074/jbc.RA119.007405

How a tree responds to infection

Fast-growing trees of the Paulownia genus have been cultivated in China for centuries. They commonly are found in parks and gardens, and the wood is used to make furniture and musical instruments. Phytoplasma bacteria pose a major threat to these trees by causing Paulownia witches' broom, or PaWB, a disease characterized by stunted growth and other malformations. Phytoplasmas infect more than 1,000 plant species, resulting in significant economic losses in agriculture and horticulture.

Post-translational modifications such as lysine acetylation and succinylation are known to be involved in plant response to pathogens. However, the functions of these modifications during phytoplasma infection had not been explored previously. In a study published in the journal **Molecular & Cellular Proteomics**, Yabing Cao and colleagues from the Henan Agricultural University in China write that acetylation may be more important than succinylation in response to phytoplasma infection in Paulownia tomentosa seedlings. They showed that rubisco and protochlorophyllide reductase, enzymes needed for chlorophyll and starch synthesis, are acetylated at specific sites in phytoplasma-infected seedlings, leading to modified enzymatic activity.
DOI: 10.1074/mcp.RA118.001104

Aging and cataract formation

Crystallin proteins within the eye lens are some of the longest-lived proteins in the body but are prone to accumulation of modifications that contribute to cataract formation. To uncover the molecular consequences of isomerization modifications in alpha A- and alpha B-crystallin proteins, Yana Lyon and colleagues from the U.S. and the U.K. exam-

Making neurotoxic plaques miss their mark

A hallmark of Alzheimer's disease is the aggregation of beta-amyloid plaques in the brain that exhibit neurotoxic properties and contribute to neurodegeneration. In the **Journal of Biological Chemistry**, British researchers report that activating an endogenous enzyme that chops off beta-amyloid targets from the surface of neurons curbs the neurotoxic effects of the plaques.

Oligomers of beta-amyloid, or ABOs, are particularly toxic and bind to receptors on the neuronal surface, triggering signaling pathways and the generation of reactive oxygen species, which impair cell function and survival. Recent research has shown that one of these receptors, cellular prion protein, or PrPC, can be removed from the cell surface by the enzyme ADAM10. Heledd Jarosz–Griffiths and colleagues at the University of Manchester and the University of Oxford sought to increase the activity of this enzyme and, in turn, reduce the toxic activity of ABOs.

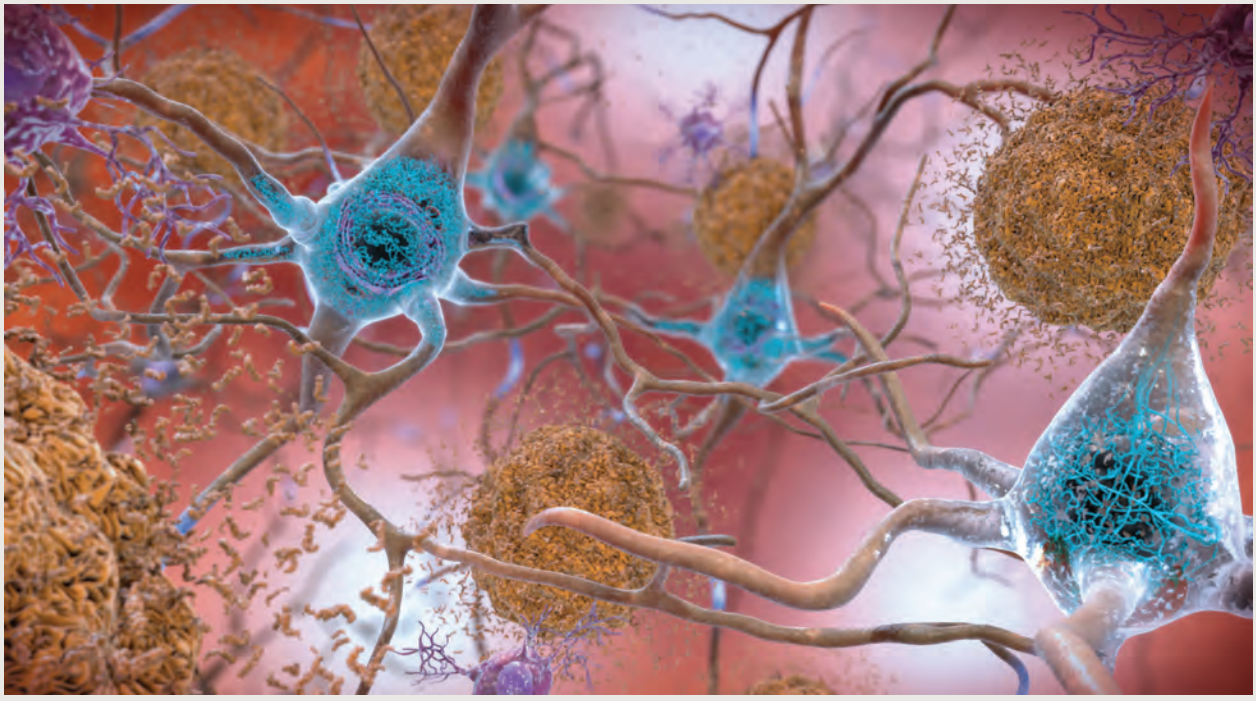
Previous work has shown that the muscarinic agonist carbachol and the vitamin A analog aciretin can activate ADAM10. Jarosz–Griffiths' team exposed human cell types to these compounds and found that either could promote shedding of PrPC from the surface of neuroblastoma cells or induced pluripotent stem cell-derived neurons. These molecules blocked the binding of ABO and reduced its toxic effects. Knockdown of ADAM10 diminished these benefits, indicating that activation of this specific enzyme is critical for PrPC shedding and protection from ABOs.

These results demonstrate that reducing neuronal targets for ABOs by activating ADAM10 could have significant therapeutic potential for Alzheimer's disease patients.

DOI: 10.1074/jbc.RA118.005364

—Jonathan Griffin

NATIONAL INSTITUTE ON AGING, NIH



In the Alzheimer's-affected brain, abnormal levels of beta-amyloid protein clump together to form plaques, shown in brown, that accumulate between neurons, disrupting cell function and survival.

ined four sites crucial for oligomerization using mass spectrometry, molecular dynamics simulations and other strategies. In their study in the **Journal of Biological Chemistry**, they report that these modifications interfere with oligomer assembly, which could lead to increased aggregation of damaged molecules and contribute to cataract formation.
DOI: 10.1074/jbc.RA118.007052

I'm not fat, I'm fluffy — refining obesity risks

More than 70% percent of American adults have a body mass index above 25, defined as obese or overweight, indicating a great societal and individual health risk. But BMI is a far-from-perfect health metric, with fit actors like Dwayne "The Rock" Johnson scoring in the obese range. Obesity metrics that better assess individual health risk are needed.

In a paper published in the **Journal of Lipid Research**, Wahyu Wulaningsih and colleagues in the U.K. analyzed the correlation between circulating metabolites and several obesity metrics, postulating that a more sophisticated understanding of weight and associated cardiovascular disease risk would allow for earlier and more focused intervention.

The researcher correlated the concentrations of 233 circulating metabolites in 900 British men and women ages 60 to 64 to their BMI, waist-to-hip ratio and android-to-gynoid fat ratio. The latter two are relevant because android (waist) obesity is considered more of a health risk than gynoid (hips) obesity. As expected, there was a strong correlation (more than 54%) of the metabolites with all three obesity metrics. BMI had the highest correlation, with 168 out of 233 metabolites, or 72%. Of the metabolites, high-density lipoprotein particle size was most highly correlated with BMI.

Furthermore, BMI measurements starting at childhood were available for most participants, and the study also correlated these with current metabolite levels. The researchers identified an inverse association between BMI at age 7 and glucose or glycoprotein at ages 60 to 64. Additionally, the data showed an inverse association between postadolescent BMI gains and one metabolite.

This study supports the importance of longitudinal measures of adiposity and metabolomic profiling in the investigation of obesity-related health risks.
DOI: 10.1194/jlr.P085944

Attacking malaria's DNA

Although medication is available for malaria infections, drug-resistant strains of the parasite continue to emerge. As such, there is an increasing need for new drug targets. Pratap Vydyam and colleagues at the University of Hyderabad identified the DNA double-strand break repair pathway as a vulnerability in the malaria-causing parasite Plasmodium falciparum. In a study published in the **Journal of Biological Chemistry**, the authors used in silico screening to find that the compound B02 binds and inhibits the recombinase protein PfRad51 with high affinity, preventing the parasite from repairing its DNA. They also discovered a synergy between B02 and anti-malarial drugs chloroquine and artemisinin.
DOI: 10.1074/jbc.RA118.005009

The Krabbe proteome in a mouse model

Krabbe disease is a lysosomal storage disorder that disrupts myelin turnover in the nervous system. This autosomal recessive disease affects 1 in 100,000 people in the U.S., and there is no known cure. Krabbe disease is associated with impaired degradation of the sphingolipid psychosine, and scientists believe that buildup of this cytotoxic lipid is the main cause of demyelination. An animal model known as the twitcher mouse has been used for metabolic profiling, but further studies are needed to understand the proteome changes in Krabbe disease.

In a study published in the journal **Molecular & Cellular Proteomics**, Davide Pellegrini and colleagues in Italy and the Netherlands write that they used laser capture microdissection combined with microproteomics to identify more than 400 protein groups that showed expression differences between wild-type and twitcher mice. Results suggest that processes related to inflammatory and immune response as well as leukocyte infiltration were upregulated in the twitcher mice. Future studies will address proteome changes in younger twitcher mice to understand how these dysregulated biological pathways are linked to Krabbe disease pathogenesis.
DOI: 10.1074/mcp.RA118.001267

Improving cancer drug evaluation

Inhibiting histone lysine demethylase, or KDM, enzymes has shown promise in treating cancers such as leukemia. However, current screening methods for these inhibitors are indirect and may not show accurately how specific targets are affected. Cristina Mascaró and an international team report in the **Journal of Biological Chemistry** that they have developed a novel immunoassay that uses a biotinylated chemoprobe capable of selectively binding to KDM1A. The results demonstrated that the assay could be applied to analyze the pharmacokinetics and pharmacodynamics of the leukemia drug ORY-1001 in tissue extracts.
DOI: 10.1074/jbc.RA118.006980

White fat no more — hope for an anti-obesity drug

Fat cells, or adipocytes, come in different flavors based on their macroscopic appearance; namely, they can be white, brown or brite (brown-in-white). White adipocytes store lipids (fatty acids and triglyceride) within a single lipid droplet and have few mitochondria. Brown adipocytes (typically found in newborns) have many mitochondria and help maintain body temperature during long-term cold exposure through nonshivering thermogenesis involving what researchers call a "futile cycle" of proton transport across the inner mitochondrial membrane. Brite adipocytes resemble both types: They can have several lipid droplets and contain many mitochondria.

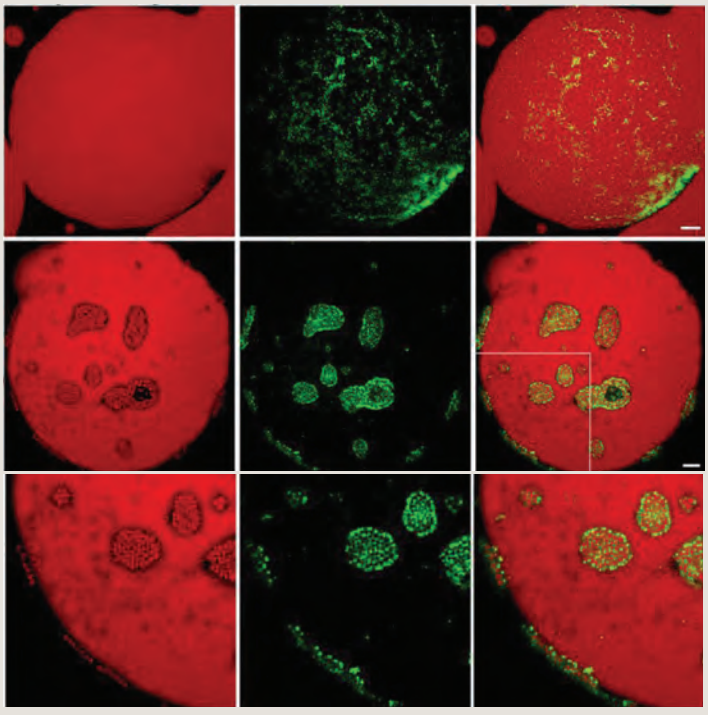
Studies in rodents have shown that mature white adipocytes can become brite in response to cold or beta-adrenergic stimulation. This transformation and the associated ability to catabolize fatty acids through mitochondria is of interest as a treatment for obesity. In a paper published in the **Journal of Lipid Research**, Mi-Jeong Lee and a team of researchers from U.S. universities write that treatment of human white adipocytes with the diabetes drug rosiglitazone, or rosi, induces white adipocytes to become more britelike.

The researchers cultured explants of human visceral and abdominal subcutaneous fat tissues for seven days with or without rosi. The drug induced transcriptional changes that resembled the brite adipocyte profile and key players of fatty acid oxidation. Further transformation was visible in the formation of small lipid droplets around the adipocyte central lipid droplet and the rearranged mitochondria surrounding the small lipid droplets. This study supports the idea that a pharmacological intervention to treat obesity and its associated metabolic diseases is possible and provides several potential targets to test for this approach.

DOI: 10.1194/jlr.M091173

—Nathalie Gerassimov

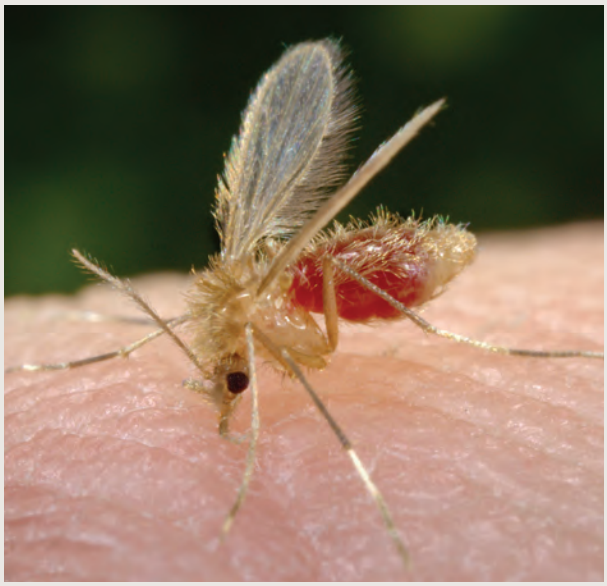
LEE ET AL/JLR



When cultured white adipocytes are treated with the diabetes drug rosiglitazone, they become more like brite adipocytes, as shown by the formation of small lipid droplets decorated with rearranged mitochondria (green large ovals in a sea of red lipid in the second and third panel of images).

Tracking gene expression in Leishmania parasites

Leishmaniasis is a parasitic disease spread by the bites of phlebotomine sandflies. The sandflies can only transfer in the infective stage of the parasite, known as a promastigote, during blood meals. The promastigotes are taken up by macrophages, where they transform into the tissue stage of the parasite, known as an amastigote. The amastigotes then replicate, destroying the host macrophage, and infect the next round of macrophages, often leading to cutaneous or visceral leishmaniasis in humans. A more common cutaneous leishmaniasis results in an open sore at the bite site that can leave a disfiguring scar, causing some patients to be shunned in their communities. Symptoms of more serious forms of visceral leishmaniasis include fever and swelling of the spleen and liver; if left untreated, they are typically fatal.



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The phlebotomine sandfly is the primary vector of Leishmania parasites.

Leishmania parasites lack promoter-mediated regulation of transcription. Gene regulation is instead controlled primarily by post-transcriptional mechanisms, such as RNA-binding proteins, or RBPs, that interact with messenger RNA to form ribonucleoprotein complexes. These complexes direct trafficking and processing of the mRNA from when it is synthesized until it decays. Environmental stimuli can affect the localization of these complexes and enhance or reduce the rate of translation or target transcripts for degradation. However, few RBPs or other transregulators have been characterized in Leishmania lifecycle progression.

Pegine Walrad and colleagues at the University of York describe the mRNA-bound proteome of Leishmania mexicana at different lifecycle stages in a study in the journal **Molecular & Cellular Proteomics**. They write that their findings support a low correlation between protein expression and transcript expression, consistent with the idea that the gene expression is regulated by post-transcriptional mechanisms.

The researchers also show that more than 250 RBPs exhibit stage-specific expression. Their analysis suggests that RBP protein expression does not correlate to RNA association, indicating that RPBs may be post-translationally modified to regulate stability and binding potential. RBPs may serve as useful targets for anti-leishmanial treatments due to their low homology with other organisms.

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— Kerri Beth Slaughter

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Breathe deeply — for August, it's oxygen

By Quira Zeidan

We mark the 150th anniversary of Dimitri Mendeleev's periodic table of chemical elements this year by highlighting elements important for life. So far, we've covered hydrogen, iron, sodium, potassium, chlorine, copper, calcium, phosphorus, carbon and nitrogen.

For August, we selected oxygen, a highly reactive nonmetal with chemical symbol O and atomic number 8. Oxygen tends to fill its two unpaired electron shells by accepting electrons from other atoms via covalent bonding. It forms oxide compounds with a variety of elements, and its most common oxidation state is -2, but it also can exist in oxidation states of -1, +1 and +2.

After hydrogen and helium, oxygen is the third most abundant chemical element in the known universe. It is the second most abundant element in the Earth's geosphere after iron and the most abundant element by mass in the Earth's crust — at about 47% to 49%. Oxygen makes up about 89% of the world's oceans, and diatomic oxygen gas constitutes about 20% of the Earth's atmosphere — second only to nitrogen.

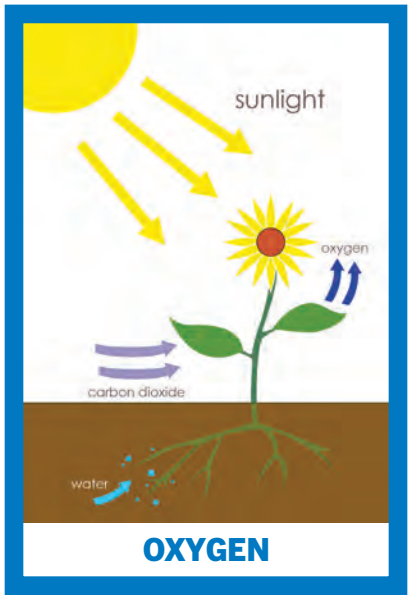
Oxygen is an important contributor to the evolution of all life on Earth. The earliest cells used components of the early Earth's atmosphere — CO, CO_2, N_2 and CH_4 — to synthesize organic compounds with the help of volcanic heat and lightning. Cells gradually developed pigments that capture visible light from the sun, acquired the ability to use H_2O as the electron donor in photosynthetic reactions and started to eliminate O_2 as waste. Under these conditions, the earth's atmosphere grew richer in oxygen.

Aerobic organisms that live in habitats with a plentiful supply of O_2 transfer electrons from fuel molecules to oxygen, deriving energy for preservation and growth. Their anaerobic counterparts have evolved in environments devoid of oxygen and transfer their electrons to nitrate, sulfate or carbon dioxide, forming dinitrogen, hydrogen sulfide and methane, respectively.

Aerobe cells obtain molecular oxygen from the surrounding medium by diffusion through their plasma membrane. However, oxygen is poorly soluble in the cytoplasm and extracellular milieu, and it cannot be diffused over long distances. Organisms have evolved water-soluble proteins that use transition metals such as iron and copper to store and transport oxygen in aqueous environments. Proteins such as hemoglobin and myoglobin use iron in the prosthetic group heme to bind oxygen reversibly and move it through tissues.

Cytochromes also use heme to transfer electrons in oxidation-reduction reactions during cellular respiration and photosynthesis. The constant movement of electrons inside the cell generates reactive oxygen species as byproducts, mostly superoxide ions and hydrogen peroxide. The immune cells of some vertebrates and certain plants use these reactive species to destroy invading microorganisms and pathogens.

Oxygen is a major constituent of the biological molecules in living beings. Chemical groups that contain oxygen include the hydroxyls, carbonyls and carboxyls in alcohols plus aldehydes, ketones, carboxylic acids and esters. These organic compounds are the building blocks for proteins, nucleic acids, carbohydrates and fats, the structural components of cells and tissues. Oxygen is also an important constituent of inorganic compounds important for life, such as water and phosphate.



Photosynthetic organisms capture the energy of sunlight and use it to produce organic molecules from the carbon dioxide and water they obtain from the environment. In the process, oxygen is released to the atmosphere.

Quira Zeidan (qzeidan@asbmb.org) is the ASBMB's education and public outreach coordinator. Follow her on Twitter @quirazeidan.

ASBMB TODAY CALL FOR SUBMISSIONS

ASBMB Today is publishing two essay series in 2019
DEADLINE: OCT. 10

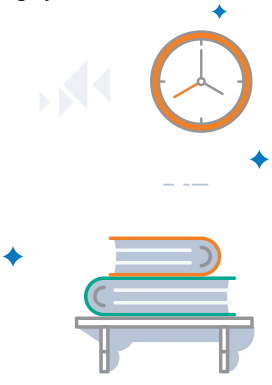
What I wish people understood about _____.
Is there an aspect of your life, personal or professional, that others just don't get? Fill in the blank in this sentence, and then set the record straight.

Night shift
Life does not end when the sun goes down, and our experiences are often heightened at night. Tell us a story about what you do while others sleep.

For information, email asbmbtoday@asbmb.org
or go to asbmb.org/asbmbtoday and click **SUBMIT.**

Upcoming ASBMB events and deadlines

AUGUST	15	Serine Proteases in Pericellular Proteolysis and Signaling poster and registration deadline
	13	**Fungal Disease Awareness Week** begins
	18–22	Mass Spectrometry in the Health and Life Sciences
	30	ASBMB–BSC Symposium on the Interplay Between Epigenetic Regulation and Genome Integrity abstract deadline
	30	Emerging Roles in Nucleolus poster abstract deadline
SEPTEMBER		**Pain Awareness Month**
	3	Communication Course applications open
	10	Emerging Roles in Nucleolus registration deadline
	12–15	Serine Proteases in Pericellular Proteolysis and Signaling
	16–20	**Postdoc Appreciation Week**
	16–20	**Peer Review Week**
OCTOBER		Communications Fall Course begins
	1	Accreditation deadline
	6	**Mental Illness Awareness Week** begins
	11	**National Depression Screening Day**
	20–24	ASBMB–BSC Symposium on the Interplay Between Epigenetic Regulation and Genome Integrity
	21–27	**Open Access Week**
	24–27	Emerging Roles in Nucleolus
	31–Nov 2	Society for Advancing Chicanos/Hispanics & Native Americans in Science (SACNAS) National Conference



ASBMB

Meet Mike Shipston

By John Arnst

The UK-based electrophysiologist and associate editor for JBC interrogates the delicate permutations in ion channels that manifest on larger scales as endocrine disorders

If you zoomed in on the Big Potassium, or BK, ion channel inside a neuron, you might see it become activated through phosphorylation by protein kinase A. However, if you looked at that same ion channel in endocrine cells, you could see its activity, the voltage-gated ferrying of potassium, being inhibited by the same act of phosphorylation.

The conundrum of how the same mechanism acting on a protein can produce two completely different outcomes is at the heart of Mike Shipston's research at the University of Edinburgh.

After earning an undergraduate degree in physiology from the University of St. Andrews in 1989, Shipston began examining mechanisms of signaling pathways and regulation as a Ph.D. candidate at the University of Edinburgh, where he subsequently did his postdoctoral work as a Wellcome Trust advanced training fellow.

Now a dean of biomedical sciences and professor of physiology at the University of Edinburgh, Shipston combines mathematical modeling and wet lab techniques in an approach he calls integrative physiology to explore ion channels at the single-cell and cellular-systems levels.

A member of the editorial board of the Journal of Biological Chemistry since 2012, Shipston became an associate editor for the journal in March 2018 and is head of the JBC Reviews Committee. He spoke with John Arnst, an ASBMB Today science writer, about his work. The interview has been edited for clarity and length.

Your lab focuses on post-transcriptional and post-translational mechanisms. Tell me about that.

I've always been interested in the broad question of how we generate physiological diversity from a limited genome. And the variety of both post-transcriptional and post-translational mechanisms that are out there that allow you to generate proteomic diversity has always been a keen interest of mine and where I've focused efforts. This really took off for me in my own research when, several years ago, I was trying to understand how one of my favorite ion channels, the BK channel, is regulated by protein phosphorylation, particularly in endocrine pituitary cells that we were looking at.

At that time, we knew that the BK channel, or at least the pore-forming subunit, was encoded by a single gene. And in some systems — for example, in a lot of neurons — protein kinase A phosphorylation activated the channel, but in these endocrine systems I was looking at, protein kinase A inhibited the channel. So it's actually

NICK CALLAGHAN

Mike Shipston, pictured here at the University of Edinburgh's Anatomical Museum, brings an approach called integrative physiology, in which scientists attempt to understand a mechanism's effects at the molecular, tissue and organismal level, to his work in the lab and at the JBC.

a very simple question of how the same channel can be regulated differently by the same signaling pathway.

It turned out to be quite a simple mechanism — that the BK channel is alternatively spliced and there's a single splice variant that acts as a molecular switch that determines whether the channel could be activated or inhibited by protein kinase A-dependent phosphorylation. We were then trying to work out how the splice variant might allow this regulation at the molecular level. And this led me into one of the focuses of the lab at the moment, the mysteries of this reversible lipid post-translational modification, with palmitoylation, also known as S-acylation (author's note: the process of linking two molecules through a thioester bond), which controls this channel.

It's always great when your research takes off with such a simple question — it's so interesting that the BK channel action is completely location-dependent.

What I've always been interested in is that we have huge complexity. But very often, this huge complexity is driven by very simple rules that are put together in different combinatorial ways. And that's a lot of what we've done in the past — trying to identify these simple rules that apparently give you this complexity.

A lot of stuff that we've been doing with S-acylation — we knew about that from the 1970s. But it's been in the last decade that the tools for that have really exploded, so we can start to interrogate biochemical and physiological questions around that.

In our endocrine systems, there's incredible heterogeneity from cell to cell in terms of how they respond, but that heterogeneity probably isn't just noise; it probably is relevant to how the system works. So trying to probe those differences is important.

How did your earlier research lead you to interrogating post-translational mechanisms in endocrine systems?

When I was doing my Ph.D., I wasn't an ion channel electrophysiologist or anything like that. I was doing biochemistry, cell biology and endocrinology. While doing that work, I realized that ion channels were fundamental targets for what I was looking at, and that actually led me to the Wellcome Trust. That was an advanced training fellowship that allowed me to develop skills in electrophysiology, which combined well with the molecular and biochemical tools that I had.

That's where this interest in the ion channel biology really stemmed from. We've followed that by using the

ion channels both as a model system to look at these mechanisms of post-transcriptional and post-translational modification and also as a way of understanding their physiological role in endocrine and other systems. So that's really where it all stemmed from.

So that's the integrative physiology approach?

My undergraduate training was as a physiologist; most of my postdoc training was using biochemical cell biological molecular tools. So for me, what I call the integrative physiology approach is really trying to understand a mechanism at multiple levels of scale. Ion channels are beautiful in that respect because they're one of the few things where you can look at a single protein doing its job in real time.

That's important, because we're ultimately trying to understand what those mechanisms mean in health and disease: How is information encoded? How do you go from a defect in a channel or a signaling pathway that may regulate ion fluxes to control of diverse physiologies and then to disease states?

We've been increasingly trying to use predictive mathematical modeling approaches to help us understand both systems and mechanisms but also to allow us to get more quickly to wet lab experiments. Because ion channels don't exist in isolation; they're there with other signaling complexes.

How does that mathematical modeling inform what you're next going to do in the lab?

A very specific example of that is the role we found for our BK channel in controlling excitability of a particular type of pituitary cell that's involved in the stress response. One of the big challenges comes back to one of these splice variants I mentioned before; from a molecular perspective, it's actually quite challenging to be able to quantitatively manipulate native systems and to really check out what each splice variant does.

We use a process called dynamic clamp, which allows us to mimic what we think the current would look like and then be able to automatically subtract or add that back to cells to see if our model of how we think the channel is working actually fits with the experiment. And that allows us to make predictions about what the properties of the ion channels that may regulate excitability need to be.

From that, without necessarily knowing the molecular nature of the channel, we can get an idea of what its properties are likely to be, which allows us to hone in to do either our genetic manipulations or our pharmacological manipulations.

That's extremely helpful for ion channels that don't exist in isolation — like if you've got a potassium channel that's regulating something else, or like the interplay between calcium channels and other signaling pathways. So getting that more holistic sense of how ion channel flux is regulated is something you can only do by adding in that extra dimension of the modeling.

So using this technique and approach, what's the frontier for your lab?

One of the key things for us is understanding different patterns of electrical excitability control, ultimately, and the secretory output of these pituitary cells — of the corticotrophs in particular, which are involved in a stress response, whose job is to integrate information from the brain and peripheral hormones like steroids and glucocorticoid hormones. It's this interplay of different signaling pathways, how they ultimately end up controlling different ion channels, different signaling pathways within the cell, that allows the cell to make the decision about what its ultimate output is.

So you have this unique approach in the lab — how do you bring that to your role as a JBC associate editor, and how is the new role going?

As an AE, I must admit I've absolutely just loved it. I bring that approach by trying to identify those papers coming in that are applying different approaches to problems, and this also expands out into the wider role that I now have with JBC reviews. I try to highlight to the broader community how integrating, for example, modeling approaches alongside classical genetic and biochemical and pharmacological approaches can be a powerful way of interrogating fundamentals of biological chemistry and biological chemistry regulation. It's been a very exciting role so far.

When did you first become involved with the journal?

I published my first paper in JBC when I was a relatively young postdoc in 1995. And I always remember, even at that point, being struck by how constructive the feedback was and realizing that the people who were doing the reviews were expert scientists working in the field. They weren't trying to say, "Well, we don't think this

is a priority." It was about, "Wow, this is a really cool idea, cool data that you've got; we've got some suggestions here about how it could be improved," and you could have a rapport with them. And that's what I've always loved about it.

Several years after that, I was asked to be an editorial board member, and I spent five years being an editorial board member, which I thoroughly enjoyed. It is a great way of exposing yourself to the wider research questions that you have, and you pick up more easily on cool techniques that people are publishing. Then a couple years ago, I was asked to do a second stint at as an EBM. And a year or so into that, (Editor-in-Chief) Lila Gierasch gave me a call out of the blue. I think there was this real connection with the vision she had, along with a team, about where JBC was going.

Over the last year or so, we've been helping drive a new initiative, JBC Reviews. They're great both for the practicing researcher to keep updated and also to help educate the next generation. I use them in my undergraduate classes, and I use them in my postgraduate classes.

Speaking of education, do you have any words of wisdom for young scientists?

Always keep the big picture and longer-term in view, and make sure that you're heading for that. You've got to be able to balance the real highs that you get when you get your next paper or your next grant out with the deep lows that you can sometimes go into, but if you if you keep your eye on the future of what you're aiming for, that allows you to take risks and not to be too short-term, even though with a lot of funding issues you also have to be a bit short-termist.

One thing I think is very important, especially to junior folk, is about how you listen to advice. My recommendation is always listen to as wide a range of advice as you can but then make your own decision.

And I think something that's also important for junior folks is taking time to mentor your staff and your trainees. Whether you're a Ph.D. student and you might be mentoring an undergrad or you're a junior faculty member who's just starting in the lab with that first postdoc, the staff that you work with are your biggest assets, so what you need to do is invest quality time in them.

In the role I currently have, I get enjoyment and satisfaction out of seeing the development not only of my own students and my own staff in the lab but also of the faculty I work with. I get as much satisfaction out of that as my own research directions.

That's heartening advice. What do you like to do outside of the lab?

I actually don't get enough time physically in the lab, but my lab probably quite appreciates that, because I'm not disrupting them and annoying them too much, so they can get on with what they do. My day job as a professor of physiology and dean of biomedical sciences in Edinburgh keeps me pretty busy, and I also have a major interaction with our education and research institute in collaboration with Zheijang University in China that keeps me busy.

But what you're probably asking for is what I do for relaxation. I love sports; these days, more watching than participating. I'm a big cricket fan, and my home team, England, just won the Cricket World Cup that was held in the U.K — the final was called the best game of cricket of all time. I know U.S. colleagues probably find cricket a bit of a mystery sport, but when I'm in the U.S. I love going to baseball games. Some other things I love are motor sports, playing golf and just relaxing, doing stuff with the family. And also reading good books — good biographies are a lot of fun.

To me, it's very important to have activities that are not science-related. It keeps my mind fresh, I think.

I've always loved tinkering with stuff. I love doing practical things with my hands and keeping my DIY skills at home tip-top. A lot of it is just understanding how something works. I remember, as a kid, my dad was always into cars. He would take people's cars and fix them. I love that sort of stuff, and part of it is just saying, look, here's an engine, it's incredibly complicated with all these thousands of pieces. But at a fundamental level, it's pretty simple. You just want an explosion that moves a piece of metal, and that sends the wheels going. But there's multiple components that need to work together. I think that interest in how systems operate from so many small pieces is built into my DNA.

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

Setting sail in a startup

By Laurel Oldach

How academic entrepreneurs build seaworthy companies

You stumble across something new in the course of your research. It solves a problem in a way no one else has. You can imagine it someday becoming a breakthrough treatment or ubiquitous lab tool. How do you proceed?

There are many ways to commercialize research; most require much less investment than becoming an entrepreneur. But sometimes an academic believes in their research so much — or sees such significant future value in it — that they take the plunge to found a company.

Some of those entrepreneurs, many of whom have kept their jobs as professors, spoke to ASBMB Today about their experiences and tips for the process.

Intellectual property and the value proposition

Any result of research at a university, commercially useful or not, belongs to that university.

Technology transfer offices handle the patenting of unpublished academic discoveries (see "How to patent an antibody" in the January 2019 issue) and own the invention — but the inventor can license it. Payment for a license can come in many forms.

According to a 2017 analysis by Hervé Lebret, who manages grants for academic entrepreneurs at a Swiss university, some institutions will accept equity in the start-up, others negotiate for royalties from the eventual sale of a product and some will sell a license for a lump sum.

In the biotechnology sector, Lebret noted, "A raw idea is worth virtually nothing, due to an astronomical risk factor." The risk is that the idea will fail before becoming a product; the long process of proving that a concept will work as a profitable product often is called "de-risking" or risk mitigation.

The process starts with determining what market need a discovery or invention meets.

Its value may be in proving a concept. Kevan Shokat's first company is a good example. Shokat, a professor at the University of California, San Francisco, launched a startup called Intellikine to commercialize kinase inhibitors discovered in his academic lab.

In 2006, Zachary Knight and colleagues in Shokat's lab reported that they had developed isoform-specific inhibitors for phosphatidylinositol-3-kinase, or PI3K, which is involved in growth signaling and was a tantalizing target for cancer treatments. There are many PI3K isoforms; broad-spectrum inhibitors block them all to varying degrees but are toxic. The series of molecules Knight and colleagues developed were highly selective for certain PI3K isoforms.

With Knight, former student Yi Liu and a fourth scientist named Pingda Ren, Shokat founded a company that initially was aimed at selling rights to develop the screened kinase inhibitors to other drug companies.

CINDY CHEW / UCSF

Kevan Shokat is a professor at the University of California, San Francisco and a successful business founder. His most recent, Revolution Medicines, works develops cancer drugs.

That idea didn't interest investors, who argued that the company would never recoup its costs by selling risky early-stage molecules. Taking that feedback, the founders decided to develop a small subset of their inhibitors themselves rather than pitching them to

other companies.

In that incarnation, after several years of research, Intellikine was a huge success. In fact, it was bought for $190 million. Since then, Shokat and his lab have garnered a reputation for "drugging the undruggable," delivering another proof of concept with the first inhibitor of KRas, another cancer-causing signaling protein.

The value proposition is what a company offers and customers want to buy. In Shokat's case, it was proving that a single PI3K isoform or a GTPase could be inhibited without doing harm. A therapeutic index, also called a drug's safety ratio, is calculated by dividing the dose that causes toxicity over the effective dose. If it is low, a drug may be risky to administer and difficult to develop.

"Nothing is as good a predictor of whether a target is druggable with therapeutic index as having a pharmacological target validation," Shokat said.

Corporate structure and the business strategy

Founding a company involves choosing a business structure, registering for licenses and tax identification numbers, and much more. Many university technology transfer offices offer help to scientists new to these processes.

UNIVERSITY OF GEORGIA

Rob Woods, a professor at the University of Georgia, is also president of a company he co-founded with Lori Yang based on their academic research collaboration.

"Science has a complicated language and so does business," said Rob Woods, a professor at the University of Georgia. "From a scientist's perspective, if somebody's talking about ROI, you're going, 'What's ROI?' I used to go and Google after every meeting." (ROI stands for "return on investment.")

Woods co-launched his first business when he was a college student. He got a small-business loan and filled his first-floor apartment with fish tanks. He and a friend raised tropical fish to sell to local pet stores.

The summer taught Woods that aquaculture wasn't for him. "I got out by breeding black veil angelfish that were as big as plates," he said. "They were spectacular … (and) made us enough money that I could pay off the loan."

In 2007, having become a full professor at UGA's Complex Carbohydrate Research Center, Woods founded a company with research collaborator Lori Yang. Lectenz Bio, which develops tools for complex carbohydrate analysis, has proved much longer-lasting than Woods' fish business. Still, those youthful summers selling fish and working in construction helped him see small business as feasible, Woods said. "A lot of academics have only ever been academics."

Woods, still working at the CCRC, became the company's president, while co-founder Yang left her role as a research scientist to become chief scientific officer. "There were a lot of things I didn't know and had to learn on the fly," Yang said.

Books like "Startups for Dummies" and other resources helped both Woods and Yang bridge the gap.

Sometimes, researchers can split their time between the roles of professor and CEO successfully. Christopher Geddes, a serial entrepreneur who is also a professor of chemistry and biochemistry at the University of Maryland, Baltimore County, has done it repeatedly.

"That coexistence is very unique to university professors," said Geddes, who has developed some 300 products. "The University of Maryland allows us to consult up to

20% of our time on outside projects."

But Marquita Qualls, a leadership coach who has worked with many new entrepreneurs, warns that some academics lack the communication skills to connect with possible investors. "It's your idea, but when you get ready to turn it into a business, you may not need to be the CEO," she cautioned. "You may need to find someone on your team who can speak well and present well to represent your company."

Whatever the infant company's leadership structure, the leaders must develop a business plan. Developing an invention into a product can be costly. A business plan that lays out the market niche and competitors, summarizes the company's operational plan, and explains its financial needs is key to landing seed funding. On the other hand, investing too much time in the plan at the expense of managing the company can be a pitfall.

"People spend a lot of time writing out a plan," Qualls said. "But the implementation of the plan is what's most important."

Some inventions, like Yang and Woods' reagents, fit into a market primarily as tools for research, while others show promise as treatments for disease. Development of the two kinds of product often is funded in different ways.

The money

The function of a startup is to de-risk its technology by proving it can work as a product. As a potential product gets less risky, it becomes more valuable. In many routes to funding startups, the business owners exchange a share of that possible future value for the capital they receive from investors.

In biotechnology and pharmaceuticals, small companies assume tremendous risk; a paper last year estimated that more than 86% of drug candidates that make it to clinical testing in humans are not approved; countless drug-development projects end before making it to the clinical trials phase. Nonetheless, the possibility of a payout attracts attention from investors such as venture capital firms. Such was the case for Intellikine, which secured $41 million in venture capital to fund medicinal chemistry and preclinical studies before its eventual buyout.

LORI YANG

Lori Yang is chief scientific officer and acting CEO at Lectenz Bio. "Sometimes, researchers are intimidated by carbohydrates," she said. "We're trying to make accessible tools."

To persuade venture capitalists to invest, a company's founder or CEO presents a product idea and a business plan. Professional analysts at or contracted by the venture capital firm investigate the company and determine whether it seems like a good investment. If it does, then the parties negotiate an exchange of equity for capital. This sometimes is called dilutive funding because it reduces the founder's stake in the company.

In the world of research tools and products, which are generally less lucrative than pharmaceuticals, companies often secure seed money through nondilutive funding such as government small-business and technology-transfer grants.

Kory Hallett handles such grants as a program director at the National Cancer Institute's Small Business Innovation Research, or SBIR, Development Center. By congressional mandate, federal agencies that fund research must set aside a percentage of their total budget to fund small businesses. That money is disbursed through the SBIR and small business technology transfer, or STTR, grants, which differ in whether they permit collaboration with academic labs. The funds are available from the departments of Defense, Energy, Health and Human Services; NASA; and the National Science Foundation.

In the 2018 fiscal year, the National Institutes of Health awarded some $504 million in SBIR and STTR grants. Applications are peer-reviewed and competitive; success rates hover around 20% each year. During an American Society for Biochemistry and Molecular Biology webinar on small-business grants, Hallett urged attendees to talk to a program officer before submitting an application. The NCI and a few other institutes have rolled out an applicant assistance program.

"Always be ready to resubmit," Hallett said. "The majority of people have to resubmit at least one time before they are successful."

For the successful applicant, early-stage SBIR awards, designed to support proof-of-concept research, offer up to $250,000 in funding. Phase II, designed to support the beginning of a commercialization plan, is capped at $1.7 million. Grantees are also eligible for training and professional-development programs, and making it through peer review confers a certain prestige. Pamela Marino, a program officer at the National Institute of General Medical Sciences, said she sees companies advertise their grant status "like a badge."

Some entrepreneurs come to small-business grant funding after realizing that the research they want to pursue doesn't fit neatly into the NIH's R01 funding model.

For example, Woods and Yang, who were working on computational models of protein-glycan binding, decided it was time for a change in their research direction from describing to designing glycan-binding proteins. Woods said, "As we went down this path, it wasn't leading to hypothesis-driven science; it was really leading to tool development. And tool development is much more suited to small business grants."

Similarly, Don Jarvis spent years characterizing glycoprotein production in insect cells, which often are used to produce recombinant proteins. After characterizing the differences between insect and human glycosylation, Jarvis led his lab at the University of Wyoming in a project to humanize insect cell glycosylation by stably introducing glycosyltransferases and other enzymes. By the time the system reliably was producing humanized glycoproteins and Jarvis began to submit grant applications to cover work on optimizing the yield, study sections had come to see his work as too applied.

"At that point, we had proved the principle and done some refinement," Jarvis said. But the experiments he now was proposing weren't the kind of basic science that R01 grants are designed to fund. "As an academic exercise, this became stale."

Pamela Marino, Jarvis' program officer at the NIGMS, suggested after an unsuccessful R01 application that Jarvis might consider applying for business funding. "This is the kind of grant that will fly through an SBIR study section," she recalled telling Jarvis.

"I was resistant," Jarvis said. "In my generation — I trained in the '70s and '80s — the notion that you could commercialize your scientific discoveries was not so popular. … It took me nearly losing my academic grants before I realized she was absolutely right. I needed to move that aspect of our research out of the academic setting."

An extra boost to launch a company arrived when doctoral student Christoph Geisler won a campus entrepreneurial competition for a proposal linked to his thesis

TED BRUMMOND / UW PHOTO SERVICE

Don Jarvis and his graduate student, Christoph Geisler (not pictured), founded the company GlycoBac after Geisler won an entrepreneurial competition at the University of Wyoming.

research in Jarvis' lab. The award included $10,000 in seed money and a free year in the University of Wyoming's business incubator. Jarvis launched the company GlycoBac that year with Geisler as its first employee.

Places, people

Jarvis negotiated with the University of Wyoming to rent space for GlycoBac adjacent to his academic lab. "It's a beautiful environment," he said, "because we have students who are exposed to translational research at the same time as they're being trained in academic research."

GlycoBac's situation is unusual, however. In many departments, space is tight, and the arrangement poses some conflict-of-interest risks. Often, an academic spinoff's first home will be in a business incubator on the university campus. Incubators rent lab space and frequently offer training and services, such as human resources management, to promising new businesses.

Lectenz Bio, Woods and Yang's company, has sites in both co-founders' hometowns of Athens, Georgia, and San Diego. Both branches started out in incubators, run by the University of Georgia and the pharmaceutical company Johnson & Johnson, respectively. But the branches faced very different prospects for growing out of the two incubators.

In the Georgia branch, Woods said, "We've run out of space in our incubator, and there's nowhere to 'graduate' to in Athens." Turning the available warehouse and retail space into a lab would require heavy investment in infrastructure such as biohazard disposal, freezers, centrifuges and other equipment. "It's a big expense to jump from where you are to where you'd have to be," he said.

On the other hand, Lectenz Bio's San Diego branch had a variety of lab space rentals to choose from when it outgrew its incubator.

A startup's location can affect more than the available lab space; it also dictates the available workforce. And hiring, many entrepreneurs say, is key to a company's success.

"There's sort of a cliché or received wisdom, especially among young biochemistry faculty members, that running the lab is similar to running a small business," Geddes said. "It's not, really. Yes, you're building a team. But the objectives are so different."

MARQUITA QUALLS

Marquita Qualls is a chemist turned leadership coach. She was a corporate strategist before launching her consulting business.

According to Qualls, an effective team needs a communicator to speak for the company, a technical expert, a go-between who makes sure they understand one another, and — a category she says many startups overlook — a market researcher who can do competitive analysis and due diligence, helping the company understand its position and unique selling points.

In addition to technical skills, entrepreneurs also recruit based on personal characteristics like drive and commitment. Balaji Sridhar, who co-founded a Colorado startup called Nanoly with a friend during his Ph.D., is particularly sensitive about recruiting. Nanoly, which makes a hydrogel that stabilizes proteins, attracted attention when it launched in 2013 touting the technology as a possible means to produce vaccines that would not need refrigeration. Sridhar still believes in that mission, but for regulatory reasons, introducing new chemistry into vaccines has not gone as quickly as he and his co-founder first envisioned.

"You want to find people who are loyal, who are committed to the mission of the company and not just looking for a paycheck," Sridhar said.

WATCH THE WEBINAR

In the ASBMB webinar, Small Business Research Funding 101, NCI SBIR Program Director Kory Hallett presents funding opportunities and other commercialization resources for small businesses in biochemistry and molecular biology, and Small Business Technology Transfer awardee Sami Kanaan (Chimerocyte) shares his experience as an applicant and an awardee. Go to asbmb.org and click on Webinars under the CAREERS tab.

Tough decisions

A startup's founders must determine whether an invention can become a marketable product. Key decision points along the way usually are laid out in the business plan, which may include a proof-of-concept stage and a development stage. Proof of concept means demonstrating through experiment or prototype that the concept is feasible. Development is making it a better product.

Early on, a company may have several candidates for development; because time and money are finite, it cannot pursue them all. This happened at Intellikine; the company owned three promising kinase inhibitors but lacked the money to fund early clinical trials for all three. After weighing all the data they had collected, the company's leaders decided in 2011 to license one of the molecules, a PI3K gamma/delta inhibitor, to another biotech company, Infinity Pharmaceuticals.

Nearly a decade later, after several subsequent licensures and near misses, that molecule, duvelisib, became the only one of the three that has made it to the clinic. It's now sold as Copiktra for patients with leukemia. But when Intellikine's leadership team was faced with deciding how to proceed, there was no way of knowing how the multiyear process of testing, chemical tweaking and clinical trials would turn out.

"If (small companies) have got multiple assets like we had, a lot of times, there's a real debate," said Shokat. Which of the assets is the best bet? Should one be sold off to fund the development of another?

"You're trying to decide of the three cards you have, which one are you going to put the money down to turn it over?" Shokat said. "It's a really hard choice."

A small company's flexibility

Though Don Jarvis' company, GlycoBac, was launched to optimize and commercialize a glycoengineered insect cell system, its most lucrative product so far doesn't come directly from that project. Instead, it builds on an opportunity the team saw and quickly acted on.

At a 2013 conference Jarvis attended, Food and Drug Administration virologist Arifa Khan presented her finding that many insect cell lines used to produce therapeutic molecules were contaminated with a hitherto undetected virus. It was an alarming reminder of the unknown pitfalls that the relatively new field of biologics manufacturing had to confront.

"This is going to have an impact," Jarvis told GlycoBac's staff of two, Geisler and Ajay Maghodia, after he returned from the conference. "I expect the FDA won't just ignore it."

He challenged the team to come up with an approach to engineer a virus-free line. All three of them, he said, independently came up with the same concept, and Maghodia started to develop an approach to eliminate virus from established insect cell lines.

The project was a commercial success: In 2018, Millipore Sigma licensed the technology, which it now sublicenses as its first insect cell line product.

"We were a glycoengineering company," Jarvis said. "We had no business creating a virus-free cell line; a board (of directors) would have said, 'What are you guys talking about? You can't do that!'"

But with no board to answer to, the team had freedom to try the project — a freedom Jarvis cherishes. "I like to say we're a PT boat circling around the Titanic. (We can) do whatever we want, right? There will be potentially bad decisions, and there could be decisions that are so bad they take the company down. But in a small biotech company, you get to take those risks."

The killer experiment

Maybe a risky project costs too much and doesn't deliver results. Maybe a pivotal experiment gives conclusive, disappointing results. Maybe the target customers aren't as interested as the inventor had hoped. It's not a popular topic in entrepreneurial circles, which prize perseverance and valorize the successful founder who makes it big. But the truth is, most startup companies fail; estimates range from 70% to 90%.

"Businesses fail for two fundamental reasons. The first is because they run out of

money," Geddes said. "But the second most important is they make a product nobody wants."

Though data specific to life science startups are scant, broader analyses back Geddes up. The consulting firm CBInsights surveyed post-mortem reflections from 101 shuttered startups across industries and reported that 29% ran out of funds and 42% discovered there was no market need for their product.

Biotechnology companies face another stumbling block: whether the science works the way founders hope it will. According to John Janczy, head of research and development at Nanoly, careful experiments are the best way to face this challenge.

"You have to design what I call killer experiments that will tell you very quickly: Is this idea going to work?" Janczy said. For example, Nanoly's hydrogels can preserve complex molecular structures; the team briefly considered extending the technology to living cells as well but scrapped the idea after a "killer experiment" failed.

As in academic science, discipline and intellectual honesty are important, Janczy and his CEO, Balaji Sridhar, said. It can be disappointing, but if the data say no, that's the answer.

"There's a line between being gritty and being crazy," Sridhar said. "You have to step back and say, 'OK, does this really work?'"

If the answer is truly no, Sridhar added, he looks for opportunities wrapped in that no.

The exit strategy

Steve McKnight, a former president of the ASBMB, has started a number of companies. The most recent, called Peloton, developed small molecules to inhibit the transcription factor hypoxia-inducible factor 2 alpha as a treatment for cancer. In five rounds of fundraising, the company raised more than $200 million from investors, and its drug met the desired endpoints in a preliminary safety and efficacy trial. To fund a final, large-scale efficacy trial in patients with renal carcinoma, the company planned to sell equity on the stock market in the spring of 2019. According to Fierce Biotech, the hope was to raise some $150 million.

A company's entry to the stock market, or initial public offering, often is regarded as a payout; founders and early investors recoup their capital and the added value of a de-risked product. It's an exit strategy for investors. But Peloton's was forestalled at the last minute when Merck bought the company for $1.1 billion. The larger corporate buyout is another common exit.

After a startup weathers the possible failure points and comes through with a marketable product — or a plausibly promising drug candidate — in hand, its time as a startup may be nearing an end. Some successful companies have stayed privately owned. But many eventually either are acquired by a larger company or go public.

This can be a huge reward for the founder; it's often also a decision point in their career. Occasionally, a founder stays with a company throughout its growth. But the skills needed to keep a large business growing are different from those needed to launch one. More often, successful entrepreneurs leave the company; many then start looking for new prospects.

Geddes, the serial entrepreneur, said he's happiest doing the early-stage work of building a company.

"I often describe myself … as very much a shipbuilder," Geddes said. "I'll go out there and find the carpenters, the steel makers and everyone else. We'll build the ship on the dry dock and we'll get the financing for putting it together.

"Eventually, a ship will roll off in the water after we broke the champagne on it. After I've taken and steered and captained that ship out of the harbor, I believe my role is done."

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THE Careers ISSUE

Consider a career at an independent research institution

By Erica A. Gobrogge

Researchers in the U.S. work in public and private colleges and universities, in government, in industry, and at independent research institutions. While the last category may not be as familiar as the first three, most scientists have certainly heard of the Fred Hutchinson Cancer Research Center, Jackson Laboratory and Cold Spring Harbor Laboratory.

IRIs are diverse in terms of their missions and sizes. They often have focused research interests, but the almost 80 U.S. research IRIs that belong to the Association of Independent Research Institutes collectively cover areas ranging from fundamental biochemistry to translational biomedicine to oceanography. Scientists at Van Andel Institute in Grand Rapids, Michigan, work primarily on cancer epigenetics and Parkinson's disease, while the Stowers Institute for Medical Research in Kansas City, Missouri, focuses on basic biomedical research.

At the Oklahoma Medical Research Foundation in Oklahoma City, Courtney Griffin leads one of 10 laboratories in the cardiovascular biology research program. "Our programs tend to be focused around tighter topic areas than a traditional academic department," she said. "This is different from a large department at an academic institution, which has a broad teaching mission and therefore has to cover a lot of diverse topic areas."

In many cases, a person or family endows an IRI to fund research on a specific disease or topic, such as Van Andel Institute. In other cases, groups establish IRIs, such as City in of Hope in Duarte, California, to serve needs in their communities. IRIs vary in size from only a few employees at their inception to hundreds or even thousands as they mature and grow.

While some IRIs have close relationships with universities, they are all by definition independent and operate under their own authority. Scientists at IRIs fill all the roles traditionally seen in academia — students, postdoctoral fellows, professional research staff (staff scientists, technicians, core managers), and faculty.

Many IRIs support their own graduate programs, which tend to be smaller than traditional university programs. The application process is similar, but each program focuses on its institution's research, so competitive applicants must demonstrate a clear interest in that field. Graduate students who are unsure of their interests may prefer the broader offerings of a traditional university. The Stowers Institute and VAI both have independent graduate schools, while the OMRF participates in a cooperative program with the University of Oklahoma Health Sciences Center.

Minge Du is a graduate student at Van Andel Institute Graduate School. She was initially reluctant to leave Stony Brook University and follow her PI to a place she'd never heard of, but she now sees the benefits. "The VAIGS curriculum uses problem-based learning," she said, referring to a student-centered approach where students work in teams to solve problems. "This style promotes student motivation and self-learning and cultivates collaboration between students and faculty, which allows students to be more involved in the process of learning."

Most IRIs support postdoctoral training programs. Some are similar to those at universities, but others take unique approaches to supporting postdocs. VAI considers all postdocs to be employees, and they receive full employee benefits and salaries above the National Institutes of Health stipend recommendations. As with any postdoc job search, candidates considering these programs should take into account their own research interests, available financial and professional development resources from the mentor and institution, and historical career outcomes of the lab and training program.

Benjamin Johnson chose to accept a postdoc position at VAI because of the "accessibility and resource support — both from a faculty/personnel standpoint and research resources angle. The direct result of this is a shorter time frame to go from a research idea or hypothesis to performing the experiment."

Eulália Lima da Silva is doing her postdoctoral training at the OMRF because the institute is committed to innovation. "We are using cutting-edge technologies to understand, treat and cure diseases," she said. "OMRF has the mission of

VAN ANDEL INSTITUTE

Van Andel Institute Graduate School uses problem-based learning, a student-centered approach where students work in teams to solve problems.

VAN ANDEL INSTITUTE

A Van Andel Institute Graduate School student works in a lab. The institute's research focuses primarily on cancer epigenetics and Parkinson's disease. Labs are designed to promote collaboration.

LEARN MORE

Information about independent research institutions can be found at the Association of Independent Research Institutions website, airi.org.

VAN ANDEL INSTITUTE

Endowments and philanthropic support enable institutes to purchase equipment such as that pictured here in one of the VAI labs.

giving back to the community and aids in helping Oklahomans live longer, healthier and happier lives."

For early-career scientists starting their research programs, the IRI search process and level of competitiveness is similar to universities. Many institutes have substantial endowments and receive generous philanthropic support, which can be used to support early-career faculty members, develop preliminary data and purchase equipment.

Matthew Gibson is an investigator at the Stowers Institute for Medical Research. "The freedom afforded by generous support from the institute allows us to pursue truly curiosity-driven research on fundamental biological questions," he said.

IRIs often can adapt and pivot more quickly than larger institutions. The small size of some IRIs may not appeal to all investigators, but Scott Rothbart, an associate professor at VAI, said, "Because we are small, we are nimble and rapidly responsive to the needs of our scientists. I saw the small size of the institute as a major strength in having a voice in decisions shaping the growth of the institute, even as a junior faculty member."

All the scientists interviewed for this article mentioned their colleagues and institutional support. Gibson said, "The level of internal support for both the labs and core facilities opens up all kinds of new possibilities and gives scientists the rare chance to move their research program in completely new directions, both technically and intellectually. I was most attracted by the opportunity to engage new technology through the cores and the chance to do truly open-ended and curiosity-driven research."

Rothbart said, "My faculty colleagues are world-renowned experts in the (epigenetics) field. Maybe it's because we are small, or because we are a close-knit community of scientists and support staff, but one of my favorite aspects of running a lab at VAI is that our successes and the successes of my colleagues are shared among the entire institute."

Erica A. Gobrogge (Erica.Gobrogge@vai.org) is the postdoctoral affairs specialist at Van Andel Institute and former education and professional development manager for the ASBMB. Follow her on Twitter @ericasieb.

To support or to deny: mentoring or gatekeeping?

By Beronda L. Montgomery

I think a lot about mentoring — both the common ways we mentor in scientific environments and the ways we should be mentoring based on a wealth of evidence about good practices for supporting individuals from a broad range of backgrounds.

Mentoring can be advising on specific goals or warning what to avoid on the path to success. Whereas it can be critical to weigh the merits of a particular opportunity, too frequently mentors outright advise against a particular path because it doesn't fit their own experience or tradition. Such viewpoints can result in what I call imprinting rather than mentoring.

I've reflected on my own engagement in mentoring scholarship and leadership development even though a mentor advised me that it could distract me from my "real" research. I've found this work highly rewarding, and based on the work and conversations it has stimulated, it meets a need in the scientific community.

This personal reflection piqued my interest in hearing from others about their successes after ignoring mentors' advice. I don't know what I expected in response when I tweeted a question about things that people have been mentored to avoid but pursued anyway.

The responses were both heart-wrenching and encouraging. I was encouraged by the individual successes and, when I reflected on the collective responses, by the lessons that emerged on how we can be more effective, responsive mentors.

Major themes materialized, including research priorities, trajectories and professional outlook; family planning issues; public engagement and communication; identity-related issues; and tone policing (criticizing someone for expressing emotion).

Research priorities

The respondents told me they were discouraged around issues that could be generalized as research framing and trajectory. They said mentors advised them which areas of research were worth pursuing and which were not based on what was popular or fundable or likely to be successful or have a high impact. This extended to mentoring against broad research interests and in favor of a narrow research focus so they could become an identified expert on a particular topic. One respondent expressed the common sentiment, "I was mentored to focus on a single research track."

Publishing advice focused on traditional priorities: publish in high-impact journals and venues and ignore trends toward open access and preprints. One person specifically mentioned being "mentored … not to shun … paywalled journals as a new assistant professor."

Respondents said they were advised not to seek positions outside of research-intensive or R1 institutions — that is, they should avoid work in high schools, community colleges, primarily teaching/undergraduate institutions or liberal arts colleges, and historically black colleges and universities or minority-serving institutions. One who was advised not to take a tenure-track job at a community college wrote, "I was told if I did that, I'd never get to go back to a 4 year school."

Some were told not to apply for prestigious awards because a previous

applicant deemed competitive had not received the honor. This advice often was framed as wanting to help mentees not waste their time in an unsuccessful pursuit. Numerous minoritized or marginalized individuals said their mentors advised them not to pursue advanced education, valued positions or prestigious opportunities because the mentors were concerned about their potential for success.

Family and career

Advice about when or whether to have children while pursuing an advanced degree or a milestone such as tenure — nearly exclusively directed at women — was surprisingly frequent. For example, one respondent wrote, "I was told in grad school that to succeed as a woman in science I should not get married or have kids."

This advice extended to taking time off for family or other nonacademic pursuits, and generally the advice was to avoid career-derailing or -ending activities rather than proactive suggestions on how to navigate such a path successfully.

Many respondents said they got specific advice about what to avoid in career pathway decisions. Mentors advised them not to serve in disciplinary societies or engage in editorial service before receiving tenure or promotion. They also warned against pursuit of administrative positions. Some may argue that this is good mentoring advice, but mentees asking about such opportunities want guidance on navigating a path of interest — not wholesale advice to avoid it. Mentors often warned against getting distracted by causes or commitments to specific service activities, rather than discussing how to do service in ways that complement core scholarly expectations. Conversely, some scholars of color or other marginalized individuals were advised to pursue such activities even to the detriment of advancing their scholarly research goals.

Stop and think deeply about your intentions when you provided the advice or mentoring in question. If you can't justify your intentions in ways that are not about self-affirmation …, reconsider your advice in the moment.

Engagement and identity

Most mentors did not see value in engaging with the public, news outlets or other outreach venues — especially through a social justice lens. Mentees were urged to avoid the use of social media or public interfaces such as blogging for science communication, which many mentors saw as a distraction. One respondent recalled being told, "Don't waste time communicating your science to and engaging with people outside of the science community."

In a couple of instances mentioned above, mentors seemed to give distinct advice to individuals from marginalized groups. Mentor support was lacking in other areas associated with issues of identity. Individuals from underrepresented groups were encouraged not to conduct research on racial, ethnic, gender or other identity groups of origin or affinity. They often were advised not to speak freely and were subject to tone policing, including advice to avoid both real and perceived politics.

From what to why

As a mentor, have you offered advice in the aforementioned areas? Do your mentoring responses seem to match those described as advice that people went against — and for which that breaking away worked well?

Stop and think deeply about your intentions when you provided the advice or mentoring in question. If you can't justify your intentions in ways that are not about self-affirmation or imprinting, reconsider your advice in the moment and your mentoring philosophy and approaches more generally. Also, stop and assess whether the identity of the person you are mentoring alters your advice.

One way to adapt mentoring to the needs of a specific mentee is to move away from offering "what" advice to offering an effective "why." Frequently, advice given by mentors centers on "what"; you might tell a student to write daily, but writing every day doesn't work for everyone. As one respondent wrote, "I was told to schedule my writing. I can't write on a schedule."

Rather, the more helpful advice is to find the groove, pace or frequency that leads to writing regularly and productively.

Those who insist on a very specific

"what" often are maintaining norms or gatekeeping. Lisa Parker, senior director of alumni engagement at Michigan State, wrote on Twitter, "There are two types of mentors — those who help establish/maintain norms and those who help disrupt them."

The advice shared with me on Twitter was based mostly on mentors' understanding of accepted norms, sometimes under the guise of offering advice that is best for you or imprinting-based advice. These mentors yielded to the common approach of status quo gatekeeping rather than embracing an opportunity or supporting individuals on their personally defined paths and adapting mentoring to individual mentee goals and aspirations.

I long for the day when mentors focus deeply on supporting the goals of mentees based on imagining the institutions and communities we can be when people pursue their goals and motivations with progressive mentoring support rather than keeping the gates to reaffirm the choices and identities of those that have come before.

Beronda L. Montgomery (montg133@msu.edu) is MSU Foundation professor in the departments of biochemistry and molecular biology and microbiology and molecular genetics at Michigan State University. The Montgomery Lab pursues a common research theme of understanding how individuals perceive, respond to and are affected by the environments in which they exist, including responses of photosynthetic organisms to external light cues. Montgomery also pursues this theme in the context of effective mentoring and leading in research environments. Follow her on Twitter @BerondaM.

Mentoring matters

By Jeff Pines

Many of us have looked for a mentor, but what does a mentor look for in a mentee? The relationship is, after all, a two-way street.

Passion for the subject, an active participant, someone who follows through and is respectful of the mentor's time and is all in: Those are among the signs of a good mentee, according to a panel of experienced mentors who participated in "Mentoring Matters," an American Society for Biochemistry and Molecular Biology webinar.

"Mentoring is an important topic to both our audience and our Education and Professional Development Committee," said Danielle Snowflack, ASBMB director of education, professional development and outreach, who organized the webinar in January to coincide with National Mentoring Month. "We've all had strong mentors throughout our careers who helped us get to our current positions. Many of us serve not only as research mentors, but as guides for navigating career changes and other aspects of personal development."

On the panel were June Oshiro and Marianne Mallia, who both work in scientific publications at the Mayo Clinic; David A. Wetter, a professor of dermatology at the Mayo Clinic; and Adela Cota–Gomez, an associate professor of medicine at the University of Colorado Anschutz Medical Campus.

How to find a mentor? Many students find them on the faculty or in the lab, but there are other ways, especially when considering a career change. Mallia suggested going to conferences to seek out potential mentors and joining a professional association. For example, someone interested in exploring a career switch from research to writing might be interested to know the University of Chicago offers a course in scientific writing. It's possible a faculty member could be a mentor, she said.

A mentor of Wetter's encouraged him to join an association, and that helped him. A senior association member naturally will take junior members under their wing, he said.

What bothers mentors? For starters, being unprepared for meetings; also, a mentee who isn't doing the homework and doesn't know what they want from a mentor, Cota–Gomez said.

Mentors are motivated by altruism, Oshiro said, and mentees can show gratitude by giving public credit to those who help them. That might mean thanking a mentor as part of a presentation or mentioning them in a paper.

Advice from the panelists already has helped some ASBMB members who participated in the live webinar.

The webinar spurred Sarah Sheridan, an undergraduate at the University of California at Davis and also a mentor, to take quick action. "I immediately clarified our (mentoring) relationship, and I think this has really given us an idea of what needs to be done," she said. "It has also given us a chance to mention when expectations have not been met and the situation can be improved."

Fei San Lee, a graduate research assistant at the University of Nebraska-Lincoln, said she picked up several useful tips. Her mentor shared the webinar with her, and Lee, who is currently mentoring an undergraduate, said she learned that honest communication always works.

"A good mentor should always provide a safe environment for the mentee to communicate their feelings, thoughts and ideas."

Watch the webinar

You can watch "Mentoring Matters" on the ASBMB YouTube channel. Go to asbmb.org/asbmbtoday for a link.

How to manage an R&D project

By Blaise J. Arena

Collaboration can move mountains. My first research director believed in assigning new staff to projects where they had little or no background. His motive was pure: challenge capable people to learn new areas. But his approach unsettled some people, including me. He assigned me to work in catalytic transformations of monosaccharides, an area foreign to me. I was starting at the low end of the learning curve of heterogeneous catalysis and carbohydrate chemistry. My background in organic chemistry helped me get up the carbohydrate curve. But heterogenous catalysis was (at that time) a highly specialized area; I had nothing to build on.

Fortunately, other researchers in the group had this background, and I found common ground with several of them. I brought some new approaches in aqueous chemistry, and they provided expertise in the preparation and evaluation of heterogenous catalysts. Together, we authored patents for new catalytic systems.

The advantages and hazards of collaboration are apparent when a big project requires many people. But as few as five or six participants can get off track in a hurry unless the project is managed effectively from the beginning.

Like most researchers, I never was taught how to manage a project. My education came during my long career with a Chicago-based global R&D and engineering company where I managed many projects. They were large and small, within the company and with other companies or universities, sometimes with organizations in other countries. As I look back on my work, I see guiding principles that were part of my project management style. Here are some of my best practices.

Build a team

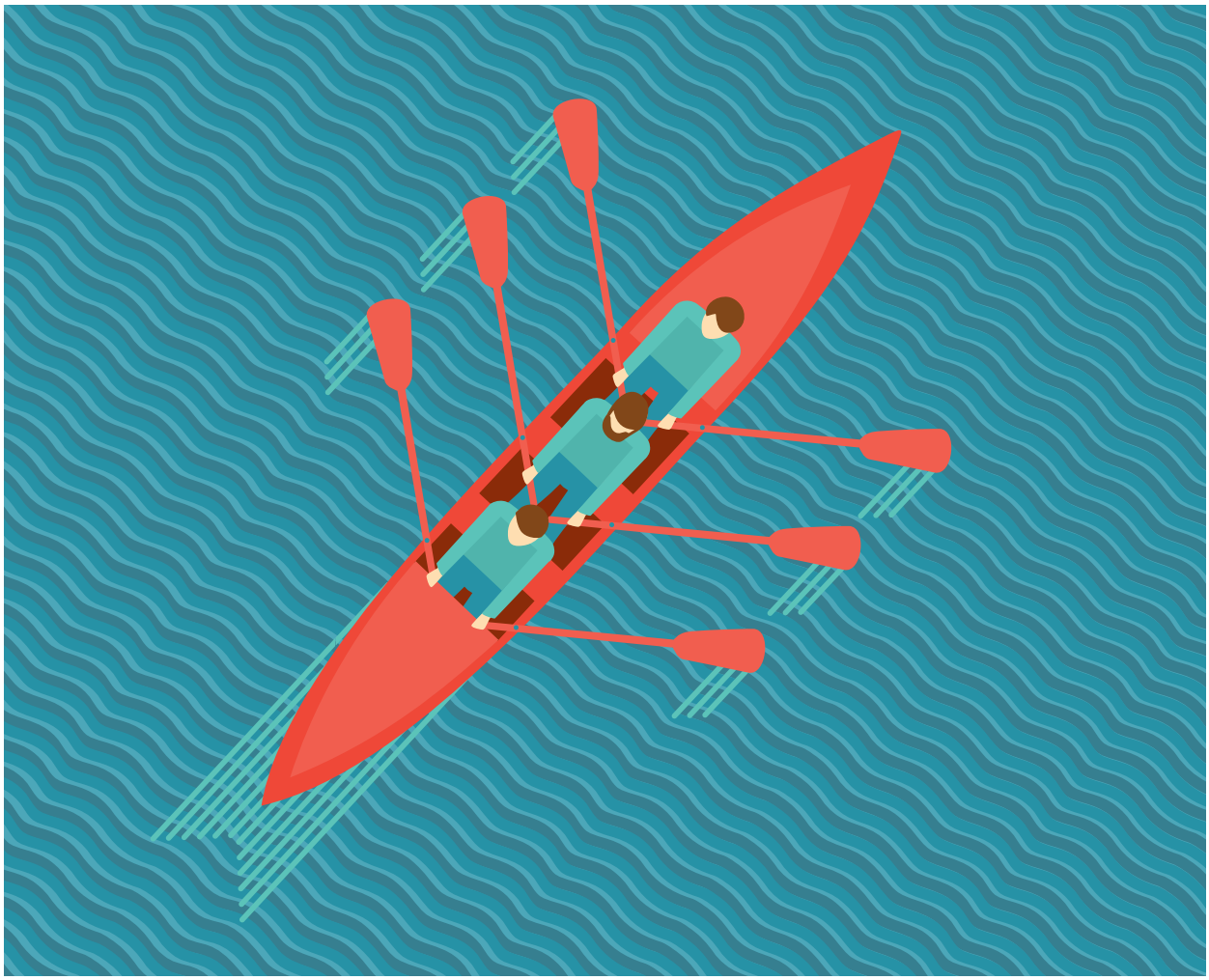
It might be nice if someone on high would assign staff members to a team and then you, the project manager, could just lead. This hardly ever happens. Either you gather people on your own initiative to work on your idea, or your employer assigns you to lead a project and it's up to you to find a team. Either way, this formation phase is a challenge.

- **Engage those with crucial skills.** This seems obvious, but determine ahead of time what skills are required and get those people. Avoid gathering them along the way.
- **Keep the same team.** Continuity is important. Make sure everyone understands that you expect them to stay on through the life of the project.
- **Engage support staff early.** That's everyone from the analytical groups to glass blowers. You can elevate their enthusiasm simply by including them in the formation stage. They deserve to understand the project and feel part of it.
- **Convince your colleagues.** Why is the project important? How will it make a difference? What will I learn? What's the time commitment? They will ask you these questions; be ready with honest answers.
- **Honesty in all things.** Overselling a project can be fatal and will reflect poorly on you later. I once became involved in a project that had been misrepresented to an outside collaborator. It collapsed quickly with bad feelings all around.

Set expectations

Everyone must understand the project objectives and their role in reaching them.

- **Hold a startup meeting.** Review the objectives and your expectations. When appropriate, incorporate the team's feedback and ideas. You won't have thought of everything; now's the time to show that you value your team's input.
- **Sow the seeds of enthusiasm.** This is a matter of personal style, but don't be overbearing, demanding or critical. Ask people to take on assignments; don't order them. Be enthusiastic yourself.
- **Initiative is key to progress.** Make it clear that you expect members to take the initiative on tasks within their domain. Do not require them to get your approval for everything. They may make mistakes or approach things differently than you would. Accept that; don't criticize or blame — teach.
- **A timeline is good, but not as an edict.** The team must reach consensus on the timeline. It must be flexible and subject to revision.



The timeline provides a working plan that everyone can refer to.

Communicate

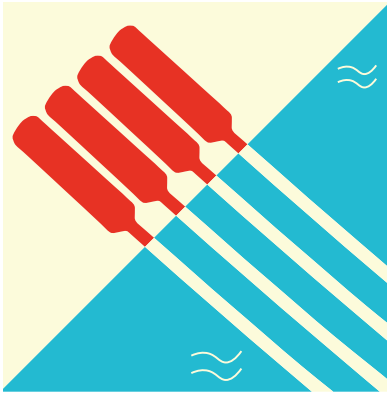
The free flow of information among all team members is crucial. Don't make yourself the focal point of all communication. If team members aren't talking to each other, why not? Be concerned.

- **Hold project update meetings.** These must be regular and frequent; they are key to keeping things on track.
- **Have an agenda.** Be sure to include opportunities for everyone, including the project leader, to summarize their activities and show their data and progress.
- **Manage the meeting.** If meetings descend into endless free-for-alls, expect the project team to dread them. Enthusiasm will plummet.
- **Produce an outcome.** Identify key issues, next steps and action items. Make assignments for follow-through.

Remote collaboration

A project involving multiple organizations and locations may require remote communication for meetings. I find this to be a necessary evil. If at all possible, bring team members face to face, at least occasionally. An effective project team requires comfortable personal relationships.

I once managed a long-term biotechnology R&D project involving team members at a Dutch company. We were big; they were small. They kept mentioning the "elephant and mouse syndrome." They were afraid of being squashed by our more formidable resources. There was no basis for this, and we worked to reassure them. Everyone spoke English, but it was not the first language of the Netherlands group. I trained myself to be hypervigilant



Never, ever allow a project to stop prematurely; maintain momentum. You may encounter seemingly impenetrable road blocks and be tempted to call a temporary halt. Don't do this.

and often halted discussions to clarify and make sure there were no misunderstandings. We agreed to meet in person about three times a year. With each meeting (and dinners and outings), relations improved and true friendships were formed. In a spirit of cooperation, we were able to get through difficult challenges and negotiations.

Do not hold meetings when participants are jet-lagged. Many of us overestimate our ability to perform under jet-lag conditions. I've witnessed important mistakes and misunderstandings when people try to hold difficult discussions immediately after crossing five times zones.

In one case, we lost an opportunity for exclusive rights to a new biodesulfurization system because our negotiator had just stepped off a nine-hour flight. He made unwarranted assumptions and failed to grasp subtle details of the discussion. His desire to spend as little time in country as possible (and overconfidence in his abilities) led to trouble and a long cleanup effort. I have no illusions about my own terrible jet lag abilities. I always tried to arrive a day before important meetings; when that was impossible, I struggled.

The important stuff

Now comes that part in all lists of best practices: If you forget everything I've said so far, remember these next two points. They are fundamental not only to your project success but also to your ability to form good teams in the future.

1. **Do not stop.** Never, ever allow a project to stop prematurely; maintain momentum. You may encounter seemingly impenetrable road blocks and be tempted to call a temporary halt. Don't do this. During the weeks or months of inaction, your team will move on to other things. Restarting will be difficult. Momentum will be lost. Find a way to avoid getting stuck. In such situations, I generally find some facet of the project that can continue or create a short-term objective to keep people moving while I work behind the scenes to remove the barriers.
2. **Spread credit and praise.** As the project leader, you are a senior person. Your status is high, so you can afford to stand away from the limelight and direct it toward your team. This is the right thing to do. It builds enthusiasm and loyalty. When a project hits a milestone, celebrate the team's accomplishments. I had long practiced this principle. But once, a moment of inattention caused a problem. At the end of a yearlong development project, I quickly wrote and distributed an announcement of our success. Unfortunately, I neglected to credit four junior team members in our India office who had made important contributions remotely. They called me on it, I apologized profusely and fixed the announcement, but the damage was done. Lesson: Always pay attention; don't rush. Giving credit is essential. Beyond that, you must take genuine satisfaction in the success of others. You will be remembered as someone who spreads the glory the next time you want to build a collaborative effort.

Running a project can be gratifying and productive. Success depends on preparation and the project leader's management style. And when you see a good leader in action, as I have, watch and learn.

Blaise J. Arena
(blaisearena@yahoo.com) is a retired research chemist and project manager with a developer of petrochemical processing technology. He is the author of over 50 patents and publications.

The tenured itch

Ready to treat your midcareer malaise?

By Graham R. Moran & Audrey L. Lamb

Graham: *In 2015, I realized that being a midcareer professor at a mid-sized state university was less satisfying than I had imagined. The research was fine (though my flow of new ideas was tapering off), and teaching was enjoyable, so what was amiss? Not knowing the root of my waning interest, I set off on a misguided and ill-advised search for a solution. I vented my frustration primarily at my institution's administration, specifically as it related to budget. They seemed to be constantly spending at the university's periphery to buy shiny objects at the expense of core activities, so it was an easy case to make. But the truth is I was more diffusely dissatisfied and needed to fashion a solution to that ailment. Compounding my predicament was the fact that I had no clue that was where I should direct my energy.*

Audrey: *Tenured, full professor: My career was set. Except … I was nearing the end of my first major federally funded project and running out of ideas for renewal. With increased responsibilities, I found it harder and harder to settle down to think and write, and I was aggravated by increased pressure from the university to do more with less. I became an advocate, speaking out against a proposal to fund a football stadium renovation instead of a new biology building (the old one, incidentally, was obsolete before the genetic code was determined), and I fought the constant musical chairs of an upper administration that implemented new policies without considering long-term effects and without staying long enough to clean up the mess they made. At times, this was all-consuming — but only mildly satisfying. I had caught the tenured itch.*

When faculty members are academically healthy, their successes emanate from their institutions in the form of scholarly works. They amass small accomplishments into profound achievements, spurred by a work ethic founded in imagination, focus and will.

However, we all have colleagues who, while clearly intelligent and insightful, have lost traction in their careers and grown restless. It can happen to any of us. Myriad events can exhaust our inspiration, but waning stimulation caused by overfamiliarity with our academic niche is at the forefront. If we don't recognize our ennui, we can't formulate a viable remedy.

Such a state of mind can occur any time after tenure, but it often comes in the second decade with an academic employer. Faculty members develop an invasive, pervasive and futile thought process that undermines productivity. They feel a vague desire to do something else. Many become mired in what has been called "midcareer malaise," trying to justify their dissatisfaction. Once-engaged scholars redirect their obsessional natures in nonproductive ways. They suddenly feel unrecognized by their institutions and frustrated with administrative policy, or they cultivate animosity toward colleagues, both personal and professional.

These academics may convince themselves that their institutions do not understand their talent or value their hard work. It is true that university faculty are costly assets in a competitive job market, and administrators often struggle to quantify scholarly successes, especially when they are comparing people who make diverse scholarly contributions. Annual evaluations and regular merit-based raises can provide incentive and stability to faculty ranks. But for the malaise afflicted, money is a superficial remedy.

Disaffected faculty commonly direct their ire at institutional policies. In the modern-day university, administrative and faculty objectives seem to have diverged. Faculty remain ideological and expect others to bow at the altar of their disciplines. Administrators focus on undergraduates and often appear uninterested in scholarly activity. Railing against the administration can seem like a noble calling, but without an understanding of the university's regulatory landscape, it may be ineptly directed. Moreover, such tilting at windmills is unlikely to yield results before it becomes all-consuming. Creative energy is finite, and a crusade to change policy comes at the expense of other accomplishments.

Some midcareer faculty vent their frustrations toward their own

The window of time to reset or re-establish a career trajectory, in whatever form, is finite. Faculty members must act while they are marketable and known within their discipline.

academic departments in petty squabbles and vendettas over space, access to department resources and perceived slights.

When a person flails about in reaction to a desire to be stimulated, inspired and driven by purpose, any and all the above behaviors may result.

If you see yourself in any of these scenarios, some part of you probably is wondering how to escape. The only path toward a cure is recognizing the malady. Selecting a remedy requires introspection and bravery. Here are some suggestions:

1. **Renewed scholarship.** Learn new skills that apply to your academic passion. Or develop a new research focus for which you already have the appropriate skills to alleviate the boredom that has caused the slump.
2. **A change in venue.** The grass might not be greener at another institution, but a new location and new colleagues can stimulate you to regather your scholarly mojo.
3. **Increase service and/or instructional duties.** A change of emphasis can be both valued and rewarding.
4. **Change from the inside.** Instead of opposing policy as just another faculty malcontent, join the administration. An activist faculty member, with the right mentoring, makes an outstanding administrator.
5. **A courageous career shift.** We all have many desirable skills: leadership, public speaking, problem solving and critical thinking, not to mention discipline-specific skills. Faculty can get into the rut of thinking their established career stretches off to the horizon. If that path no longer inspires, consider forging a path outside the academy.

So what steps did we take to shake our malaise?

Graham: *Fast forward four years: I'm in a new research-intensive position at Loyola University Chicago and have enjoyed every minute since arriving. I am now a more agreeable individual. The research is flowing and all-consuming. I am happy to be absorbed in experimental subroutines and executing experiments with my lab members. I see projects and objectives laid out in front of me. Overall, I found the precise salve for my ills: I required new surroundings and stimuli. It was a bold step, but I am convinced completely it was the correct response to the state I was in.*

Audrey: *I cured my malaise in two ways. First, Graham and I started new collaborative projects far removed from my previous work (new enzyme systems! new methods!) that provided fresh inspiration. Second, I took an interim dean position. While I seem to be a capable administrator (time will tell how history views my legacy), I am now certain that what gets me up in the morning is figuring out how enzymes work. I look forward to handing the dean role off to my successor and returning to my lab to work on opine metallophore and riboflavin biosynthesis — and maybe a third new project in the works.*

In closing, the window of time to reset or re-establish a career trajectory, in whatever form, is finite. Faculty members must act while they are marketable and known within their discipline. And they must not yet have adopted a disaffected mindset as the new normal.

A career driven and sustained by purpose requires honest introspection. Discovering that one is no longer fulfilled by the work has tremendous value. Without this knowledge, a faculty member may well be relegated to a purgatory of their own making.

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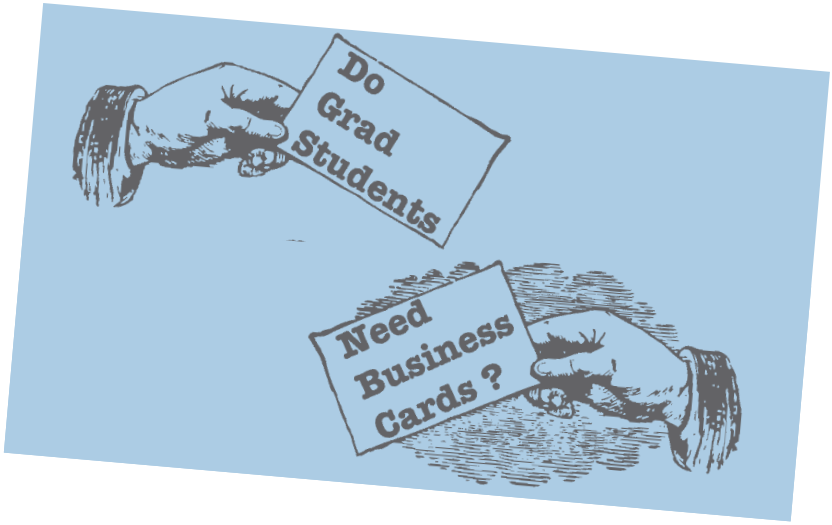
Do graduate students need business cards?

Even in today's high-tech job market, a simple paper card might be the key to getting a call back from a future employer

By Charlotte Cialek



AMANDA KOCH

I still remember how embarrassed I was at my first biotech industry networking event. As a graduate student, I started attending these events to learn about careers in industry and build my professional network. I had just met a biotech entrepreneur — perhaps my future boss or mentor? Excitedly, I asked if I could email him with questions. He asked for my business card.

Business cards? I'd never had my own business cards. I offered to write out my contact information with a pen and paper … which I then couldn't find in my purse. The entrepreneur handed me his card. "Here's my card if you ever need to get in touch," he said, rescuing me from my embarrassment, and then joked, "But don't let me catch you here again without business cards."

At my next networking event, I was prepared. Tucked in my purse were freshly printed business cards. On the flip side of each card I had added my graphical abstract and keywords for my research. That idea came to me after sorting through business cards from my first networking event and seeing how similar they were; I wanted my cards to stand out.

That night I handed out a dozen cards. I encouraged each new contact to visit my LinkedIn page. It worked. Eye contact, an introduction and small talk, a handshake, and my business card led to dozens of LinkedIn profile views, emails and connections. With these cards — and my newfound confidence — I am beginning to build a solid professional network.

Exchanging business cards can mark the first step toward a lasting connection with a colleague or possible future employer. It's not only sharing information but also an agreement to contact each other freely when needed. For me, business cards took an introduction to the next step in communication: phone calls, emails and LinkedIn messages. However, not all graduate student career paths include the type of networking that requires business cards.

Cards are less useful in the academic world. If you seek a job as a postdoc or in academia, it's more important to have a personal endorsement from your research advisor or someone in your field. Some academic fields are so small, specialized or close-knit that they don't require a broad network. Ask your mentor or see for yourself at a conference whether people in your field use business cards.

As the path to becoming a professor grows increasingly difficult, many new Ph.D.s are moving away from academia and into the private sector. In the fast-paced industry culture, career changes are more common than for a tenure-track professor. A good first impression — including your business card — can spur a future employer to contact you when a position at their company opens.

Business cards are the norm in

East Asia and parts of Europe. If you network or job hunt abroad, bring business cards and learn the local culture of when and how to exchange them. What hand do you use to present your card? What should you say after handing someone your card? Do you need to translate your card into the local language?

And if you're interested in freelancing, consulting or starting your own business, consider business cards and/or a business card-like logo for virtual networking. These self-promotion materials catalyze connections with clients, recruiters, representatives or independent contractors. Lastly, people with advanced biotech degrees can find careers in science policy or patent law, fields that commonly network with business cards.

These days, I always keep a few business cards handy. I've handed them out everywhere from grocery store checkout lines to ski lifts. I'm meeting people, learning names and career positions, and expanding my LinkedIn network. I'm even matchmaking within my network. When my friends talk about future careers, I've started saying, "I know someone who …"

And now, when I walk into the brewery for that monthly biotech networking event, I move with confidence. The entrepreneur who first suggested I needed business cards is my LinkedIn contact. I invited him to my university to help out with a grad student networking event I organized, and he complimented me on how far my networking skills have come.

With a couple of years of grad school to go, I haven't landed my dream job yet, but I'm equipped with the soft skills I need to find and land an industry job. With my business cards and my newfound self-assurance, I know I make a great first impression.

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is a Ph.D. candidate in biochemistry and molecular biology and co-founder of FoCo Academia Industry Alliance at Colorado State University in Fort Collins. Follow her on Twitter @ccialek.

We're going to need a bigger network

By Melissa Vaught

When I first started looking for positions outside of typical academic and research tracks, I discovered an unexpected challenge. I quickly realized I didn't know all the job titles and keywords I should be searching for.

As I waded through job postings, a friend pointed me toward a potential opportunity. I ended up taking on the role, monitoring and developing a platform for post-publication commenting. I later contributed to studies about communication of issues in the scholarly literature, for instance, through editorial expressions of concern. The work aligned with and expanded my skills and interests, the team was wonderful, and the environment was world-class. I happily spent almost four years in that role.

I don't know that I ever would have thought that such work existed, much less under the title "scientific editor," and I might have missed it had it not been for that friend.

Networks are embedded in every aspect of professional life, and they hold considerable value and power, even in seemingly innocuous actions. This is one reason we should pay close attention to who is in our networks. Bias infiltrates human decisions. We see the results in many aspects of professional work. The mostly male or all-male panel. The overwhelmingly white speaker lineup. The skew in nominating women for teaching vs. research awards. The disproportionate burden of service work that faculty of color carry.

We like to think that talented and hardworking individuals rise naturally. When we accept that disparities exist, we look to the structural barriers, the systemic issues that individuals from different backgrounds encounter — pervasive bias and discrimination in who gets into a program or hired or published or funded, contributing to bigger gaps at each step along the way. Maybe we recognize a role for stereotypes and social conditioning. But these are big challenges. They feel utterly beyond our control.

Many of these things will take time and commitment — from institutions, professional organizations and our fields at large — to change. But there are places where we have influence, and much of it is through our networks. Whom do we bring into them? Whom do we share opportunities with? Whom do we mention when asked to suggest people who fit a particular bill?

We don't need to set out to exclude. But if we don't work to include with equity, we achieve the same outcome. If we just flow with the first person who comes to mind, there's a good chance we end up propagating networks of individuals and attention that look much as they did before. What if, instead, we paused and asked, "Who else?"

A journalist at the BBC kept running into a problem. He and his colleagues thought that increasing representation of women in the media was a desirable goal, but "We had also accepted that it wasn't possible." Until one day they decided to track the genders of those they were putting on air to provide expert commentary. They continued to put

Networks are embedded in every aspect of professional life, and they hold considerable value and power, even in seemingly innocuous actions. This is one reason we should pay close attention to who is in our networks.

the best person on air, but in time, the balance shifted toward gender parity. Their approach spread across the BBC, with other media companies pledging to join the project.

You and I may not be able to lead organizational change in this way. But we can pay attention to the little ways we have influence. When someone asks you to suggest someone to speak at a session or write a commentary, don't fire off a response immediately. Take a moment to look further.

It's not just about those at our own professional level and above. Let's pay attention to whom we're connecting with at earlier career stages too. Whom do we introduce ourselves to at meetings? Whom do we invite for coffee or offer the chance to connect with our network? Whom do we share our knowledge and experiences with?

Several years ago, I was the anxious, searching, flustered postdoc trying to figure out what I could do with all the experience I'd gained in the lab and beyond that wouldn't involve staying in the lab. I met and, through my network, was introduced to many people doing lots of different work. I learned things and asked questions that I couldn't get from reading all the articles about career opportunities for those with science Ph.D.s. As importantly, I made connections that continue to thrive and support me in different ways today. As I meet grad students and postdocs who are now where I was years ago, I try to be generous with my time, experience and connections as others were for me.

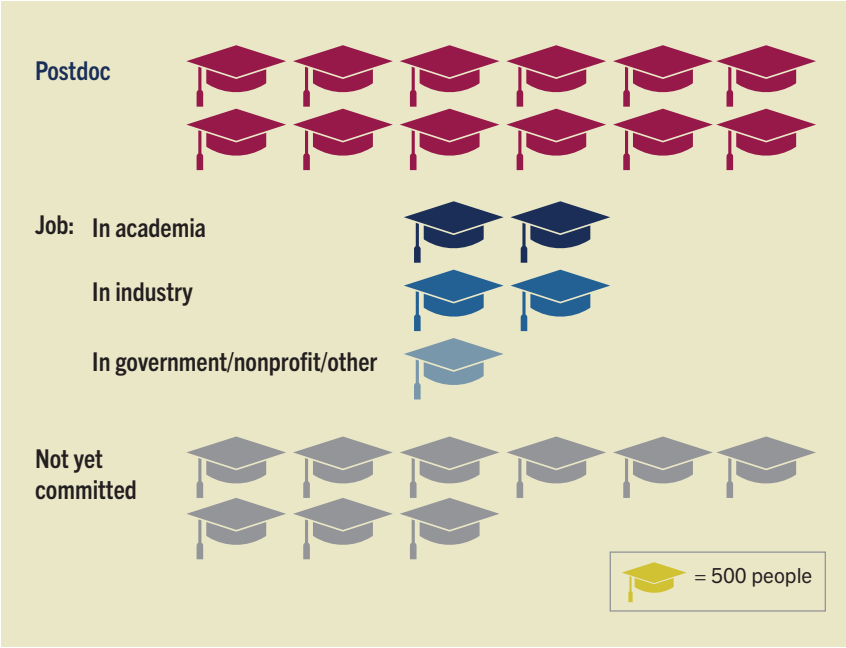
Each of us, whether we realize it or not, has power in our networks. It's up to us to pay attention to how — and to whom — we wield it.

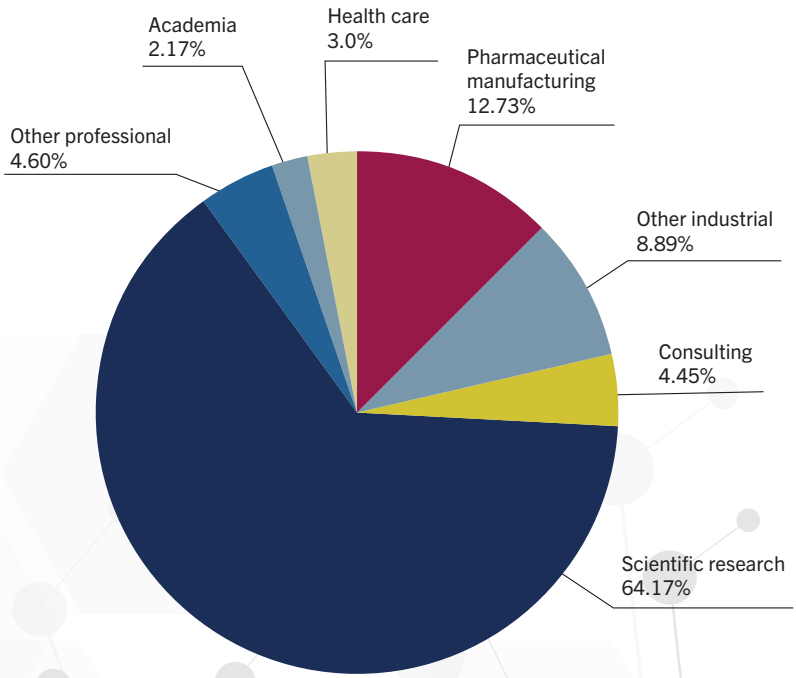
Melissa Vaught (vaughtmd@gmail.com) is a research navigator at the Institute of Translational Health Sciences in Seattle, Washington. Most weekends, you'll find her on a mountain. Follow her on Twitter @biochembelle.

PH.D. OUTCOMES BY THE NUMBERS: Career prospects in the life sciences

The first step after graduate school

The National Science Foundation administers the Survey of Earned Doctorates to degree recipients before they leave their universities. One line of inquiry in the survey is about post-graduation plans for employment. Among about 12,500 graduates in the life sciences in 2017, most had not made a definite commitment by the time they took the survey. Others had accepted job or postdoc offers. Here's where.





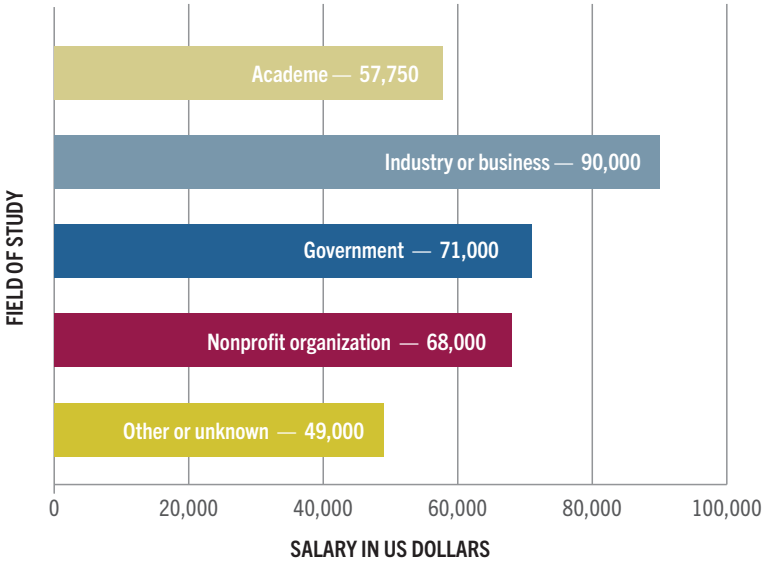
A finer-grained look at industry

What does "industry" mean, exactly? To find out, we turned to Occupational Employment Statistics collected by the Bureau of Labor Statistics, which include information on job title, sector, compensation and location. Among employees classified as biochemists and biophysicists (which excludes most professors), here's where they fit into the North American Industry Classification System. This chart represents about 26,000 working scientists.

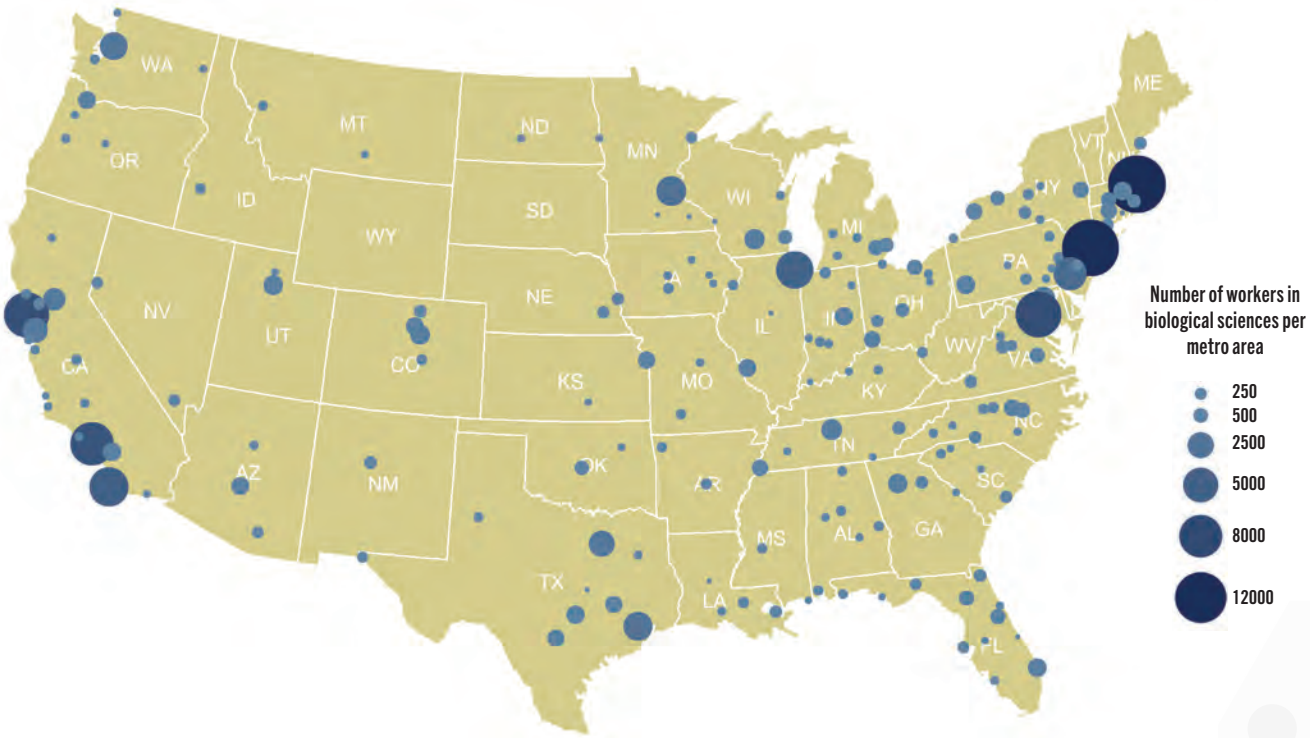
PH.D. OUTCOMES BY THE NUMBERS: Career prospects in the life sciences

What can a Ph.D. biologist expect to earn after graduate school?

The SED counted about 8,500 degree recipients in the biological and biomedical sciences in 2017. In the subset who had accepted a job offer when they took the survey, here's the median salary they expected to earn. These salaries exclude any bonuses or other extra compensation.

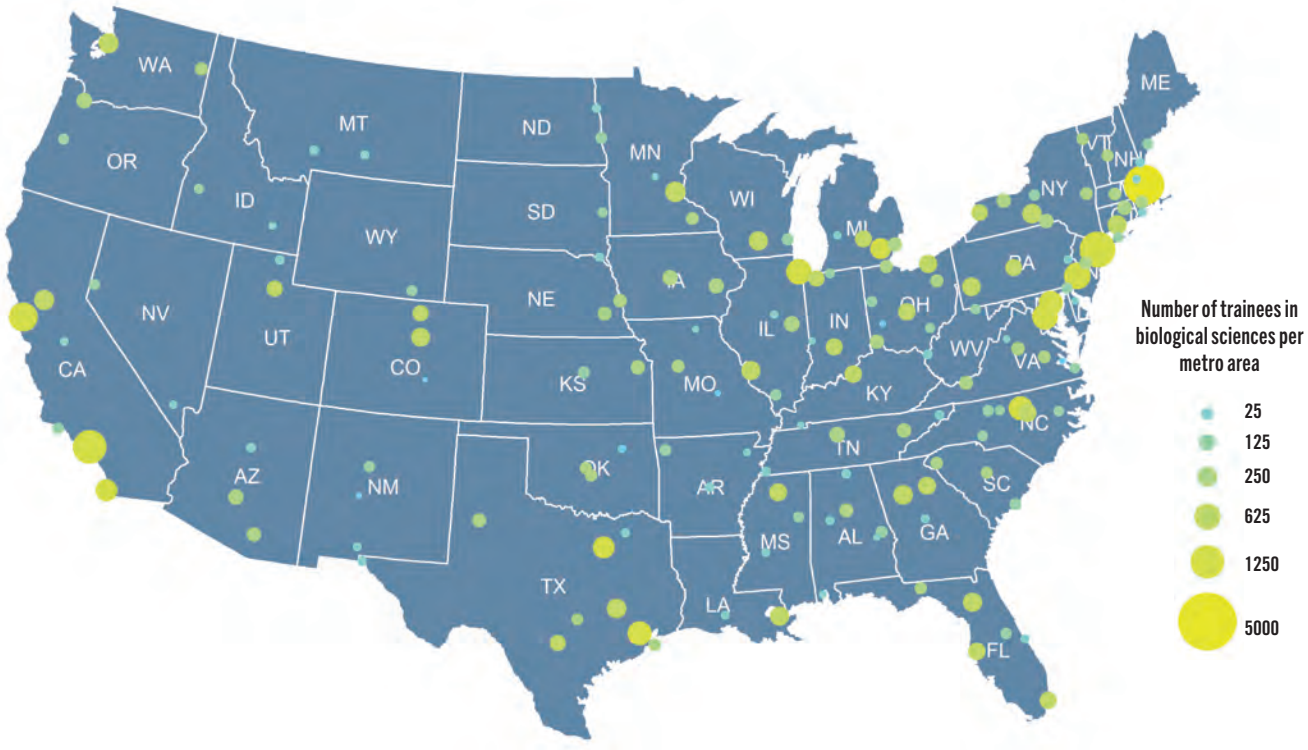


Where are the biology jobs?



The **MAP ABOVE** shows the location of 120,000 workers in the biological sciences in 2017, as reported by the Bureau of Labor Statistics. These dots represent people working as biomedical engineers, biology professors, biochemists and biophysicists, biological technicians and catch-all categories for people whose jobs aren't described by those job titles, but still fit into biological or life sciences.

Where are the biology trainees?



The **MAP ABOVE** shows the location of graduate students and postdoctoral researchers in the biological sciences as of 2017. These data represent about 79,000 graduate students and 19,000 postdocs at Ph.D.-granting institutions, counted in the National Science Foundation's Survey of Graduate Students and Postdoctorates in Science and Engineering.

Ph.D. outcomes — one university at a time

By Comfort Dorn

In addition to the statistics compiled by the Bureau of Labor Statistics and the National Science Foundation that we used to create the graphs and maps on these pages, we asked biochemistry and molecular biology departments at universities across the U.S. to send us information about where their students go after earning a Ph.D. We did not intend to do a statistical survey but rather to get snapshots from around the country.

We asked:

- What share of Ph.D.s move right into academic/teaching positions?
- How many get jobs in industry?
- How many pursue postdocs?
- What kind of nontraditional outcomes do you see?
- Has this picture changed in the past decade or so?
- What steps has your department taken to support students who chose careers other than academic research?

Add your outcomes

This is just the beginning. The editors of ASBMB Today want to expand the online version of this article to include more universities. If your department would like share your answer to the six questions in the introduction at left, please email your information (50-100 words) to asbmbtoday@asbmb.org using the subject line "Ph.D. outcomes."

We heard back from six universities. Below are their responses, edited for length and clarity.

University of California, Los Angeles

The biochemistry, molecular and structural biology graduate program at the University of California, Los Angeles, tracks the career paths of our Ph.D. alumni.

Research-active BMSB faculty have reported on 325 alumni spanning the years of 1971 to 2018. More than 32% of these alumni currently are employed in industry, 18% are in academic research and teaching, 13% do research in an academic or government lab, and 13% are postdoctoral fellows.

Of the remaining alumni, 5% teach at a college or university, 5% work in medical or healthcare professions, 4% work in law/patent/financial institutions, 2% are consultants and 7% are categorized as other/unknown.

Data from recent 2015 to 2018 graduates indicate that nearly 50% start their careers as postdocs and 33% get a position in industry.

Our graduate students invite alumni from diverse backgrounds and careers to give seminars about their career paths. This facilitates networking among our current students, faculty and alumni and generates internships and support.

— **Catherine Clarke**, Professor and Chair
Department of Chemistry and Biochemistry

The Pennsylvania State University

The biochemistry, microbiology and molecular biology graduate program at Penn State strives to promote the success of students with diverse academic interests and career goals. For students interested in exploring their options, we initiated an invited speaker series on career opportunities, and we have increased formal training in pedagogy, communication and professional-development skills that are useful in a wide range of careers.

Although our graduates ultimately work in a wide variety of careers, most decide that an academic postdoc is their best first step after obtaining their Ph.D. From 1998 to 2008, 70% of Ph.D. graduates started with a postdoctoral position. That percentage declined from 2010 to 2015, with a concomitant increase in graduates directly entering teaching and industry positions. From 2015 to the present, we have seen a return to the historical rate of 70% postdoctoral positions.

Most graduates who do not follow the postdoctoral path start with a job in an industry or government lab. Over the past 10 years, 16% of graduates have taken an industry position, 9% have started in a government lab, and 6% have moved directly to a teaching job. Other graduates have started in patent law, science writing or business.

— **Kenneth Keiler**, Professor and Associate Head for Graduate Education, Department of Biochemistry and Molecular Biology

Washington University in St. Louis

About 73% of biochemistry, biophysics and structural biology Ph.D. graduates at Washington University in St. Louis progress to postdoctoral positions. While the number proceeding directly to industry positions after graduation is only about 9%, more graduates have been moving toward industry over the past decade. As alumni move on to their second, third and fourth jobs, the industry number increases to 30%. About 5% move to other careers that are not in academia or industry.

We take pride in the multiple destinations of our graduates. We have received enthusiastic feedback about the performance of industry Ph.Ds. in both traditional and nontraditional industry roles.

We believe in the broader value of doctoral training and are introducing new innovations into the graduate curriculum to help students excel in both academia and industry.

These include science communication, biotech industry inclusion and expanded career planning, as well as support of career-development groups. We aim to equip our graduates to succeed in a variety of pathways after graduation.

Note: Our biology and biomedical sciences graduate programs are administered through the Division of Biology and Biomedical Sciences, or DBBS, with support and input from both preclinical and clinical department faculty. Washington University's new BBSB program includes faculty and students from the previous biochemistry and computational and molecular biophysics programs. These statistics represent past and present programs in biochemistry and molecular biophysics.

— **Jeffrey P. Henderson**, Co-director Biochemistry, Biophysics and Structural Biology Graduate Program

—**Andrew Richards**, DBBS Director of Recruitment, Admissions and Alumni Affairs

University of California, San Diego

In the department of chemistry and biochemistry at the University of California, San Diego, the largest percentage of our Ph.D. students, 44%, goes directly into postdoctoral positions at four-year colleges and universities. Almost as many, 40%, pursue positions in industry. Six percent of our graduates have secured positions in national laboratories. Of the remainder, 3% initially take positions at university-affiliated research institutes, 3% have adjunct faculty positions at community colleges and 3% have positions in government. These initial placement trends have been relatively consistent over the past several years.

To support our graduate students in their efforts to pursue careers outside of academia, we host a number of industry events throughout the year, which include networking and career panel sessions with successful industry professionals. We also have organized a number of group tours to local industry companies, and we encourage our graduate students to pursue summer industry internships when these opportunities arise.

—**Erica Lennard,** Director of Student Affairs,
Department of Chemistry and Biochemistry

The Ohio State University

Roughly half the students earning a Ph.D. in the Ohio State Biochemistry Program still seek a postdoctoral position immediately after graduation. Jobs in industry (including consulting) are now the next most-frequent outcome, typically about 25% of graduates. Over the past 10 years, more students have been pursuing additional professional degrees (law or medicine) and other paths, such as government positions or clinical trials administration.

Our program is getting away from characterizing "nontraditional" career paths as alternative outcomes, and we embrace opportunities that are aligned better with students' diverse interests and career goals. Students tell us what career support they want and need, and we focus our efforts and funding on the most current and relevant needs. For example, along with three other life sciences graduate programs, we host a student-run biannual career day, where students select and invite speakers (including many program alumni) who represent a wide array of career paths.

As a large public research university, our career-development infrastructure includes an entrepreneurship institute started by our business school. We have embraced partnerships with several National Institutes of Health-funded training-grant programs that help students gain internships in nonacademic fields and encourage early career planning.

— **Jane E. Jackman**, Director, Ohio State Biochemistry Program;
Professor, Department of Chemistry and Biochemistry

University of North Carolina at Chapel Hill

The graduate education office at the University of North Carolina at Chapel Hill tracks the outcomes of its life science and biomedical Ph.D. graduates. From 2000 to 2018, more than 1,400 Ph.D. students graduated; we have outcome data for 93% of them. About 60% do postdoctoral training for more than 12 months, and the other 40% enter the workforce directly or after a short postdoc, often in their Ph.D. lab.

Removing postdocs from the analysis, 42% of life science Ph.D. alumni are in academia and 37% work at for-profit companies. Common jobs in academia are faculty member, health care provider, senior scientist/technical director, lecturer/instructor and program administrator. Top job functions in the for-profit sector include group leadership, researching, science writing and communication, business development, and regulatory affairs.

In all job sectors, 47% of our alumni are in career paths defined as primarily research, and 32% are in science-related careers that support the research enterprise in business development, consulting, clinical research management, program direction, intellectual property and other niche careers.

These data inform our professional-development program, including creating and advising student-led career groups, building employer relations and internship partnerships, and renewing and applying for National Institutes of Health funding.

— **Patrick Brandt**, Director of Career Development and Outreach
— **Jean Cook**, Professor of Biochemistry and Biophysics, Associate Dean for Graduate Education

Looking back at the journey

Three early-career researchers answer questions about their educational paths

By Marya S. Sabir

Every educational step beyond high school involves big choices. When making major life decisions, I often ask people with ambitions similar to mine who are further along in their journeys about their experiences.

I recently asked three trainees in the Laboratory of Neurogenetics in the National Institute on Aging at the National Institutes of Health about their education and career paths so far. I am an aspiring physician-scientist and soon will start my doctoral studies at the University of Oxford. I thought I might gain a better perspective on the graduate school experience from these three individuals, two of whom studied outside the U.S. Additionally, their viewpoints may be helpful for anyone interested in a postdoc position within the intramural side of the NIH.

Adamantios Mamais earned a Ph.D. at University College London, and Melissa Mazza earned a Ph.D. in behavioral neuroscience from Binghamton University; both are postdoctoral fellows. Ruth Chia did graduate research at University College London and is now a senior research fellow. Their answers have been edited.

What's the most important advice you wish you had received about graduate school?

Mamais: Be brave. Reach out to big names in the field and ask for their advice on your career path. You'll find that, in most cases, people are very willing to listen to you and offer their expertise.

Mazza: Make sure the lab you join is a good fit. It's important to feel compatible with the lab's methodology, subject matter and social environment. Working well with your lab mates and getting along with your advisor will help you have a positive graduate school experience.

Chia: I've heard horror stories of how some graduate students struggle to get the support they need to be successful. Choosing a good graduate mentor is far more important than selecting a mentor based solely on how famous they are in a particular research field. Based on my experience interacting with numerous graduate students, prospective students need to be clear about why they are pursuing a graduate degree. Not every scientific career requires a Ph.D. If your target career does not, then perhaps graduate school is not the right path. I also wish I had known earlier in my research career that having a Ph.D. does not mean you are destined for the traditional academia route — and that's OK.

How was the transition from undergraduate studies to graduate school?

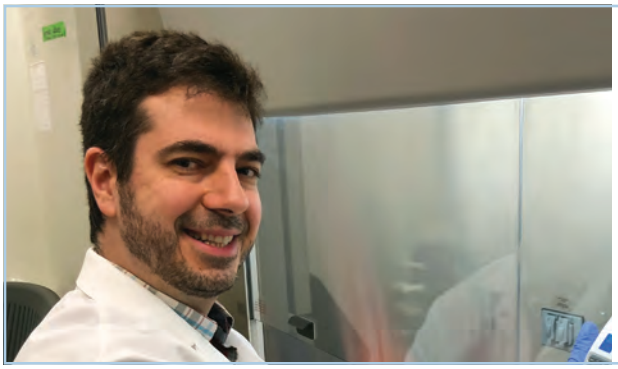
Mamais: When I graduated with my bachelor's degree, I had a rough idea that in five years I wanted to be completing a Ph.D. in molecular biology. I thought I needed more lab experience to be ready for a Ph.D. program, and a research assistant placement gave me confidence. My advice: Get to know and really explore your choices, and get to know yourself and what you want to achieve.

Mazza: My transition to graduate school was rough, mostly because I didn't have lab experience. I was a psychology major. I didn't know what a Western blot was and had never touched a rat. I was unaware of the time commitment that research demanded on top of classes and teaching responsibilities. It took about a year to learn what was required of me and how to best manage my time.

Chia: My transition was rather seamless. I had already learned that research was not a five-days-a-week, 9-to-5 profession. My earlier research experiences helped me prepare mentally for graduate school and taught me how to think creatively and be comfortable asking questions.

Did graduate school meet your expectations?

Mamais: Graduate school was super fun, challenging and rewarding. In the first couple of years, you realize that what sounded like a great research idea may be more complicated than you initially thought; you spend a long time making the tools or collecting the resources you'll need to start testing your hypotheses. Most of your quality data probably come after a lot of trial and error and painstaking analysis. You navigate the hard times by talking to people, keeping an open mind and keeping up with the literature and current

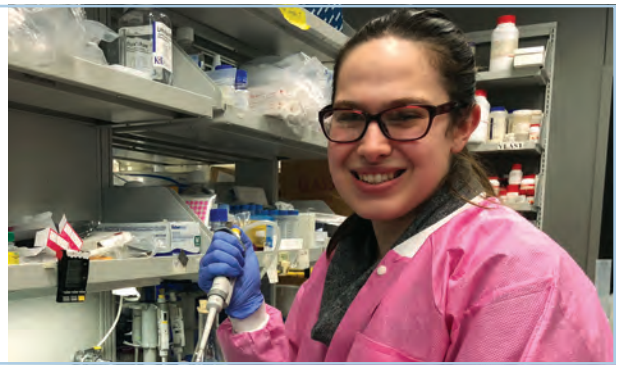


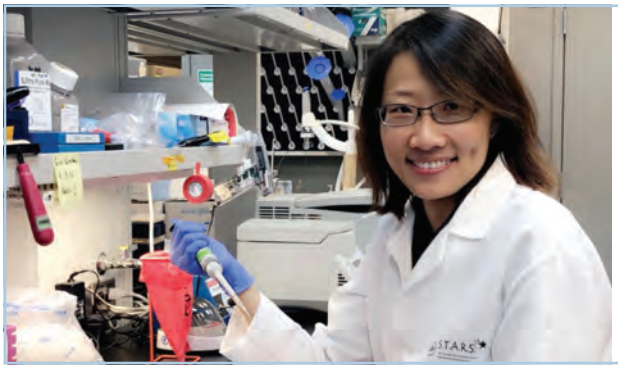
"Sometimes we work on something so specialized and narrow that our work doesn't make for a good pub talk. Even so, developing your Western blot on a Friday night when everybody's gone and realizing that you are the first person on Earth to see that protein A interacts with protein B — the first person to see a miniscule but real and important event in nature — it's magical."

Adamantios Mamais, postdoctoral fellow

"My transition to graduate school was rough, mostly because I didn't have lab experience. I was a psychology major. I didn't know what a Western blot was and had never touched a rat … It took about a year to learn what was required of me and how to best manage my time."

Melissa Mazza, postdoctoral fellow





"I've heard horror stories of how some graduate students struggle to get the support they need to be successful. Choosing a good graduate mentor is far more important than selecting a mentor based solely on how famous they are in a particular research field."

Ruth Chia, senior research fellow

events in your field, all while trying not to lose focus on the project. Soon enough, you realize that you've gone so deep that you are the expert. This is both scary and freeing.

Mazza: I spent my first year in a lab that was not a good fit, but then I transitioned into another lab and my time became more positive. I experienced achievements and failures that pushed me to learn how much I am capable of. One of the most soul-crushing times was the preliminary exams after completing my master's degree. I had to do a lot of work on my own, but once it was done, I realized I was able to teach myself something new. My time in graduate school taught me how little I know and to take pride in what I can accomplish.

Chia: Graduate school met my expectations. I knew it would be a challenge and require a monumental amount of dedication, both in time and stamina.

What's it like to be a postdoc? What does your typical day look like?

Mamais: As a postdoc, you have the chance to develop professionally in a safe and nurturing environment. It can be the perfect balance of freedom to pursue your passion while feeling OK with having to seek advice. This is the time to take on new responsibilities, push yourself to try new techniques and explore different fields. You can apply for grants, present talks at conferences, start new collaborations, and even supervise and train students. The hardest thing to master is a work-life balance.

Every day is a work day. A typical day is coming into work with a plan to do two experiments, the first one starting with the cells you plated the day before. You start your day by adding the treatment onto the cells and rush to a lab meeting where a person from your group presents for 45 minutes and you all offer critique on the data and propose future directions. Following that, you rush to the tissue culture room and start collecting and processing your cells. You remember you booked the afternoon slot for the confocal microscope, so you grab a 20-minute lunch and turn on the microscope so the lasers warm up. Cells are now in the centrifuge, lunch is done, and you've started looking down the microscope while trying to reply to your emails and analyze the data you got two days ago that you didn't have time to look at yet. Finally you have some quiet time at the confocal and you're taking some beautiful images for analysis. When that's done, you rush back to the cells you treated this morning so you don't have to stay too late.

Sometimes we work on something so specialized and narrow that our work doesn't make for a good pub talk. Even so, developing your Western blot on a Friday night when everybody's gone and realizing that you are the first person on Earth to see that protein A interacts with protein B — the first person to see a miniscule but real and important event in nature — it's magical.

Mazza: There is no typical day. My schedule is dictated by experiments: I could be at the bench doing wet lab work, with the mice running behavioral tests, or in the rare down time at my desk catching up on reading and writing. Being at the NIH, I have a lot of freedom to explore my scientific interests without the pressure of writing grants. While this allows for great scientific growth and the chance to do high-risk, high-reward experiments, it requires drive and motivation to gain the grant-writing experience that's so valuable after a postdoc. As a postdoc in the intramural side of the NIH, my research is funded internally. Some internal grants do exist for postdoc trainees, but to gain grant-writing experience, we must reach out for opportunities external to the NIH, such as foundations. The NIH also offers a wide variety of workshops and seminars to help with improving grant-writing skills, and these can be helpful for learning the basics.

Chia: As an undergrad and grad student, I studied human genetics, disease modeling in mice and protein biochemistry. My postdoc focus was cellular biology of Parkinson's disease and amyotrophic lateral sclerosis using high-throughput and gene-silencing approaches to delineate the pathogenic disease mechanisms. Now, as a senior research fellow, I manage and analyze big data generated from human genetic studies using bioinformatics tools and write my own computational scripts to perform analyses to answer the hypothesis at hand. It has been a satisfying journey.

My typical day starts the day before. I am a planner, and I perform best what I know what I need to do ahead of time. There are days where I need to multitask and perform different assays for different projects in one day. Planning helps me manage my time and focus.

A postdoc can explore research interests and determine the career path they want to carve. Within a supportive research environment, and perhaps with a little serendipity in science, a postdoc can make a successful transition to becoming a PI with a laboratory in an academic setting.

Next steps: Adam Mamais plans to enter academia, where he can have his own lab and teach; Melissa Mazza will apply for a K99/R00 award in hopes of facilitating a tenure-track position in academia; and Ruth Chia plans to continue in her new role as a staff scientist at the NIH.

Marya S. Sabir
(msabir@asu.edu) is a postbaccalaureate Intramural Research Training Award fellow at the National Institutes of Health studying neurogenetics.

How I got a job away from the bench when all I had were degrees in biochem

By Joanna Kotloski

I spent 20 years of my life in school. I got a bachelor's degree in biochemistry and then went to graduate school for biochemistry. My educational saga culminated with me stumbling out of a brutal almost-Ph.D. experience, narrowly escaping with a master's degree. I then took a job in an academic department setting up teaching labs and quickly realized that this was not something I could build a career on.

I knew the type of position I was looking for — something in a creative field — and I had the required skills in the listing for every job I applied for, but no matter how many resumes and cover letters I sent, my phone stayed silent. I started to wonder if I was doing something wrong.

When I decided to apply for jobs outside biochemistry, I knew I faced an uphill battle. Clearly, I would have to rely on experience gained outside of the classroom and lab to make up for the difference.

I was in for some surprises along the way, though. I thought that having an advanced degree in science would be additive or at least couldn't hurt. But when I started applying for jobs away from the bench, I began to think that not only was it not necessarily a positive, it was possibly a flat-out negative to have that master's degree on my resume when I wasn't applying for a science job.

My friend Mallory, a lawyer by training, went through the same thing when she was searching for jobs outside her field. It's not that your degree makes you unqualified, she told me, but the hiring committee is confused about why you'd earn a graduate degree to then turn around and not use it. Especially when the public perception is that the field you're leaving is high-paying (whether that's true or not). So even though I had a master's degree, I needed to work extra hard to prove my worth. It was like starting from scratch or not having a degree at all.

It was like starting from scratch or not having a degree at all.

To make up for the fact that I didn't have the right degree, I had to make sure I could demonstrate that I had the skills to do the job. I scoured postings for jobs that looked interesting and made a list of tangible skills I would need to get an interview. In my case, a lot of jobs required knowledge of website and photo-editing programs.

After those 20 years in the classroom, I really didn't want to go back to school, so I found a free online training program to learn some coding. I practiced using illustration and photo-editing programs in my spare time. I created an Instagram account to post my work, which helped me become more comfortable sharing what I had created. I began to take side gigs designing print materials and website wireframes for friends — things that I thought would land me a job when I added them to my resume.

Incorrect. I now had all sorts of overlapping dates — including freelance work (something that's harder to verify with references) — on my resume. I had to find a way to package my new hard-earned skills into something more legitimate looking.

Lucky for me, the biology department where I was setting up teaching labs desperately needed a website editor — and lucky for them, I was desperate to help them out. I redesigned the website, redesigned the lab manuals and started several social media channels. I then went back to my resume, removed the bits about freelancing, and swapped in the parts about my department's website, lab manual and social media.

Finally, I decided to leverage my degree for what it was. I began typing "biochemistry marketing" into the Indeed.com search bar and found the niche I wanted to pursue. The whole process of building up my resume and skills took about a year, but once I found where I could shine, I landed job interviews at the first three places I applied.

Joanna Kotloski (jkotloski@asbmb.org) is the ASBMB's marketing coordinator.

2020 ASBMB award winners

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

ASBMB Award for Exemplary Contributions to Education


Black

Paul Black, a professor at the University of Nebraska–Lincoln, won the ASBMB Award for Exemplary Contributions to Education, given annually to a scientist who encourages effective teaching and learning of biochemistry and molecular biology through his or her own teaching, leadership in education, writing, educational research, mentoring or public enlightenment. Black leads the biochemistry department at Lincoln. In 2016, he was named an ASBMB education fellow.

ASBMB–Merck Award


Hayer-Hartl

Manajit Hayer–Hartl, a group leader at the Max-Planck Institute of Biochemistry, won the ASBMB–Merck Award, which recognizes outstanding contributions to research in biochemistry and molecular biology. Hayer-Hartl has led a research group focused on chaperonin-assisted protein folding research since 2006.

Avanti Award in Lipids


Schaffer

Jean Schaffer, a board-certified cardiologist and researcher affiliated with the Joslin Dia betes Center at Harvard Medical School, won the Avanti Award in Lipids, which recognizes outstanding research contributions in the area of lipids. Until recently, Schaffer led the Diabetic Cardiovascular Disease Center and Diabetes Research Center at Washington University in St. Louis.

Bert and Natalie Vallee Award


Dennis

Edward Dennis, a distinguished professor at the University of California, San Diego, won the Bert and Natalie Vallee Award in Biomedical Science. The award, established by the Bert and Natalie Kuggie Vallee Foundation in 2012, recognizes international achievements in the sciences basic to medicine. Dennis is a former chair of UCSD's chemistry and biochemistry department and has led the faculty senate.

DeLano Award for Computational Biosciences


Zhang

Yang Zhang, a professor at the University of Michigan Medical School, won the DeLano Award for Computational Biosciences, established to honor the legacy of Warren L. DeLano, creator of the PyMOL open-source molecular viewer and given to a scientist for advances in computer technology to enhance research in the life sciences at the molecular level. Zhang's lab is recognized for its algorithms for predicting the 3D structures of proteins.

Earl and Thressa Stadtman Young Scholar Award


Pagliarini

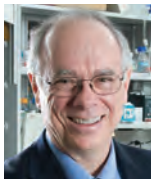
David Pagliarini, an investigator at the Morgridge Institute of Research, won the Earl and Thressa Stadtman Young Scholar Award, established by friends and colleagues of the Stadtmans to preserve their legacies as scientists and mentors. It is given to scientists with 10 or fewer years of postdoctoral experience, including medical residencies and fellowships. Pagliarini is also a professor at the University of Wisconsin–Madison.

Walter Shaw Young Investigator Award in Lipids


Baskin

Jeremy Baskin, an assistant professor at Cornell University, won the Walter Shaw Young Investigator Award in Lipids, which was established by ASBMB's Lipid Research Division and recognizes outstanding research contributions in the area of lipids by young investigators who are assistant professors (or equivalent) with no more than 10 years of experience since receiving their degrees.

Herbert Tabor Research Award


Campbell

Kevin Campbell, a professor at the University of Iowa Carver College of Medicine, won the Herbert Tabor Research Award. The ASBMB established this award to recognize the contributions of Herbert Tabor, longtime editor-in-chief of the Journal of Biological Chemistry. It is given for excellence in biological chemistry, molecular biology and contributions to the community of scientists. Campbell is director of the Senator Paul D. Wellstone Muscular Dystrophy Cooperative Research Center.

Mildred Cohn Award in Biological Chemistry


Fierke

Carol Fierke, provost and executive vice president of Texas A&M University, won the Mildred Cohn Award in Biological Chemistry, which recognizes scientists who have made substantial advances in understanding biological chemistry using innovative physical approaches. The award honors the pioneering scientific accomplishments and the spirit of the late Cohn, the first female president of the society. Before moving to A&M, Fierke led the chemistry department and served as graduate dean at the University of Michigan.

Ruth Kirschstein Diversity in Science Award


Allison

Lizabeth Allison, a professor at the College of William and Mary, won the Ruth Kirschstein Diversity in Science Award, which honors an outstanding scientist who has shown a strong commitment to encouraging underrepresented minorities to enter the scientific enterprise and has offered effective mentorship of those within it. The winner is chosen by the ASBMB's Minority Affairs Committee. Allison is a past chair of the biology department at William and Mary.

William C. Rose Award


Schiffer

Celia Schiffer, a professor at the University of Massachusetts Medical School, won the William C. Rose Award, which recognizes outstanding contributions to biochemical and molecular biological research and a demonstrated commitment to the training of younger scientists. Schiffer directs the Institute for Drug Resistance at the University of Massachusetts medical school.

Alice and C. C. Wang Award in Molecular Parasitology


Johnson

Patricia Johnson, a professor at the University of California, Los Angeles, won the Alice and C.C. Wang Award in Molecular Parasitology. The award recognizes established investigators who are making seminal contributions to the field of molecular parasitology. Novel and significant discoveries on the biology of parasitic organisms are of particular emphasis. Johnson's lab at UCLA studies the cause of the most prevalent, nonviral, sexually transmitted infection worldwide, the parasite Trichomonas vaginalis.

The winners of the American Society for Biochemistry and Molecular Biology annual awards were nominated by colleagues and other leaders in their fields for making significant contributions to biochemistry and molecular biology and the training of emerging scientists.

The recipients will give talks about their work at the society's 2020 annual meeting, which will be held in conjunction with the Experimental Biology conference April 4-7 in San Diego.

In addition to cash prizes ranging from $2,000 to $35,000, each ASBMB award consists of a plaque and transportation expenses to the ASBMB annual meeting.

Learn more about the ASBMB awards at asbmb.org/awards.

2020 annual meeting abstract categories

Below are the abstract categories for the American Society for Biochemistry and Molecular Biology annual meeting to be held in conjunction with the Experimental Biology conference in San Diego in April. Note that abstract categories 2160 through 2166 are organized by the Society for Experimental Biology and Medicine, a guest society of the ASBMB. Submissions to SEBM categories qualify as ASBMB categories for those seeking early decisions and travel awards.

Genome Dynamics: DNA Replication, Repair and Recombination

2001 DNA Recombination, Structure and Topology
2002 CRISPR/Genome Engineering
2003 DNA Polymerases, Telomerase, Replicases and Replisomes
2004 DNA Damage and Repair

Chromatin Structure, Remodeling and Gene Expression

2011 Chromosomes Structure/Dynamics
2012 Epigenetic Modifications of DNA and RNA
2013 Histone Modifications
2014 Transcriptional Mechanisms, Regulation and RNA Polymerases
2015 Transcriptomics

RNA: Processing, Transport and Regulatory Mechanisms

2021 RNA Polymerases
2022 RNA Binding Proteins
2023 RNA Structure, Folding and Dynamics
2024 Noncoding RNAs
2025 CRISPR: Methods and Applications
2026 RNA Processing and Editing

Protein Synthesis, Structure, Modifications and Interactions

2031 Ribosomes
2032 Mechanisms and Regulation of Protein Synthesis and Dynamics
2033 tRNA and tRNA Synthetases
2034 Protein Interactions and Binding
2035 Protein Modifications
2036 Protein Structure and Biophysics
2037 Protein Folding and Chaperones
2038 Protein Dynamics and Fluctuations, Turnover and Quality Control
2039 Protein Turnover, Misfolding, Aggregation and Degradation
2040 Intrinsically Disordered Proteins, Prions and Amyloids
2041 Ubiquitin Pathway and Targeting
2042 Proteasomes: Structure and Regulation
2043 Proteolytic Enzymes and Inhibitors

Enzyme Chemistry and Catalysis

2051 Biomolecular Catalysis
2052 Enzyme Mechanisms, Kinetics and Energetics
2053 Structural Dynamics of Enzymes and Multienzyme Complexes
2054 Enzyme Regulation and Allosterism
2055 Cytochromes P450
2056 Enzyme Inhibitors and Drug Design

Chemical Biology, Drug Discovery and Bioanalytical Methods

2061 Drug Screening and Development
2062 Chemical Biology of Natural Products, Nucleic Acids and Small Molecules
2063 Chemical Probes, Biosensors and Biomarkers
2064 Protein and Peptide Chemistry
2065 Protein Engineering and Design
2066 Protein–Small Molecule Interactions
2067 Bioanalytical and Biophysical Methods
2068 Nanotechnology
2069 Targeted Therapies and New Targets for Drug Discovery

Genomics, Proteomics and Metabolomics

2071 Next-Generation Sequencing
2072 Genomics
2073 Lipidomics, Pharmacogenomics and Toxicogenomics
2074 Proteomics
2075 Metabolomics

2076 Glycomics
2077 Systems Biology and Regulatory Networks
2078 Computational Biology and Bioinformatics

Signal Transduction and Cellular Regulation

2081 Hormone Signaling in Animals and Plants
2082 Extracellular Matrix and Cell Signaling
2083 G proteins and Small GTPases
2084 Protein Kinases
2085 Phosphatases
2086 Ion Channels
2087 Cyclic Nucleotides
2088 Lipid Metabolism in Signaling
2089 Calcium, Nitric Oxide and Other Chemical Regulators
2090 Redox Signaling
2091 Apoptosis and Cell Death
2092 Cell Stress and Xenobiotics
2093 Allosteric Control of Signaling Pathways
2094 Spatiotemporal Control of Signaling
2095 Cell Motility and Migration
2096 Tumor Suppressors and Tumor Drivers
2097 Cancer Signaling and Therapeutics
2098 Neurobiology and Neuronal Signaling
2099 Immune Signaling
2100 Targeted Therapies and New Targets for Drug Discovery

Bacteria and Parasites: From Microbiome to Antibiotics

2111 Microbe/Parasite-Host Interactions
2112 Antibiotic Resistance
2113 Antibacterial Targets and Drug Discovery
2114 Microbiomes

Metabolism and Bioenergetics

2121 Plant Metabolism and Biosynthetic Pathways
2122 Energy Metabolism, Oxidative Phosphorylation
2123 Oxidative Stress and Reactive Oxygen
2124 Mechanisms and Metabolism of Aging
2125 Metabolism and Cancer
2126 Metabolism and Nutrition
2127 Diabetes, Obesity and Metabolic Syndrome

Lipids and Membranes

2131 Biofuels and Lipid Metabolizing Enzymes
2132 Regulation of Lipid Metabolism
2133 Lipid Signaling and Eicosanoids
2134 Lipids and Inflammation
2135 Lipid Storage and Trafficking
2136 Membrane Proteins and Lipid Interactions
2137 Lipid Domains and Lipid Rafts
2138 Membrane Transport and Channels

Biochemistry of Organelles and Organelle Trafficking

2141 Organelle Structure and Biogenesis and Disease Association
2142 Vesicle Trafficking and Cargo
2143 Mitochondria in Health and Disease
2144 Organelle Dynamics and Dysfunctions

Glycans and Glycobiology

2151 Glycosyltransferases and Hydrolases
2152 Protein–Glycan Interactions
2153 Glycan Biotechnology
2154 Glycans in Disease

Interdisciplinary/Translational Science (SEBM)

2161 Mitochondria Dysfunction and Disease (SEBM)
2162 Free Radical Biology (SEBM)
2163 Structural Biology (SEBM)
2164 Sirtuins in Cancer Biology (SEBM)
2165 Biotherapies and Immunotherapies (SEBM)
2166 Molecular Medicine (SEBM)

BMB Education and Professional Development

2171 Active Learning in the Molecular Life Sciences
2172 Big Data in Molecular Life Sciences, Student Projects, Labs and the Classroom
2173 Institutional Change and Faculty Perspectives about Teaching in the Life Sciences
2174 Service-Learning Initiatives, Community Involvement and Context-Dependent Biochemistry Instruction

2020 PROGRAM THEMES

The 2020 ASBMB Annual Meeting will include sessions on these eight themes. Look for details in next month's ASBMB Today.

Biochemistry of lipids and membranes

ORGANIZERS

Steve Claypool, Johns Hopkins School of Medicine
Teresa Dunn–Giroux, Uniformed Services University of the Health Sciences

SESSIONS

- Membrane biogenesis and trafficking
- How lipids impact the structure and function of membrane proteins
- Novel roles of lipids in health and disease

Glycosylation and extracellular matrix in development, repair and disease

ORGANIZERS

Jamey Marth, Sanford Burnham Prebys Medical Discovery Institute
Joanne Murphy–Ullrich, University of Alabama Medical Center

SESSIONS

- Glycosylation and extracellular matrix in development, repair and cancer
- Glycosylation and extracellular matrix in immunologic, inflammatory and infectious disease
- Glycosylation and extracellular matrix in neurologic and metabolic diseases

Molecular mechanisms of cell signaling

ORGANIZERS

Wendy Gordon, University of Minnesota
Adrian Salic, Harvard University

SESSIONS

- Mechanosignaling
- Post-translational modifications/signaling
- Emerging mechanisms of signaling

New developments in metabolism

ORGANIZERS

Marcia Haigis, Harvard University
Anne Murphy, University of California, San Diego

SESSIONS

- NAD synthesis, salvage and sirtuins in tissue health
- New insights into control of metabolism by transporters
- Control of cell fate by metabolic intermediates

Molecular machines — structure and function

ORGANIZERS

Nathan Alder, University of Connecticut
Jochen Zimmer, University of Virginia

SESSIONS

- Molecular motors
- Molecular motors in transport, biosynthesis and energy transduction
- Molecular machines: New paradigms in structure, function and engineering

RNA and disease

ORGANIZERS

Takahiro Ito, University of Georgia
Anita Hopper, Ohio State University

SESSIONS

- Noncoding RNAs and disease
- RNA modifications and disease
- RNA binding proteins and control of RNA biogenesis in disease

Re-imagining STEM: Who we are and what we do

Sponsored by the Education and Professional Development Committee

ORGANIZERS

Daniel Dries, Juniata College
Nathan Vanderford, University of Kentucky

- Who we are: Creating a culture of wellness in science
- What we do: Choosing pedagogy over content

Understanding the rules of life

Sponsored by the Minority Affairs Committee

ORGANIZER

Suzanne Barbour, University of Georgia

SESSIONS

- Cell decision-making
- Regulation of gene expression
- Best practices for preventing/managing incidences of harassment in the workplace

Scouting for science

Am I a scientist scouting for answers or a Scout doing science?

By Ana Zambrana

I was born in Montevideo, the capital of Uruguay, but I grew up in a country house by the sea in a place now called the City of the Coast.

It was great to grow up in constant contact with nature: the starry skies, the winds and storms amplified by the nearby sea, the dunes next to my house and vast woodlands, the coastal birds, lizards and moles, cows and horses in what was then a rural area. I was connected to the scientific roots of humankind.

When I was 8 years old, following a family tradition, I joined the Scout Movement and henceforth spent a lot of time enjoying nature and doing community service with my group. My parents met in one of the first Scout groups in my country (unlike the U.S., scouting in Uruguay is all coed); they inspired me to join the Cub Scouts as soon as I was old enough. My nephew joined the pack in 2015, becoming the third generation of Scouts in our family.

We camped in the woods, built canoes to cross a small river, backpacked in the countryside, climbed hills guided by the Southern Cross and slept under the Milky Way. I learned that life is great and Mother Earth is wonderful. Scouting activities challenged me to break the boundaries of my comfort zone and to develop skills such as teamwork, empathy and problem-solving.

I was the group chief on a tent camping trip one summer evening about six years ago when a coming storm forced us to evacuate for safe overnight housing. The 30 adult leaders and educators had to make a spot decision and organize the safe transportation of about 100 children and teenagers. This was the first time some of the younger adults had been in charge of children, and they were in distress. The experienced leaders didn't see as much potential danger; we had to calm the younger adults, keeping all the leaders happy and all the children safe. We acted quickly, talking assertively and caring for the youngsters. As Scouts, we always were prepared for such situations. In this case, since it was a big group, I had called a nearby military base a week in advance to organize for a possible evacuation. It went very well; the younger Scouts had fun in the big rooms with bunk beds, and

COURTESY OF ANA ZAMBRANA

Top: Ana Zambrana, shown here in about 1985, grew up in a rural coastal area of Uruguay.
Bottom left: Zambrana, pictured in 2000, uses a globe to show Brownies and Junior Girl Scouts in Rochester, Minnesota, where her home country of Uruguay is.
Bottom right: Ana Zambrana, center, poses with her fellow Scouts in 1999 in Uruguay.

soldiers greeted us, saying they had been Scouts when they were younger.

Now, 30 years after joining the Scout Movement, I am a biochemist specializing in nanotechnology and plant biotechnology.

As a child and teenager, I was deeply interested in exploring the world around me. Whether in astronomy, physics or other natural sciences (my father was an officer in the merchant marines) or in the social sciences (my mother had a degree in sociology and is now an English translator), I wanted to understand how our surroundings affect our lives. Among my wide-ranging interests, biology attracted me from the very beginning: I wanted to learn the secrets of life itself.

In high school, I did not do particularly well in science courses, and I had to study hard to pass the exams. My school counselor encouraged me to take more science credits, and I majored in biology in college. I did not find it easy, but, still intrigued by the wonders of life, I enjoyed the challenge. After a year abroad in the U.S. as an exchange student, I made up my mind to start a career in biochemistry.

Due to limited science funding in my country, I've faced difficulties. My university did not have funds for a full-time research position, so I had to earn my Master of Science part time and needed twice the time to graduate. I worked long hours in the lab, distancing myself from the outside world. I analyzed isolated cardiomiocytes from diabetic mice and tested their stiffness using atomic force microscopy.

At the same time, I joined the directive board of the Uruguayan Scout Movement — becoming a scientist during the week, a Scout on weekends. I no longer work directly with young people, but I help coordinate activities around the country. I contribute from this position to the World Scout Movement because I believe the values we learn as young Scouts remain forever.

I can no longer divide these two aspects of myself: Am I a scientist scouting for answers or a Scout doing science?

I've concluded that I am both, and they are interconnected.

Scouting let me see challenges as learning opportunities, learn useful life skills and do research from a young age. As an adult, I apply these experiences in my life. After months of struggling with an experiment, it's fascinating to find out whether my hypotheses are confirmed.

My community service is using science for social justice; my research topics — biofortified rice for my bachelor's degree and Type 1 diabetes for my master's thesis — have had a strong social component.

Rice is polished because the outer components, rich in vitamins, rot and get moldy, making it more expensive to store. White polished rice, mostly starch, has almost no nutrients. Therefore, people in developing countries whose main food is white rice have poor nutrition and often suffer from anemia and iron deficiency. The rice developed in my lab (which I analyzed at the molecular level) had higher levels of iron than normal rice; I was motivated to work in a project that helps reduce health problems.

For my master's studies, I worked on a project looking for a possible explanation and treatment for heart failure due to Type 1 diabetes. Once again, I wanted to help patients to have better and longer lives.

For the past three years, I have worked part time as a high school biology teacher. Explaining to my students what I do in the lab reinforces my commitment to research. They ask big questions: What is the meaning of life? If our bodies decompose because we are organic, does that mean we are reincarnating in a new life form? If our telomeres didn't degrade, could we be immortal?

When I tell my students that my research is on diabetes, they urge me to find a cure. Most have diabetic relatives. This reminds me that what we do in the lab can improve people's lives. Science communication has become a new interest, as I must explain my research to my students.

Scouting taught me to organize group activities and to give workshops. It gave me a head start in science communication and teaching varied audiences in programs such as Gusto a Ciencia — Taste of Science — where we do science outreach in bars and restaurants in Montevideo. I've done science monologues in several countries in South America, sharing my passion for research from the stage with my outreach group, Bardo Científico. In 2017, I was invited to join the American Society for Biochemistry and Molecular Biology Science Outreach and Communication Committee. Now I work with them to reach the society's education and communication goals.

I am a scientist scouting for answers and a Scout doing science. Whatever obstacles might come my way, I shall be fearless and march onward — for science.

An earlier version of this essay was published on The Xylom, a website where scientists tell their stories.

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CLASSIFIEDS

Soka University of America: Open Rank Professor of Biochemistry

Soka University of America (SUA) seeks to fill a position for a full-time tenure-track Professorship (Open-Rank) in Biochemistry beginning August 2020. The successful candidate will demonstrate their ability to excite and interest students in small classroom and laboratory settings and to develop a productive program of research and scholarship. This position will support SUA's new Concentration in Life Sciences and Pre-Health Program housed in a new state-of-the-art science teaching and research facility. The teaching responsibilities of this position include developing and teaching new biochemistry and interdisciplinary classroom and/or laboratory courses for these programs.

http://www.asbmb.org/Careers/Jobs/80710/

Amherst College: Assistant Professor of Biochemistry

The Department of Biology at Amherst College invites applications for a tenure-track position at the rank of assistant professor in the area of biochemistry, to begin on July 1, 2020. We seek a colleague who is committed to teaching and scholarship in a liberal arts college, and who shows promise for establishing a high-quality research program that involves undergraduates. A Ph.D. is required, and postdoctoral experience is strongly preferred. The successful candidate will teach an advanced biochemistry course with laboratory and rotate through a team-taught introductory course in molecular and cellular biology. Additional teaching responsibilities will depend on the candidate's interests and expertise. Pedagogical support is offered by Amherst's Center for Teaching and Learning and other institutional initiatives.

http://www.asbmb.org/Careers/Jobs/80676/

FDA/CBER: Senior Staff Fellow — Allergic Diseases (Biologist)

The FDA's Center for Biologics Evaluation and Research (CBER), Office of Vaccines Research and Review (OVRR), Division of Bacterial Parasitic and Allergenic Products (DBPAP) is recruiting to fill a Senior Staff Fellow position to serve as a Principal Investigator in the Lab of Immunobiochemistry. Members of DBPAP are actively engaged in a variety of areas including allergic diseases, bacterial pathogens, vaccines and the microbiome. These investigators lead research teams in the fields of immunology, microbiology and gene therapy employing state-of-the-art techniques to address critical public health issues as part of the CBER mission. DBPAP is located at the FDA's White Oak campus in Silver Spring, Maryland and is part of the CBER research program, which includes more than 100 principal investigators. The newly built laboratory complex at White Oak includes core facilities, such as flow cytometry, confocal and electron microscopy.

http://www.asbmb.org/Careers/Jobs/80702/

Texas A&M University: Postdoctoral Position

Dr. Robert Chapkin's laboratory is focused on environmental modulation of membrane biology and its impact on chronic disease risk. Our lab infrastructure includes: Flow cytometry, single cell imaging, cell sorting and 3D mouse and human organoid cell culture, fluorescence microscopy (FLIM, FRET, TIRF) and super-resolution microscopy (STED, STORM), among others. Signaling pathways of interest include Wnt/EGFR/Ras dependent networks. The successful candidate must have a PhD degree in cell biology, biochemistry, chemistry, systems biology, nutrition, or relevant field. The candidate must be highly motivated, comfortable with technical challenges and problem solving and able to work collaboratively. Experience with fluorescence microscopy is an asset. Competitive salary and benefits are available commensurate with experience. Fluent English, a track record of strong publications, and a cooperative attitude are a must for this position.

http://www.asbmb.org/Careers/Jobs/80507/

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