Vol. 20 / No. 7 / August 2021

ASBMB TODAY

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

Careers Issue

Outlook & Opinions

FAST-TRACK YOUR ABSTRACT!

Hate waiting months to hear if your meeting abstract has been accepted?

Submit your abstract for the 2022 ASBMB Annual Meeting in Philadelphia 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.

Priority consideration deadline is Oct. 15. The system will open in September.

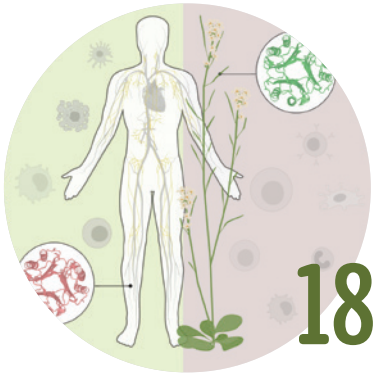
2022 ASBMB Annual Meeting
APRIL 2–5 | PHILADELPHIA

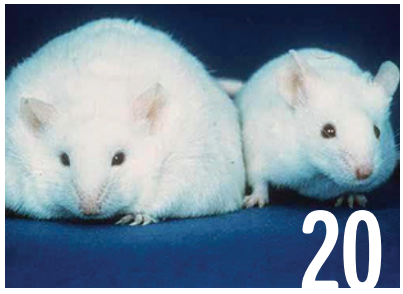
ASBMB EB Experimental Biology

The ASBMB annual meeting is held in conjunction with Experimental Biology.

CONTENTS

NEWS

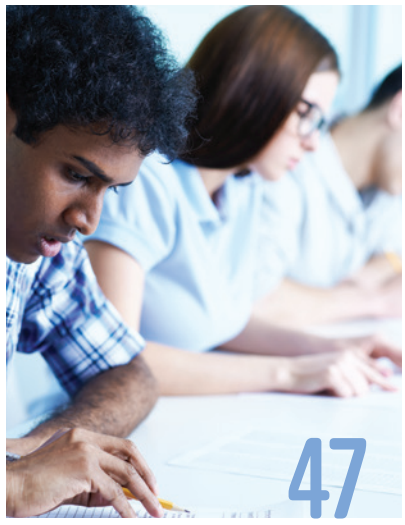




FEATURES

Careers Issue

PERSPECTIVES



ASBMB TODAY

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

www.asbmb.org/asbmbtoday
PRINT ISSN 2372-0409

Be special with us

By Comfort Dorn

Though I hear great things about Southern California, I can't imagine living in a place without real seasons. I like some punctuation in my year: the first snowfall, the first crocus, the first red leaf drifting from a branch. I could live without the first 90-degree day, but it helps me appreciate that wonderful morning in October when I can smell the first autumn chill.

I like holidays for the same reason. They give me something to look forward to. I can make lists of stuff to buy and dig out all my best recipes. I inherited a lot of holiday traditions — especially from my mother, who loves any excuse to buy festive napkins — but now that I feel free to ditch the ones with an unbalanced work-to-pleasure ratio, holidays are a lot more fun.

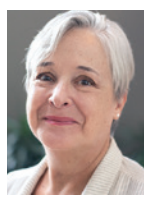
I also like special issues of this magazine. This is my fourth Careers Issue — August 2018 was the first ASBMB Today that I really edited, so I have a soft spot for careers (you never forget your first issue). Last month, we published our inaugural Reimagining Issue (another tradition in the making?). And in January, if all goes according to plan, we'll roll out our fourth Wellness Issue.

If I had to pick a favorite holiday, I'd be torn between Halloween and Christmas, but I'm pretty sure Wellness is my favorite issue of ASBMB Today. Because I'm mostly a mom (now also a grandmother), I like to take care of people, and it makes me happy to see them take care of themselves. I worry about all you scientists pipetting all day and hunching over a hot autoclave. I enjoy reading about your self-care rituals and hacks.

And even though the mercury is still dancing around 90 — at least in the metro D.C. area — it's not too early to be thinking about January and Wellness 2022. As we creep out of our pandemic state, maybe you've started a new practice to care for your body, mind or spirit that you intend to continue even when the sidewalk is no longer littered with used facemasks. Maybe you have newfound appreciation for longtime healthy habits.

Whatever you do for wellness, we want to read about it. Aim for about 500 to 1,000 words for your first draft. The deadline is Oct. 15.

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



Kinzy assumes Illinois State presidency

Terri Goss Kinzy, formerly a professor and the vice president for research and innovation at Western Michigan University in Kalamazoo, has been named president of Illinois State University. Her appointment began July 1.

Kinzy had been at Western Michigan University since 2018. In addition to running a laboratory that focused on protein synthesis and drug development, she oversaw offices at the university responsible for research, contracts, animal facilities, communications and other administrative areas. Previously, she was a professor at Rutgers University's Robert Wood Johnson Medical School, where she served as a senior associate dean, directed the M.D./Ph.D. program and led a core facility, as well as vice president for research for Rutgers University.


KINZY

Kinzy's research focuses on translation mechanisms, particularly eukaryotic elongation factor complexes that deliver amino acid–bound tRNAs to the ribosome. Her lab has worked on the structure and organization of elongation factors on their own or in complex with the ribosome, as well as noncanonical EF functions such as actin binding.

Kinzy leads the American Society for Biochemistry and Molecular Biology's Public Affairs Advisory Committee, and she is a fellow of the American Association for the Advancement of Science.

She earned her Ph.D. in biochemistry at Case Western University and did postdoctoral research in molecular genetics at Carnegie Mellon University.

Johnson selected as Azrieli Global Scholar

Elizabeth L. Johnson, an assistant professor at Cornell University's division of nutritional sciences, is one of 19 Azrieli Global Scholars chosen for the 2021 class by the Canadian research organization CIFAR.

Johnson, a molecular biologist by training, studies the role of the microbiome in infant nutrition. Her lab focuses on how bioactive lipids from human milk influence microbial metabolism and how microbial metabolites in turn affect an infant's health.

She earned her Ph.D. in molecular biology at Princeton University studying cell cycle transcriptomics and conducted postdoctoral research in the lab of Ruth Ley, who is now at the Max Planck Institute for Developmental Biology, before starting her own lab at Cornell in 2018.


JOHNSON

CIFAR is a charity based in Canada that supports international scholars in themed research areas such as Humans & the Microbiome or Fungal Kingdom Threats & Opportunities. (The organization originally was named the Canadian Institute for Advanced Research.) Recipients of its Azrieli grant are matched with a research mentor, receive $100,000 Canadian in research funding, and join a CIFAR research program for two years.

"Beyond ecstatic to join this inspiring group of scholars," Johnson tweeted when the award was announced in May. "Shoutout to my family who tirelessly listened to me talk microbiome and human milk during one of the most insane periods of my life."

Shea wins teaching award

Madeline Shea, a professor of biochemistry at the University of Iowa, was one of four faculty members to receive her institution's 2020 President and Provost Award for Teaching Excellence.


SHEA

Shea uses biophysical methods to study calcium-dependent structural changes to calmodulin and the mechanisms by which calmodulin binds to and regulates other cell signaling proteins, such as ion channels and kinases.

In addition, she is a committed educator who has developed new courses for graduate and undergraduate students, mentored numerous student researchers and founded the university's FUTURE in Biomedicine program, which enables faculty and undergraduates from primarily undergraduate colleges in Iowa to gain research experience in the institution's laboratories. (The full name of the program is Fostering Undergraduate Talent — Uniting Research and Education.)

Shea earned her Ph.D. at Johns Hopkins University and conducted postdoctoral research there before joining the University of Iowa's biochemistry department in 1989.

CONTINUED ON PAGE 5

Academy elects new members

The National Academy of Sciences has announced the election of 120 members — 59 of whom are women, the most elected in a single year — and 30 international members in recognition of their achievements in original research. Nine of those elected are members of the American Society for Biochemistry and Molecular Biology.

Ta Yuan Chang is a professor in the biochemistry and cell biology department at the Geisel School of Medicine, Dartmouth College. The Chang lab studies cholesterol homeostasis in the central nervous system and in systemic tissues, with a focus on investigating the biochemistry and physiological roles of the cholesterol storage enzyme acyl-coenzyme A:cholesterol acyltransferase 1, a membrane protein in the endoplasmic reticulum, in health and diseases.

Michael L. Dustin is a professor of molecular immunology and director of research at the Kennedy Institute of Rheumatology, University of Oxford. Dustin's lab studies the immunological synapse and recently observed that the small vesicles enriched in T cell receptor, synaptic ectosomes, are directly budded into the immunological synapse, handing off T cell receptor and other cargo to the antigen-presenting cell.

Vadim N. Gladyshev is a professor of medicine at Harvard Medical School and director of redox medicine at Brigham and Women's Hospital. Gladyshev's lab studies the molecular basis for natural changes in longevity and recently sequenced the genomes of the naked mole rat, the Brandt's bat and other mammals, uncovering adaptations that contribute to their exceptional life spans.

Maureen R. Hanson is a professor in the molecular biology and genetics department in the College of Agriculture and Life Sciences at Cornell University. The Hanson lab studies molecular and cell biology of plant organelles, photosynthesis and the pathophysiology and molecular biology of myalgic encephalomyelitis, also known as chronic fatigue syndrome.

Joseph Heitman is a professor and chair of the molecular genetics and microbiology department at the Duke University School of Medicine. The Heitman lab discovered TOR and FKBP12 as targets of the immunosuppressive natural product rapamycin and defined nutrient-sensing pathways in the model yeast Saccharomyces cerevisiae. They study unisexual reproduction and mechanisms of pathogenesis and drug action and resistance with the fungus Cryptococcus neoformans and other human fungal pathogens.

Rachel Klevit is a professor of chemistry and biochemistry in the biochemistry department at the University of Washington. The Klevit lab studies protein–protein interactions involved in quality control and repair, which play important roles in human disease, including projects in BRCA1, the breast cancer susceptibility protein; ubiquitinases; and human small heat shock proteins alpha-B crystallin and HSP27.

Margaret A. Phillips is the chair of biochemistry and a professor in the biochemistry and pharmacology department at the University of Texas Southwestern Medical Center at Dallas. Phillips' lab studies polyamine and nucleotide metabolism in African trypanosomes and is developing inhibitors of pyrimidine biosynthesis and polyamine biosynthesis to treat malaria and African sleeping sickness.

Geeta J. Narlikar is a professor in the biochemistry and biophysics department at the University of California, San Francisco. Narlikar's lab studies how the folding and compartmentalization of our genome is regulated to generate the many cell types that make up our body. Her laboratory has pioneered the application of sophisticated biophysical approaches to study the mechanisms of macromolecules that regulate genome organization.

Wilfred A. van der Donk is a Howard Hughes Medical Institute investigator and chair of the chemistry department at the University of Illinois, Urbana–Champaign. The van der Donk lab focuses on the discovery, mode of action, and mechanism of biosynthesis of two classes of antibiotics: ribosomally synthesized and post-translationally modified peptides and phosphonate antibiotics.

CONTINUED FROM PAGE 3

Her prior awards include the Iowa Center for Research by Undergraduates' Distinguished Mentor Award, the Biophysical Society's Emily M. Gray Award for contributions to education, and the Carver College of Medicine Collegiate Teaching Award.

Wolberger to chair biophysics department

Cynthia Wolberger, a professor at the Johns Hopkins University School of Medicine, is the new director of the school's biophysics and biophysical chemistry department.

Wolberger, a structural biologist, studies the intersections between post-translational histone modifications and transcription regulation. Her team uses structural methods to investigate ubiquitination on the nucleosome protein histone H2B, which is modified by a single ubiquitin in response to DNA damage and during transcription. They also study enzymes involved in converting histone modification to transcription activity, focusing on the SAGA complex, which deubiquitinates H2B and acetylates another histone to activate transcription.

WOLBERGER

Wolberger is a fellow of the American Association for the Advancement of Science and the Biophysical Society and an elected member of the National Academy of Sciences. She has received, among other honors, the Protein Society's 2018 Dorothy Crowfoot Hodgkin Award for "exceptional contributions in protein science which profoundly influence our understanding of biology."

She earned her Ph.D. at Harvard University and did postdoctoral research at the University of California, San Francisco, and the Johns Hopkins University School of Medicine.

Steitz and Maquat to share Alpert Foundation prize

Joan Steitz and **Lynne Maquat** have won the 2021 Warren Alpert Foundation Prize for work that has improved the understanding, prevention, treatment or cure of human disease. Both have made significant contributions to the field of RNA biology.

STEITZ

The prize is administered by the foundation and Harvard Medical School, which holds a symposium in the winners' honor each fall.

Steitz is a professor of molecular biophysics and biochemistry at Yale University and an investigator at the Howard Hughes Medical Institute. As a postdoc, she made seminal contributions to structural knowledge about prokaryotic translation, demonstrating that ribosomes use complementary base pairing to locate translation start sites; as a professor, she led a team to understand the structure of the spliceosome and the role of small nucleolar ribonucleoproteins, or snRNPs, in splicing quality control. Her lab has studied how snRNP production can go awry and contribute to disease in viral infection and in autoimmune conditions such as systematic lupus erythematosus, in which antibodies attack snRNPs.

MAQUAT

In an article on Harvard's website, Steitz said, "Sharing the joy of discovery in this area with many talented mentees ... has continually brought deep satisfaction."

Maquat, a professor of biochemistry and biophysics at the University of Rochester, also studies problems with splicing and other steps in mRNA production and maturation. Her group discovered nonsense mediated decay, or NMD, the mechanism by which the cell recognizes and removes defective mRNA. In later work, they found that cells can alter the efficiency of NMD to adapt to changes in environment, such as during differentiation, and that dysregulated NMD is a feature of fragile X syndrome, the most common single-gene cause of autism and intellectual disability. Maquat is the founding director of the Center for RNA Biology at Rochester and founding chair of Graduate Women in Science.

"I am honored to be recognized for research accomplished by the many members of my lab — dedicated individuals who trained and worked with me to solve the complicated puzzles that continually cropped up as we dug deeper into our studies of mRNA," she said.

The pair will share a cash prize of $500,000 and be feted at a virtual symposium Oct. 7.

Earlier this year, they shared the 2021 Wolf Prize. Steitz won the ASBMB's Herbert Tabor Research Award in 2015. Maquat won the Federation of American Societies for Experimental Biology Excellence in Science Award in 2018.

Craik to join Royal Society

David Craik, a professor of chemistry and structural biology at the University of Queensland and director of the Australian Research Council Centre of Excellence for Innovations in Peptide and Protein Science, recently became a fellow of the Royal Society.

The Royal Society of London inducts up to 60 new members each year, most from the U.K. and the Commonwealth. It is the world's oldest scientific society.

CRAIK

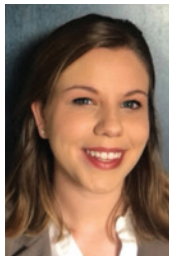
Craik is known for his discovery with colleagues of cyclotides, circular cysteine-rich peptides with N and C termini joined. A structural biologist, he and his team described the structure of numerous plant and animal cyclic peptides, including a family of cyclotides stabilized by a cystine knot structure. He also has been involved in adapting structural features from cyclic peptides to make longer-lasting peptide drugs.

Craik earned his Ph.D. in organic chemistry at La Trobe University in Melbourne and came to the United States to do postdoctoral research at Florida State University and Syracuse University. He has worked at the University of Queensland since 1995. Among his prior international honors are the Adrien Albert Award and the HG Smith Medal from the Royal Australian Chemical Institute; the Hirschmann Award in Peptide Chemistry from the American Chemical Society; and the GlaxoSmithKline Award for Research Excellence. He is a fellow of the Royal Australian Chemical Institute and the Royal Society of Chemistry.

Wiegel lands Watson fellowship, wins presentation award

Savannah Wiegel, a senior biochemistry/molecular biology major

at Hendrix College in Conway, Arkansas, landed the Outstanding Presentation award for undergraduate talks at the virtual 2021 Southeastern Yeast Regional Meeting held in April. Wiegel's 10-minute talk described her research on how RNA polymerase II overcomes DNA-binding proteins that present an obstacle to transcription, which she carried out in the lab of Hendrix biology professor Andrea Duina.



WIEGEL

After graduation, Wiegel plans to spend a year traveling as a Thomas J. Watson fellow. This fellowship is awarded to recent college graduates from a handful of U.S. liberal arts colleges to go abroad in pursuit of "purposeful, independent exploration."

Wiegel, who hopes to work in health care, plans to study narrative medicine, which encourages doctors to strengthen their communication with patients by recognizing people's stories and using storytelling as part of their clinical practice. She will investigate the role of narrative medicine in public health initiatives in Ireland, Switzerland, Japan, Guatemala and Argentina.

Upcoming ASBMB events and deadlines

AUGUST

1	**RNA Day**
5	Abstract and early registration deadline for ***Emerging roles of the nucleolus***
9	**National Breastfeeding Month**

SEPTEMBER

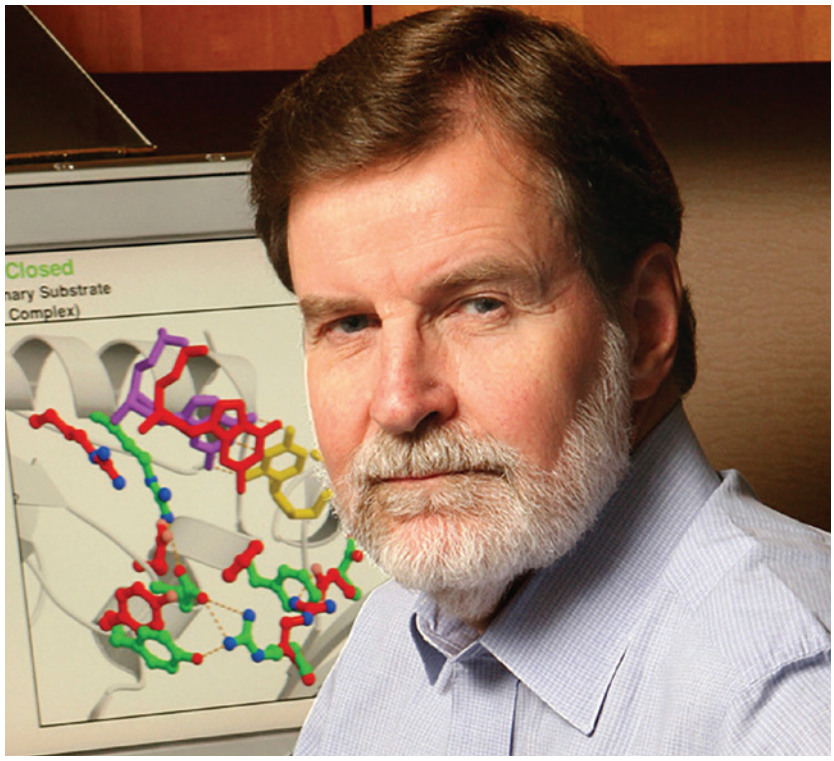
1	**Cholesterol Education Month**
1	Abstract deadline for ***Serine proteases in pericellular proteolysis and signaling***
8	**Blood Cancer Awareness Month**
15	**Hispanic Heritage Month**
20–24	**Postdoc Appreciation Week**
20–24	**Peer Review Week**
29	**World Heart Day**
30	Early registration deadline for ***Serine proteases in pericellular proteolysis and signaling***

OCTOBER

1	ASBMB accreditation program deadline
1	Registration deadline for ***Emerging roles of the nucleolus***
4	**Breast Cancer Awareness Month**
6–9	***Emerging roles of the nucleolus meeting***
10	**World Mental Health Day**
15	ASBMB annual meeting priority abstract deadline
16	**World Food Day**
12	**Bone and Joint Health Action Week**
18	**Disability Employment Awareness Month**
25	**National Eczema Awareness Month**
27	Registration deadline for ***Serine proteases in pericellular proteolysis and signaling***
28–30	***Serine proteases in pericellular proteolysis and signaling meeting***

Samuel H. Wilson Jr. (1939–2021)

By Angela Hopp



NATIONAL INSTITUTES OF HEALTH

Sam Wilson joined the American Society of Biological Chemists (later renamed the American Society for Biochemistry and Molecular Biology) in 1981. He served on the editorial board of the society's Journal of Biological Chemistry from 1992 through 1997 and, all told, published 68 articles in it. He served as a member of the ASBMB Council in the early 2000s.

Samuel H. Wilson Jr., who made seminal contributions to the field of DNA repair and who served for decades as a leader at the National Institutes of Health, died at his home in Chapel Hill, North Carolina, on April 23. He was 81.

Wilson's research career was dedicated to the study of genomic maintenance and DNA repair. He pioneered molecular biology tools, determined the structure of DNA polymerases and elucidated details in the base excision-repair pathway.

Wilson was born to Samuel H. Wilson Sr. and Sue Whatley Wilson on Aug. 5, 1939.

He earned his undergraduate degree at the University of Denver in 1961 and spent the next year as a graduate fellow at the department of chemistry and the Denver Research Institute.

He then moved on to Harvard Medical School, where he worked under Mahlon Hoagland. Hoagland years earlier had demonstrated the initial step in protein synthesis: the activation of amino acids by formation of aminoacyl adenylates from amino acids and ATP. He also discovered transfer RNA.

In 1967, Hoagland left Harvard for an appointment at Dartmouth Medical School, and Wilson went with him. Wilson earned his medical degree from Harvard in 1968.

According to a tribute by E. Bradridge "Brad" Thompson, an emeritus professor at the University of Texas Medical Branch in Galveston, "He always had aimed to do medically relevant basic research, thus choosing the M.D. as his advanced degree and taking extra training in biochemistry in lieu of clinical postdegree training."

As many new doctors did in those days, Wilson joined the U.S. Public Health Service.

Beginning in 1968, at what was then called the National Heart Institute (now the National Heart, Lung and Blood Institute), Wilson worked as a postdoc for geneticist Marshall Nirenberg, who later that year shared the 1968 Nobel Prize for physiology or medicine with Har Gobind Khorana and Robert W. Holley "for their interpretation of the genetic code and its function in protein synthesis."

Wilson began his own lab at the National Cancer Institute in 1970. It was the start of a long and fruitful independent career during which he not only made groundbreaking discoveries (more than 400 publications and several edited volumes) but also mentored dozens upon dozens of graduate students, postdoctoral fellows and other researchers. His research group studied the structures of enzymes involved in synthesizing and repairing DNA.

He became chief of the Nucleic Acids Enzymology Section in the Laboratory of Biochemistry in 1986.

During the 1990s, Wilson briefly was lured away from the NIH to serve as the founding director of the Sealy Center for Molecular Science at the University of Texas Medical Branch in Galveston. According to Thompson at UTMB, it was the first transdepartmental center at the institution, and Wilson assembled "one of the world's strongest collections of DNA repair experts."

"Sam shared the realization that the then-new tools being developed and improved in molecular and structural biology were making possible the dream of studying the many important but previously inaccessible molecules critical for cellular function," Thompson wrote in his tribute.

Upon his return to the NIH in 1996, Wilson joined the National Institute of Environmental Sciences in Research Triangle Park, North Carolina. He first served as deputy director and then acting director until 2009, at which point he focused solely on the work in his own lab.

Over his lifetime, Wilson received many awards and honors. In 2009, he was elected as a fellow by the American Association for the Advancement of Science. He frequently was invited to serve as a keynote speaker for symposia.

In 2015, he received the highest honor given to an intramural scientist, an NIH Director's Award. More specifically, he won the Ruth L. Kirschstein Mentoring Award. More than 100 former students and colleagues turned out to celebrate him. (In an NIEHS newsletter that year, you can see a special cake shaped like DNA polymerase beta, with fondant repair workers meant to depict its key role in base-excision repair.)

Timely tribute

In 2020, the journal DNA Repair, for which Sam Wilson had served as editor-in-chief since 2011, compiled a collection in Wilson's honor.

In his editorial, Philip C. Hanawalt of Stanford University wrote that the contributors wanted "to honor him for his numerous fundamental contributions as a pioneer and leader in the field of genomic maintenance, and for his generous and thoughtful support of his associates."

Bennett Van Houten, who was recruited to the Sealy Center for Molecular Science at Galveston during Wilson's time there and who later overlapped with Wilson at the National Institutes of Health, provided several figures and tables of interest: a graph showing Wilson's volume of publications during his 55-year career, a keyword interactome, a list of Wilson lab personnel and a co-authorship interactome.

Dozens of other scientists contributed reviews on DNA polymerases and DNA repair. The full open-access collection is available at sciencedirect.com/journal/dna-repair/vol/93/suppl/C.

In a 2020 tribute, Philip C. Hanawalt of Stanford University described Wilson's teaching style: "(He) developed a unique ability to explain details of the complex structures revealed by crystallography in a straight-forward manner that could be understood and appreciated by students and others, who were not experienced in X-ray crystallography and the interpretation of resulting molecular models."

At the time of his death, Wilson was head of the DNA Repair and Nucleic Acid Enzymology Group at the NIEHS and held a second appointment at the institute's Epigenetics and Stem Cell Biology Laboratory.

He was preceded in death by his namesake son. He is survived by his wife, daughter, grandchildren and brother.

> "Sam shared the realization that the then-new tools being developed and improved in molecular and structural biology were making possible the dream of studying the many important but previously inaccessible molecules critical for cellular function."
>
> E. BRADRIDGE "BRAD" THOMPSON
> EMERITUS PROFESSOR
> UNIVERSITY OF TEXAS MEDICAL BRANCH

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

Advocate with the ASBMB

The American Society for Biochemistry and Molecular Biology Public Affairs Advisory Committee, the society's advocacy arm, welcomes applications from members who are interested in serving on the committee. The PAAC sets the society's policy agenda and leads its interactions with Congress, the White House and federal science funding agencies, such as the National Institutes of Health and the National Science Foundation. Advocacy experience is not required, but an interest in and basic understanding of the policymaking process are helpful. Send applications to ASBMB Public Affairs Director Benjamin Corb at bcorb@asbmb.org.

Heck joins MCP

Albert Heck of Utrecht University began a five-year term in April as an associate editor for the ASBMB journal Molecular & Cellular Proteomics. Heck is director of the Netherlands Proteomic Center. His lab is a leader in proteomics and the study of protein structure and interactions using mass spectrometry.

SUPPORTING JUNIOR SCIENTISTS

The ASBMB advocacy team submitted a letter in May to U.S. Citizenship and Immigration Services advocating for international students and scholars, who frequently face visa-processing delays and difficulty obtaining work visas after degree completion. Read the letter at asbmb.org/USCIS-comments.

Save the date! We're going to Philly

The 2022 ASBMB Annual Meeting will be held April 2–5 in Philadelphia. For the final year, we'll be meeting with our sister societies at the Experimental Biology meeting. Put this interdisciplinary event on your calendar. We look forward to seeing you! Sign up for email updates at asbmb.org/meetings-events/2022-annual-meeting.

Did you miss "Picture a Scientist"?

Late last year, the ASBMB Women in Biochemistry and Molecular Biology Committee hosted a screening and panel discussion about the award-winning film "Picture a Scientist." The film is now available for viewing on the PBS website (pbs.org/wgbh/nova/video/picture-a-scientist/) and on Netflix. You can watch the ASBMB event featuring director Sharon Shattuck at asbmb.org/meetings-events/picture-a-scientist.

Organize an event with the ASBMB

The society provides a variety of opportunities for members to bring people together, both virtually and in person, to share their research and make connections. From webinars to networking events to conferences over several days, the ASBMB will help you to bring your event to fruition.

Propose an event at asbmb.org/meetings-events/propose-event.

Two new MOSAIC scholars

In February, we announced the first five members of the inaugural cohort for the society's Maximizing Opportunities for Scientific and Academic Independent Careers, or MOSAIC, program. In April, we welcomed two new participants.

Josefina Inés del Mármol is a postdoctoral fellow in the lab of Vanessa Ruta at The Rockefeller University, where she is studying the structural mechanisms of odorant recognition by olfactory receptors. She was born and raised in Buenos Aires, Argentina. She earned an undergraduate degree in biology from the University of Buenos Aires and a Ph.D. in molecular neurobiology and biophysics at Rockefeller, during which time she was one of the Howard Hughes Medical Institute's inaugural international student research fellows. She is a mentor for the Científico Latino Project and a volunteer for the Society for Advancement of Chicanos/Hispanics and Native Americans in Science.

"I am excited to join a generation of scientists with heightened awareness and skills to promote diversity and inclusion in the biomedical workforce," del Mármol said. "To that aim, this award will provide me and fellow MOSAIC scholars with formal training and community resources to become active agents of social and academic change, while supporting our professional development to succeed as independent investigators."

Chelsey C. Spriggs is a postdoctoral fellow in the lab of Billy Tsai at the University of Michigan, where she studies polyomavirus trafficking to the nucleus. A native of Detroit, Spriggs earned her bachelor's in microbiology from Michigan State University and her Ph.D. in microbiology and immunology from Northwestern University, where she studied human papillomavirus infection and tumorigenesis. Last year, she led the fundraising team for the inaugural Black in Microbiology Week, which increased the visibility of Black microbiologists.

"I am so excited to be a part of such an amazing program! This NIH MOSAIC award will provide the career development and training required to ensure my future success as an independent investigator," Spriggs said. "In addition, I look forward to networking and building community with other MOSAIC scholars as we work to improve diversity and inclusion in science."

New publications department employee

Chengmin Jiang joined the ASBMB as assistant publications director in June. Prior to joining the ASBMB, he worked as senior development editor at the American Chemical Society focusing on manuscript triage workflow and manuscript transfer as well as journal strategy and data analysis. He can be reached at cjiang@asbmb.org.

Outreach grants for student chapters

The ASBMB Student Chapter Outreach Grants support chapters doing outreach activities in their communities. This year, we welcome proposals for virtual as well as in-person or hybrid programming and encourage applicants to be creative in their approaches. The deadline to apply for a grant worth up to $500 is Oct. 1. Visit asbmb.org/education/student-chapters/awards/outreach-grant.

ASBMB certification exam by the numbers

All students who are enrolled in an ASBMB-accredited degree program are invited to take the certification exam in their junior or senior year. The exam has been designed to test students' knowledge and understanding of the core competencies in biochemistry and molecular biology developed by the ASBMB and its members. Here's a glimpse at the 2021 exam:

1st year of online delivery

938 test takers

359 test takers (38.3%) earned degree certification

118 test takers (12.6%) earned certification with distinction

95 volunteer question writers and scorers

97% of scoring volunteers from 2020 also scored in 2021

Share your science outreach initiative!

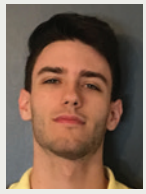
Are you doing science outreach in your community? Are you running your own science café or creating a program that you know will make an impact and want to share it? We want to know about it! Complete the form at asbmb.org/education/science-outreach and let us help promote your important work.

ASBMB inducts honor society members

The American Society for Biochemistry and Molecular Biology Honor Society (Chi Omega Lambda) recognizes exceptional undergraduate juniors and seniors pursuing degrees in the molecular life sciences at colleges or universities with ASBMB Student Chapters. Students are recognized for their scholarly achievement, research accomplishments and outreach activities.

The honor society inducted 31 new members this year. Meet them here. Learn more on the education page at asbmb.org.

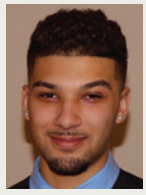
By Stephanie Paxson



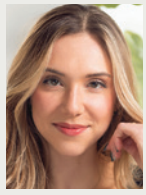
Nick Amendola recently graduated from the University of Nebraska–Lincoln. He starts medical school in the fall and is considering a career in academic medicine to help train future physicians and continue doing research.

Kimaya Bakhle recently graduated from Purdue University and now is taking a gap year to do research in the pathology department at Purdue's college of veterinary medicine. She hopes to attend veterinary school.

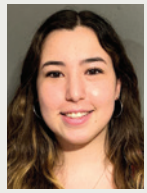
Ashleigh Bonanno recently graduated from St. Mary's University College of Maryland and is taking a gap year, working in a military research lab while applying to medical schools with the goal of becoming an emergency room physician.



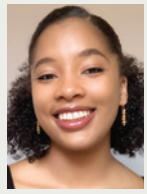
Elijah Castro plans to apply to medical school after he graduates from Marymount Manhattan College, with the goal of becoming a doctor in medicine and continuing research in molecular biology.



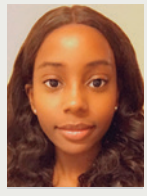
Taylor Collington recently earned a B.S. in biochemistry from the University of Tampa and will attend medical school in the fall. She plans to continue doing research in her medical career.



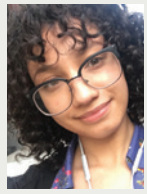
Victoria DeMarco is a biochemistry major at Monmouth University. After graduating in 2022, she plans to go directly into the science field either as a forensic scientist or as a research chemist.



Shadé Eleazer, a junior at Marymount Manhattan College with a double major in biomedical sciences and behavioral neuroscience, hopes to complete an M.D. specializing in internal/emergency medicine and a Ph.D. focusing on conscious and unconscious bias.



Teyana Grooms majored in biochemistry and minored in biology at Stephen F. Austin State University with the goal of becoming a pharmacist and assisting in the mass production and shipping of life-saving medications.



Khaitlyn Figueroa is majoring in biology and minoring in chemistry at Manhattan College. She plans to take two gap years to solidify her clinical experience before applying to medical school.

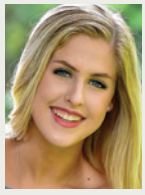
Nour-Saïda Harzallah majored in molecular biology and biochemistry and physics at Wesleyan University. She hopes to pursue a career in biomedical engineering, with a focus on molecular oncology research.

ASBMB inducts honor society members (CONTINUED)

Anna Hu majored in biochemistry at St. Bonaventure University. She plans to attend medical school and hopes to make impactful contributions to individual patient care, community education and population research.

Isabella Jacus recently graduated with honors in religion and biology with a specialization in biomedical and health sciences from Saint Leo University. She plans to attend medical school.

Kayla Karnes received her bachelor's degree in biochemistry in May from Texas Wesleyan University and plans to earn a Ph.D. in biological chemistry and pursue a career in research.



Anahita Keer graduated with honors in May from Texas Wesleyan University and plans to attend New York University to pursue a Ph.D. in chemistry. She then intends to complete her postdoc and build a career in academia.

Han Beom (Jack) Kwon plans to earn his M.A. in molecular biology and biochemistry through the Wesleyan University B.A./M.A. program and then pursue either a Ph.D. in a related field or a research career in industry.

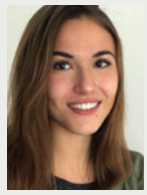
Hope Lewis is scheduled to graduate from Otterbein University in spring of 2022. She then plans to attend medical school to study pediatric oncology.

Shawn H. Lin is a junior at Wesleyan University majoring in biology, molecular biology and biochemistry, and biophysics.

Elizabeth Lucas is a student at Rochester Institute of Technology. She would like to go to graduate school to pursue a master's degree in genetic counseling.

Lucasantiago (Luca) Henze Macias graduated from the University of Texas at El Paso and will start graduate school in the biochemistry and cell biology program at Rice University in fall 2021.

Diandra Mastrogiacomo graduated from the University of Tampa with a B.S. in biochemistry in May and started the medical sciences Ph.D. program at the University of South Florida in August.



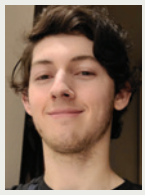
Rylee McDonnell recently graduated from Goucher College as a biochemistry and molecular biology major with a premedical concentration. She intends to take a gap year before attending medical school.

Alex Meyer recently graduated from the University of Nebraska–Lincoln as a biochemistry major. He plans to pursue a Ph.D. in pharmacology.

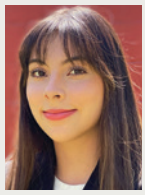
Aiah Nour is a senior biochemistry major at the University of Nebraska–Lincoln. After graduation in December, she hopes to enroll in an M.D–Ph.D. program.

Nicki Nouri recently completed her third undergraduate year at the University of Illinois at Chicago majoring in biology with minors in chemistry and entrepreneurship. She aspires to attend a D.D.S.–Ph.D. dual degree program.

Alex Poppel is a master's student in the molecular biology and biochemistry department at Wesleyan University. He intends to earn a Ph.D. in structural biology and work in the pharmaceutical industry.

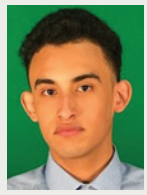


Paulina Rios aims to obtain a B.S. in biological sciences with a biomedical concentration at the University of Texas at El Paso and then earn a biochemistry Ph.D. to prepare for employment in the pharmaceutical industry or at a government health institution.

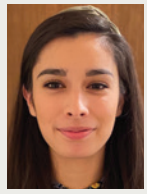


Elizabeth Scott is an undergraduate at Marymount Manhattan College with a double major in biomedical sciences and urban and environmental sustainability. She intends to pursue an M.Sc. or an M.P.H. and later a Ph.D. in environmental health sciences.

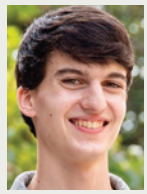
Ryan Torres, an undergraduate at Manhattan College, recently was accepted into the University of Michigan's program in chemical biology. After earning a Ph.D., he hopes to transition into the biotech industry or a government lab position.



Maya Vaishnaw is a member of the Wesleyan University class of 2021 with a molecular biology and biochemistry and psychology double major. She hopes to pursue research in clinical genetics.

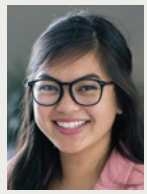


Zach Williams is set to graduate from the Rochester Institute of Technology in 2022 as a biomedical science major and chemistry minor. He then plans to attend Upstate Medical University to earn an M.D. and possibly a Ph.D. as well.



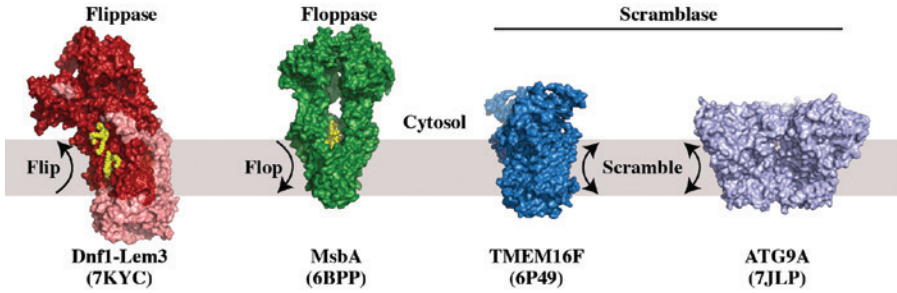
Huey-Xian (Kelly) Wong is an undergraduate at the University of Nebraska–Lincoln. She aspires to become a physician specializing in psychiatry or obstetrics/gynecology.

Stephanie Paxson (spaxson@asbmb.org) is the journals marketing associate at the ASBMB. Follow her on Twitter @stephaniepaxson.



Tour de flippase

By Todd R. Graham



COURTESY OF TODD R. GRAHAM

A few examples of flippase, floppase and scramblase structures. Dnf1 is dark red, and lipids bound to Dnf1–Lem3 and MsbA are in yellow.

The lipid flippase business is booming. Researchers are discovering new members of this protein family and reporting new structures for old members.

The term "flippase" was coined to describe any protein that catalyzes the flip-flop movement of phospholipid between the two leaflets of a membrane. However, we now recognize three functionally distinct categories of lipid transporters: flippases, floppases and scramblases.

Flippase is used to describe inward-directed pumps that transport lipid unidirectionally from the extracellular leaflet to the cytosolic leaflet, while floppase describes outward-directed pumps that transport lipid in the opposite direction. Most flippases and floppases are adenosine triphosphate–powered pumps in the P4-ATPase and ATP-binding cassette, or ABC, transporter families, respectively. Energy-independent transporters that allow bidirectional transport of lipid are called scramblases, and these are members of several evolutionarily distinct protein families.

Flippases have a primary role in establishing and maintaining membrane asymmetry in eukaryotic cells by enriching phosphatidylserine, or PS, and phosphatidylethanolamine to the cytosolic leaflet of the plasma membrane and removing these lipids from the extracellular leaflet.

The structural basis for lipid substrate recognition by P4-ATPases started to emerge over the past two years from cryo-electron microscopy structures of P4-ATPases with PS bound in an entry site where substrate initially loads. However, recent cryo-EM structures of fungal Dnf1–Lem3 reveal substrate also bound to an exit site that surprisingly sits 10 angstroms above the cytosolic leaflet. It will be interesting to determine if this cytosolically exposed exit site is conserved in other P4-ATPases.

Floppases function in the formation of asymmetric membranes as well as the export of lipids from the cell. MsbA from E. coli is an example of an ABC transporter that flops lipopolysaccharide substrate across the inner membrane. Cryo-EM studies have provided insight into how lipopolysaccharide enters MsbA from the cytosolic leaflet, but how this bulky substrate manages to flop as it moves across the membrane remains unclear.

Two types of scramblases break plasma membrane lipid asymmetry and expose signaling lipids such as PS on the extracellular leaflet. The anoctamin/TMEM16 family of scramblases are activated by a Ca^{++} influx and expose PS on blood cell membranes to stimulate clotting. Another type of scramblase, Xkr8, primarily acts during apoptosis and is activated by caspase cleavage. This results in PS exposure, which is important for recognition of the cell corpses by phagocytic cells.

Several new scramblases have been discovered with links to autophagy and lipoprotein secretion. ATG9, TMEM41B and VMP1, proteins implicated in the growth of autophagosomes, recently were shown to be scramblases. ATG9 localizes to the autophagosome, while VMP1 and TMEM41B proteins are endoplasmic reticulum residents. These scramblases are connected by a lipid transfer protein called ATG2 that mediates movement of phospholipid from the ER to the autophagosome. VMP1 and TMEM41B presumably allow for balanced extraction of lipid from both leaflets of the ER, while ATG9 would allow newly delivered lipid to flow into both leaflets of the autophagosome.

Flippase research is in a bull market right now, and the torrid pace at which new components and mechanistic insights are emerging bodes well for the future of this field.

Todd R. Graham (tr.graham@vanderbilt.edu) is a professor in the biological sciences department at Vanderbilt University. His lab studies membrane biogenesis and protein trafficking with an emphasis on the function of P4-ATPases.

Host immunity across kingdoms

By Nuala Del Piccolo

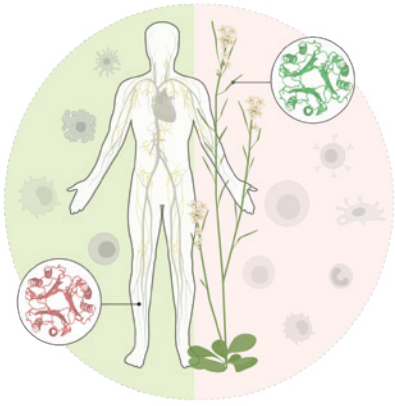
Almost a decade ago, Ralph Panstruga and Jürgen Bernhagen served together on a student's thesis committee at Rheinisch–Westfälische Technische Hochschule Aachen. At first glance, Panstruga, a molecular botanist, and Bernhagen, a biochemist in cardiovascular medicine, would seem to have little in common. However, they discovered a shared interest — host immunity — while chatting over coffee after the student's presentation.

Bernhagen told Panstruga about his research into macrophage migration inhibitory factor, or MIF, a noncanonical cytokine and chemokine that regulates innate immunity and is involved in inflammatory and cardiovascular diseases. Evolutionarily conserved, MIF was incompletely characterized at the time.

"Jürgen told me that he'd heard anecdotes that MIF-like chemokines should also exist in plants, which I couldn't believe, because chemokines are known to be animal-specific signaling molecules with dedicated receptors and signaling cascades," Panstruga said. "They were, in my view, unlikely to be present in plants."

Nonetheless, Panstruga returned to his office and did a computer search that identified related biomolecules based on sequence similarity. He found that Bernhagen was right: Plants have three homologs to MIF known as MIF/D-dopachrome tautomerase–like, or MDL, proteins. However, plants lack cognate receptors.

Panstruga and Bernhagen began characterizing the proteins in both kingdoms. "I've learned over the years that although the types of immune systems in plants and humans are really significantly different, there are some joint principles that have obviously developed over millions of years," Bernhagen said.



JELENA MILIC / LUDWIG MAXIMILIAN UNIVERSITY

The human chemokine MIF and its plant homolog MDL (depicted as crystal structures) regulate host immunity in humans (left) and Arabidopsis thaliana (right), respectively.

Bernhagen moved to Ludwig Maximilians University in 2015, but their collaboration continued. Their most recent study, published in the **Journal of Biological Chemistry**, characterizes the biochemical and biological activity of MDL in Arabidopsis thaliana, a plant from the mustard family.

The paper begins with a simple question: Where are MDLs located? Most human chemokines are secreted from cells; however, MIFs can be found both inside and outside the cell. Bernhagen and Panstruga's recent study shows that MDLs are inside cells. This is consistent with the hypothesis that MIF-like cytokines were originally intracellular proteins that evolved to gain secondary functions outside the cell.

The research team deleted the genes coding for MDL from A. thaliana and exposed both mutant and wild-type plants to common pathogens. Mutant plants were more resistant than wild-type to bacterial infections. A targeted metabolite screening failed to identify a mechanistic explanation.

The team plans to continue studying host immunity through characterization of MIF and MDL. "The mere comparison of plant protein structure and functions with human proteins — we call this structure–activity relationships — can tell us about which amino acids are important and inform design of drugs against the human protein," Bernhagen said.

"We learned a lot from each other regarding possibilities and limitations of our experimental systems," Panstruga said, "and how each can be used to address questions that are not so easy to address in the other system. For example, in plants we can easily generate transgenic lines; this would not be so straightforward in mice."

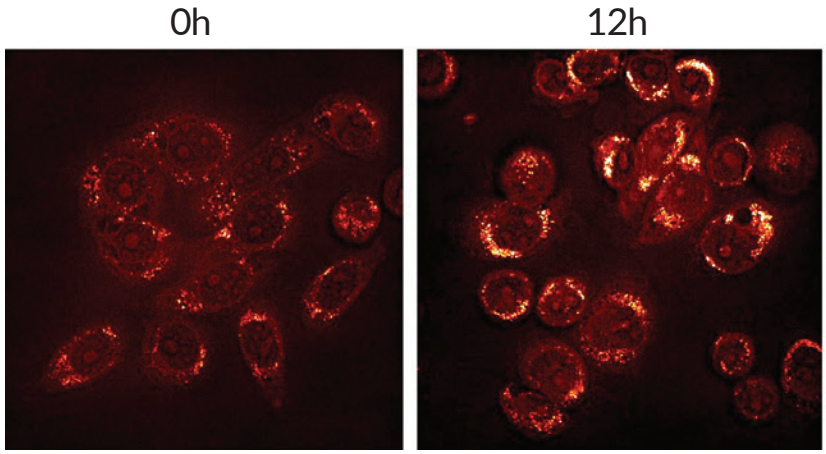
The two are eager for the post-pandemic return to campus. "We started working together after a chance meeting at a student's committee meeting," Panstruga said. "These little chats are important idea generators in science," Bernhagen said.

DOI: 10.1016/j.jbc.2021.100611

Nuala Del Piccolo (ndelpiccolo@ucdavis.edu) is a science writer in the biomedical engineering department at the University of California, Davis. She earned her Ph.D. in materials science and engineering at Johns Hopkins University.

Starved to death: Can dietary methionine combat cancer?

By Nicole Lynn



KAISER GROUP, UNIVERSITY OF CALIFORNIA, IRVINE

This image shows cancer cells (red) starved of methionine. The stress of this deficiency results in the accumulation of lipid droplets (yellow) in the cell.

The organic compounds that form proteins are called amino acids. Humans use amino acids as sources of energy for functions such as homeostasis, growth and repair. While our bodies can produce some amino acids (nonessential), others are strictly obtained through diet (essential).

Methionine, or Met, is an essential amino acid critical to gene regulation, protein production and cell metabolism. Unlike noncancerous cells, most cancer cells cannot recycle Met efficiently; instead, cancer cells rely on a continuous supply of methionine from external sources for survival. This vulnerability is known as Met dependence, or Met stress sensitivity.

A recent study published in the **Journal of Lipid Research** evaluated this phenomenon, focusing on the role of Met dependence in cancer cell lipid metabolism. Peter Kaiser of the University of California, Irvine, and collaborators at the University of California, Davis, Metabolomics Center and University of Texas MD Anderson Cancer Center used Met-dependent and Met-independent breast cancer cell lines to characterize changes to lipids in response to Met-stress sensitivity.

In the cell, diverse lipids make up the cellular membrane and aid in signaling and transport, and are important for nutrient and energy storage. Lipid metabolism is studied widely in heart disease, but researchers know little about lipid metabolism in cancer.

"In cancers, specifically in breast cancer, there has always been a connection to lipid metabolism," Kaiser said. "We are very interested in understanding how these changes in lipids can affect cancer cells and how they can translate into feasible drug targets."

Kaiser and colleagues fed the cells Met-deficient media to induce stress, then used high-performance liquid chromatography, genetic analysis and cell microscopy to characterize lipidomic changes. They found Met stress directly affects lipid abundance and remodeling in cancer cells, promoting the accumulations of lipid droplets and a global decrease in diverse lipid synthesis and abundance (with the exception of triglycerides). These changes suggest Met stress may affect the endoplasmic reticulum, or ER, an organelle in the cell responsible for many metabolic processes, including lipid synthesis.

"A lot of proteins are folded in the ER," Kaiser said. "This can lead to a stress response because protein folding becomes impacted in the ER as a consequence of the changes occurring to the lipids."

These findings support a previous study in which reduced dietary Met helped shrink tumors in rats when used in conjunction with radiation or chemotherapeutics.

Kaiser and his colleagues seek to understand the molecular mechanisms involved in cancer Met dependence, and effects on the cell cycle. These studies could increase knowledge of the unique metabolic needs of cancer cells and lead to better therapies.

Nicole Lynn (nalynn@ucla.edu) is a Ph.D. candidate at UCLA and a volunteer writer for ASBMB Today.

Using plasma proteomics to understand obesity

By Kian Kamgar–Parsi

During the COVID-19 pandemic, one of Western society's greatest health problems has continued its decades-long rise: obesity. According to the Centers for Disease Control and Prevention, obesity rates nearly tripled from 1962 to 2016 (from 14% to 40%), with obesity-related health care costs now likely over $150 billion annually. While the effects of obesity are easy to see, our understanding of its underlying physiology continues to evolve.

"Unfortunately, obesity is at epidemic levels in our communities," Stephen Twigg, an endocrinologist at the University of Sydney, said. "Methods to prevent it, let alone treat it, are still quite lacking."

Twigg and University of Sydney biochemist Mark Larance, along with an international team of scientists, have sought to characterize the interplay of two key obesity triggers. High–fat diets and lack of exercise both have been implicated in obesity; however, their effect on the plasma proteome (the milieu of soluble proteins within an organism) has not been well characterized. In a paper recently published in the journal **Molecular & Cellular Proteomics**, Larance and Twigg compared mice fed a high–fat diet to those fed a normal diet and subjected to various exercise regimens to elucidate their combined effect on the plasma proteome.

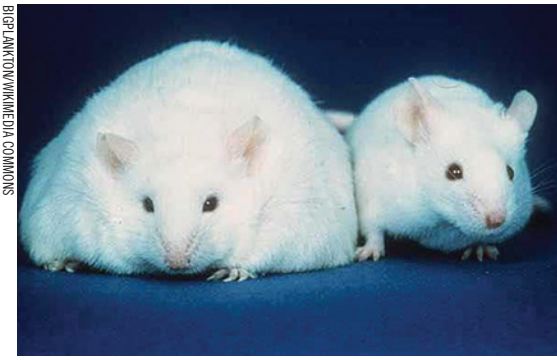
After 10 weeks on a high–fat diet, nearly 40% of detected plasma proteins in the mice showed changes. These changes were primarily in liver-associated proteins such as aldolase B, or ALDOB (a key sugar-metabolizing enzyme), a finding consistent with the prevalence of liver damage in obese mice and humans. For mice where these changes already had occurred, exercise as treatment after the fact provided little benefit: Only two of the 82 changed proteins were returned to pre-high–fat diet levels. However, in mice that exercised concurrently with the high–fat diet, roughly 20% of the proteins that were altered in the nonexercising mice maintained their healthy baselines. These effects were independent of the type of exercise, with both endurance and high-intensity interval exercise showing similar results.

"This is one of the first unbiased analyses of the response to high–fat diet," Larance said. "A lot of those changes, we couldn't have predicted what they would be. I've got the feeling that there are definitely proteins in the plasma that are being ignored at the moment that could be more sensitive than some of the current markers of liver damage … For example, ALDOB might be a more sensitive measure (than current clinical markers) both in humans and in mice."

Despite these exciting discoveries, significant questions remain. "From the most abundant protein to the least abundant protein spans 13 orders of magnitude," Larance said, noting the difficulty in detecting low-concentration but important protein species. The type of high–fat diet also heavily influences outcomes, with proteins behaving differently based on the types of fats and number of calories eaten. Additionally, as with any study in mice, differences between the specific changes seen in them and in humans are likely.

Despite these limitations, Larance and Twigg's work provides a significant advance in our understanding of the proteomics of obesity, and if nothing else, as Twigg concluded, "Probably much better to do some exercise rather than none."

DOI: 10.1074/mcp.TIR120.002343



BIGPLANKTONWIKIMEDIA COMMONS

A high-fat diet is known to cause obesity in both mice and humans. New research highlighting how exercise can prevent high-fat diet–induced changes in protein levels could provide new tools in the fight against obesity.

Kian Kamgar–Parsi (kkamgar@umich.edu) received a Ph.D. in biophysics from the University of Michigan. He currently works as a consultant to the pharmaceutical industry.

From the journals

By Nivedita Uday Hegdekar, Latavia Hill, Laurel Oldach & Anand Rao

We offer summaries of recent research papers published in the **Journal of Biological Chemistry,** the **Journal of Lipid Research**, and **Molecular & Cellular Proteomics**.

Driving dopamine modulation

If asked to name a chemical responsible for brain functioning, most people would say dopamine is among the first that come to mind. Dopamine is central for a number of functions, such as reinforcement of behaviors, motivation, memory, attention and mood. Dopamine is released by brain cells into synapses, where it acts on the receptors of postsynaptic cells. While some of the unused dopamine then is degraded, most is taken up into the releasing cell by the dopamine transporter, or DAT. This process allows DAT both to recycle dopamine and to regulate the duration and intensity of dopamine-mediated neurotransmission. Thus, understanding how DAT functions can affect the design of therapies for a number of brain-related disorders. Researchers know that DAT molecules can oligomerize but do not yet understand the biological significance of this ability.

In recent work published in the **Journal of Biological Chemistry**, Tatiana Sorkina and colleagues at the University of Pittsburgh describe a series of small molecules that link transporter conformation to oligomerization and endocytosis. The team used a combination of chemical cross-linking, fluorescence resonance energy transfer micros-

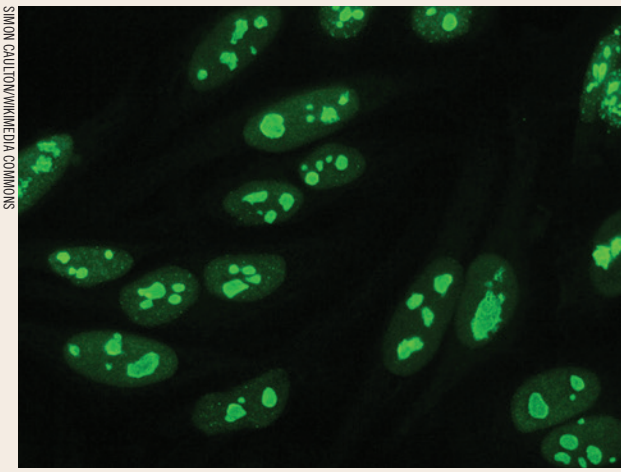
A lipid in the nucleus

Phosphatidylinositol is a complex molecule. The lipid's head group, a sugar, has three potential phosphorylation sites, generating seven potential phosphorylated species called phosphoinositides, each of which is thought to bind a different set of effector proteins and exert diverse effects.

Researchers long have known that cleavage of the head group from its hydrophobic fatty acid tails forms a cytoplasmic second messenger. More recent research has identified polyphosphoinositides, complete with fatty acids, in nonmembrane environments. Researchers have mapped the interactions of a few phosphoinositide species with cytoplasmic and nuclear proteins, but they do not understand yet the role of the triphosphorylated species PIP_3.

In a recent article in the journal **Molecular & Cellular Proteomics**, postdoctoral researcher Fatemeh Mazloumi Gavgani and colleagues at the University of Bergen in Norway describe how they used immunofluorescence to determine that nuclear PIP_3 mostly is located in the nucleolus, where ribosomes are assembled. Then they used mass spectrometry to identify PIP_3-interacting proteins from the nuclear fraction of HeLa cells; most of the proteins were nucleolus residents with known roles in RNA processing, splicing or catabolism, or translation.

SIMON CAULTON/WIKIMEDIA COMMONS



Immunofluorescence microscopy picks out nucleoli within the nuclei of cultured cells.

One binding partner was poly(ADP-ribose) polymerase 1, or PARP1, an enzyme that adds a chain of ADP-ribosyl subunits to protein substrates after DNA damage, mobilizing proteins involved in damage repair. Through truncation analysis and directed mutations, the authors found that three polybasic regions in PARP1 rich in arginine and lysine residues mediate its binding to PIP_3. The authors argue that the interaction suggests a link between PIP_3 and DNA repair that merits further study.

Given that the bulk of each PIP_3 molecule is hydrophobic, the researchers still aren't sure how it might be transported to or synthesized in the nucleolus and remain in solution. They speculate that the lipid could form micelles or be shielded by binding to carrier proteins.

DOI: 10.1016/j.mcpro.2021.100102

— **Laurel Oldach**

copy, an antibody-uptake endocytosis assay, live-cell lattice light sheet microscopy, ligand binding and substrate transport kinetics analyses, and molecular modeling and simulations. They showed that the DAT oligomerization and endocytosis induced by these small molecules involved interactions of four hydrophobic residues at the interface between two transmembrane helices. The authors then created a quadruple DAT mutant that replaced these same four hydrophobic residues and found that oligomerization and internalization of the receptor were suppressed. Moreover, the mutant DAT displayed altered dopamine transport kinetics and increased cocaine binding, suggesting that the residues involved in oligomerization also play an important role in the regulation of DAT function.

These findings show a direct coupling between conformational dynamics of DAT, functional activity of the transporter and the oligomerization leading to its internalization. They also highlight the identified transmembrane domains as a target for drug-mediated modulation of DAT activity.
DOI: 10.1016/j.jbc.2021.100430

How tissues regulate octanoate oxidation

Cardiac hypertrophy is a disorder characterized by the thickening of the heart muscle, and researchers have found evidence suggesting it sometimes is caused by defects in mitochondrial fatty acid oxidation, or mFAO. Some individuals with this condition have genetic deletions of CPT1 and CPT2, two enzymes important in the mitochondrial oxidative pathway that metabolizes fatty acids. Therapies for cardiac hypertrophy include a medium-chain fatty acid diet, although researchers do not yet know the molecular effects of this therapy.

In a recent paper in the **Journal of Lipid Research**, Andrea Pereya and a team from three U.S. universities describe how they determined that octanoate, a medium-chain fatty acid, had no effect on cardiac hypertrophy or pathological hypertrophy genes in mice that have a genetic deletion of CPT2. The researchers determined that liver mitochondria, not heart or skeletal muscle, oxidizes free octanoate and highly expresses mitochondrial medium-chain acyl-CoA synthases, or ACSMs. They also found that each type of tissue (liver, heart and skeletal muscle) oxidized an important metabolite of octanoate in the mFAO pathway, octanoylcarnitine, and they proposed a model wherein the liver oxidizes free octanoate via ACSMs and each tissue can metabolize octanoylcarnitine, which then is converted back to octanoyl-CoA in a CPT2-independent fashion.

The researchers concluded this work by hypothesizing that dietary medium-chain fatty acids experience high energetic catabolism in the liver but are metabolically limited in the heart, particularly in the absence of carnitine.
DOI: 10.1016/j.jlr.2021.100069

New approach holds promise for Alzheimer's diagnosis

The cerebrospinal fluid, or CSF, that surrounds and supports the central nervous system, or CNS, plays an important role in brain development and neuronal functioning. It is the only body fluid that directly interchanges with the extracellular fluid of the CNS and reflects ongoing pathological changes in the CNS. Thus, proteomic analysis of CSF has great potential for CNS-related disease diagnostics.

Glycosylation, an important post-translational modification, regulates many cellular processes. Defects in glycosylation have been linked to human diseases, making it a valuable target to study. While researchers have done extensive proteome profiling for CSF, few studies aim at unraveling a site-specific CSF N-glycoproteome.

In their recent paper in **Molecular & Cellular Proteomics**, Zhengwei Chen, Qinying Yu and a team at the University of Wisconsin–Madison describe their large-scale site-specific approach for in-depth CSF N-glycoproteome analysis, which allows for thorough coverage of CSF N-glycopeptides, including glycopeptide sequences, glycosylation site and glycan composition. In addition to generating the largest reported N-glycoproteome data set for CSF to date, the researchers applied this strategy to compare the N-glycoproteome coverage between people with and without Alzheimer's disease. They uncovered diverse and distinct glycosylation patterns, paving the way for promising glycosylation-based biomarker candidates for Alzheimer's. This work lays a foundation for more in-depth investigation of the functional roles of these glycosylated proteins in the progression of Alzheimer's and other neurodegenerative diseases.
DOI: 10.1016/j.mcpro.2021.100081

PIP_2 polices ion channel permeability

Transient receptor potential canonical type 5, or TRPC5, ion channels are calcium-permeable cation channels that are expressed in the brain and kidney. TRPC5 is

involved in fear-related behaviors and also plays a role in chronic kidney disease, making it a promising therapeutic target. TRPC5 channels are activated transiently by phospholipase C enzymes, which hydrolyze phosphatidylinositol 4,5-bisphosphate, or PIP_2, leading to phosphorylation of TRPC5 mediated by protein kinase C, or PKC. However, researchers do not understand yet how PIP_2 and its product diacyl glycerol, or DAG, activate and maintain TRPC5 channel activity.

In a paper published in the **Journal of Biological Chemistry**, Mehek Ningoo and colleagues at Northeastern University distinguish between the processes responsible for channel activation and those underlying inhibition. Using whole-cell patch-clamp coupled with an optogenetic tool to dephosphorylate PIP_2, the authors assessed channel–PIP_2 interactions influenced by activators, such as DAG, or inhibitors, such as PKC phosphorylation, and used total internal reflection microscopy to quantify the channel cell surface density. They showed that PIP_2 controls both the PKC-mediated inhibition and the DAG-mediated activation of TRPC5 currents by control of gating rather than channel cell surface density.

These findings may help researchers develop more selective and precise inhibitors to block TRPC5 channel

A mechanism of liver disease treatment

Nonalcoholic fatty liver disease, or NAFLD, causes liver swelling and sometimes cirrhosis due to excess fat accumulation. Epigenetic modification — specifically 5-methylcytosine, or 5mC, methylation — regulates gene expression, and a drug for NAFLD, 25-hydroxycholesterol 3-sulfate, or 25HC3S, now in clinical safety trials, plays a role in global regulation of gene expression. Previous research has suggested that 25HC3S is an epigenetic regulator.

Yaping Wang and a team based at Virginia Commonwealth University and the McGuire Veterans Affairs Medical Center published a paper recently in the **Journal of Lipid Research** elucidating the molecular mechanism of 25HC3S. The researchers determined that 25HC3S inhibited the activity of three DNA methyltransferases (DNMT-1, DNMT-3a and DNMT-3b) and reduced 5mC methylation in promoter regions of key genes. They also found that demethylation by 25HC3S regulated the expression of genes involved in various signaling pathways.

Using whole-gene expression analysis of human hepatocytes treated with 25HC3S, the team found that cell survival–associated pathways were upregulated, while lipid metabolism–associated pathways were downregulated. This study provides key mechanistic details for how intracellular oxysterol sulfates, such as 25HC3S, regulate cell-signaling pathways at the transcriptional level in hepatocytes to treat NAFLD effectively.

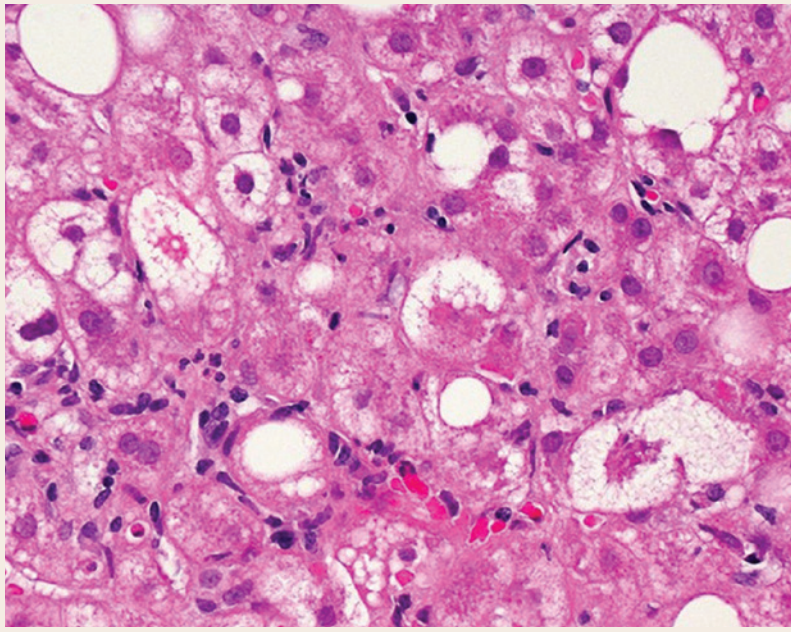
The researchers proposed that inhibition of DNMTs by 25HC3S could lead to demethylation, which increases gene expression of several pathways. These pathways include ones responsible for blocking cell apoptosis; increasing cell proliferation; and blocking cholesterol, fatty acid and triglyceride biosynthesis. Overall, the results of this study provide information that could be useful in developing new treatments for NAFLD and other chronic diseases.

DOI: 10.1016/j.jlr.2021.100063

—Latavia Hill

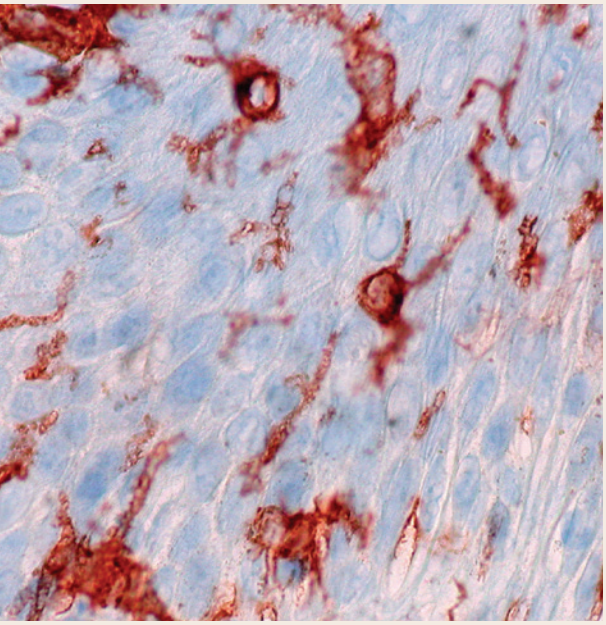
A microscopic image of liver tissue affected by nonalcoholic fatty liver disease. The large and small white spots are excess fat droplets filling liver cells.

DAVID KLEINER, NATIONAL CANCER INSTITUTE/NIH



pH-dependent recognition of pathogens

When pathogens invade the human body, sentinel macrophages called Langerhan cells that reside in tissues capture some of the pathogens, break them down and present antigens for adaptive immune cells. This swift activation of the adaptive immune system is essential for survival, and langerin, a receptor expressed on Langerhan cells, plays a central role in this process.



ED UTHMAN/WIKIMEDIA COMMONS

This image shows Langerhans cells in normal epidermis.

Langerin is a transmembrane carbohydrate receptor that belongs to the class of type II C-type lectin receptors. It recognizes a host of pathogens, including influenza virus, measles and HIV, by binding to carbohydrates on the pathogens' surface. Central to langerin's function is a calcium co-factor that resides in the carbohydrate binding pocket. After the pathogen is bound, langerin is engulfed by an endosome and degraded. When langerin and its bound pathogen are immersed into the acidic environment of the endosome, the pH change is sensed by protonation of the allosteric pH-sensor histidine H294. However, researchers do not yet understand the processes responsible for removal of the calcium co-factor from the binding pocket.

In a paper published in the **Journal of Biological Chemistry**, Jan-O Joswig of the Free University of Berlin and colleagues used molecular dynamics simulations and Markov models to find the molecular basis for the displacement of langerin's calcium molecule and the subsequent release of its bound pathogen. The researchers showed that H294 protonation disrupts a precarious network of hydrogen-bonded protein residues, causing a conformational change. In this new conformation, a lysine side chain forms a new bond with a calcium-coordinating aspartic acid residue, resulting in calcium's release. Once expelled, the calcium is prevented from rebinding through additional changes to the aspartic acid residue.

These findings show how biological systems use pH regulation of a binding site to drive a specific chain of functionally relevant conformational arrangements and may serve as a road map for future studies that aim to identify pH sensitivity in these systems.
DOI: 10.1016/j.jbc.2021.100718

— Anand Rao

activity, which might be used in therapies for chronic kidney diseases.
DOI: 10.1016/j.jbc.2021.100726

A perilipin's role in cholesterol balance

Steroidogenic cells store cholesteryl esters, or CEs, instead of triacylglycerol, or TAG, in lipid droplet organelles. These CE-rich lipid droplet organelles, or LDs, help maintain cholesterol balance in the adrenal gland through mobilization via two distinct pathways. One of these involves proteins of the perilipin, or Plin, family, which bind directly to both CE-rich LDs and TAG-rich LDs. Previous work has shown that Plin2 regulates degradation of TAG-rich LDs. A recent paper in the **Journal of Lipid Research** by Yuchuan Li and an international team describes their study of the role of Plin2 in regulating CE-rich LDs.

The researchers determined that mice with a genetic deletion of Plin2 had age-dependent adrenal gland enlargement, elevated levels of unesterified cholesterol and elevated levels of CE-rich LDs, which did not impact steroidogenesis. They analyzed mRNA expression and determined that the adrenals of the genetically modified mice had increased levels of Plin3, which compensated for the loss of Plin2. The researchers also discovered ceroidlike structures and multilamellar bodies in the adrenal cortex in the female modified mice. They found that these mice had increased levels of phosphatidylglycerols, a hallmark of autolysosome accumulation.

The researchers suggest that a lack of Plin2 leads to a cholesterol imbalance in the adrenal cortex, highlighting the importance of this protein.
DOI: 10.1016/j.jlr.2021.100048

New platform to quantify histone methylation

Histone modifications are post-translational modifications to histone proteins that affect gene expression by altering chromatin structure and are responsible for packaging long DNA molecules into more compact, denser structures. Methylation is a common histone modification mediated by the addition of one or more methyl groups on the lysine or arginine amino acid of the histone protein.

Methylation is important in gene regulation and has been linked to progression of many cancers; however, researchers have difficulty quantifying this histone modification because of the spatial complexities that result when more than one methyl group is added on the same amino acid.

Francesca Zappacosta and a team of researchers at GlaxoSmithKline recently developed a simplified mass spectrometry–based platform for histone methylation analysis. The technique uses chemical derivatization to reduce the complexity of the protein to be analyzed, improving sensitivity for the detection of methylation. In one tested approach, the researchers quantified and distinguished between symmetrical and asymmetrical dimethylation of histone H4R3. They also were able to quantify modification levels as low as 0.02%. The team describes their mass spectrometric platform and findings in a recent article in **Molecular & Cellular Proteomics**.

This effective and robust MS-based approach holds promise for many studies that involve quantification of histone methylation profiles.

DOI: 10.1016/j.mcpro.2021.100067

Dual-acting J-domain proteins aid chaperone client delivery

70-kDa heat shock proteins, or Hsp70s, are abundant molecular chaperones that are involved in nearly every stage of the cellular protein life cycle, from folding to remodeling, as well as in the development of diseases, including cancer. The efficacy and versatility of Hsp70 function rely on its cooperation with J-domain proteins, or JDPs, co-chaperones that stimulate the Hsp70 ATPase cycle and allow it to bind to client proteins.

In a recent study published in the **Journal of Biological Chemistry**, Hyunju Cho of the California Institute of Technology and colleagues showed that cytosolic JDPs have two distinct functions in the protein biogenesis process: initial capture of the client protein, in this case tail-anchored proteins, and transfer of the protein into the guided-entry-of-tail–anchored protein, or GET, pathway.

Using a hybrid protein containing yeast membrane protein that is strongly dependent on the GET pathway, specific mutations that compromised JDP function, and a battery of biochemical analyses including sedimentation and pulse-chase analyses, the authors discovered that the proteins Ydj1 and Sis1 function in parallel to support Hsp70-mediated relay of tail-anchored proteins to downstream chaperones so they can be delivered to the endoplasmic reticulum. To guide tail-anchored proteins into the GET stream, Hsp70s must capture and then transfer substrates to the protein Sgt2. The researchers showed that both of these actions are stimulated by JDPs in two independent steps involving ATP hydrolysis by Hsp70 and thus require at least two Hsp70 ATP cycles before the Hsp70 reaches the GET pathway.

DOI: 10.1016/j.jbc.2021.100546

Nivedita Uday Hegdekar (nivedita.hegdekar@gmail.com) is a graduate student at the University of Maryland working toward a Ph.D. in biochemistry and molecular biology and an M.S. in patent law. Follow her on Twitter @NiveditaHegdek1.

Latavia Hill (lataviahill@ku.edu) is a graduate student studying microbiology at the University of Kansas.

Laurel Oldach (loldach@asbmb.org) is a science writer for the ASBMB. Follow her on Twitter: @LaurelOld.

Anand Rao (arao@asbmb.org) is ASBMB publications strategy manager. Follow him on Twitter: @AnandRaoPhD.

Send us your news!

Have you recently been promoted or honored? Do you have good news to share with your fellow ASBMB members? Email it to us at asbmbtoday@asbmb.org and include a photo!

Faculty hiring challenges and resilience in the face of a pandemic

By Guananí Gómez–Van Cortright

During more than a year of pandemic shutdowns, universities have faced a barrage of challenges and barriers to hiring new faculty. Department heads have had to meet ongoing crises and adapt to the new needs of their institutions, everything from disrupted interviewing practices to budget restrictions to complete hiring freezes.

Here, five members of the board of directors of the Association of Medical and Graduate Departments of Biochemistry, or AMGDB, share the difficulties their departments have faced in hiring faculty during the pandemic, the lessons and new perspectives gained from the disruption, and some advice and optimism they would like to offer potential applicants. All are department heads at their institutions.

Distanced, shut down and frozen

When the U.S. government declared the COVID-19 outbreak a national emergency in March 2020, many colleges and universities responded with partial or complete research shutdowns, throwing a wrench in lab routines and faculty searches alike. Jennifer Normanly at the University of Massachusetts Amherst navigated a brief lab shutdown followed by occupancy restrictions as well as the disorienting switch from in-person to online teaching.

"We have one of the largest residential operations in the Northeast, and without students on campus we took a huge financial hit," Normanly said. "We've been on a financial freeze for most of the fiscal year." Depending on budget decisions currently being made, faculty hiring at UMass could resume in fall 2021.

On top of budget cuts and financial strain caused by pandemic mitigation efforts, many faculty searches were put on hold or halted, even those that were already in

On top of budget cuts and financial strain caused by pandemic mitigation efforts, many faculty searches were put on hold or halted, even those that were already in progress.

Even without stringent financial restrictions such as a freeze, the AMGDB directors agreed that making hiring decisions without being able to meet job candidates in person was a major struggle.

progress. Rebecca Dutch said the University of Kentucky instituted a hiring freeze as she was making an offer to an applicant.

"It took several months, but we were finally given approval to bring in the candidate," Dutch said. "It's still a cumbersome process." Currently, any hiring decision at the University of Kentucky must be approved by the provost.

Even without stringent financial restrictions such as a freeze, the AMGDB directors agreed that making hiring decisions without being able to meet job candidates in person was a major struggle.

Hiring on Zoom

In traditional faculty hiring, finalist candidates are invited to the campus for in-person visits, interviews, seminars and more. But not this year, as Chris West of the University of Georgia explained.

"The seminars were through Zoom, the talks were through Zoom, the one-on-one interviews were through Zoom, the grad student conversations were through Zoom," West said. "But who would want to accept getting hired without ever being there?"

Deciding whether candidates were qualified and whether their work would complement existing research programs on virtual interactions was a challenge. Karlett Parra at the University of New Mexico was especially concerned about virtual versus in-person assessments. Parra has hired four tenure-track professors and four faculty lecturers in her more than eight years as department chair, but this year posed a unique challenge.

Rebecca Dutch said the University of Kentucky instituted a hiring freeze as she was making an offer to an applicant.

Jennifer Normanly said the University of Massachusetts Amherst was in a hiring freeze for most of the fiscal year and might start faculty hiring again this fall.

"Zooms are great for a first screen, but they cannot replace face to face — never," Parra said. "Normally you get to do everything at once — interviews with faculty and leadership, seminar presentations, chalk talks, and touring of facilities and the city — in person. We're still in the hiring process, doing interviews (in May). Normally we would be done in March or April."

Shifting practices

The pandemic, and specifically the use of video call services, taught department heads and others at some institutions to think more about inclusive practices when searching for new hires. Dutch and others mentioned the utility of doing more thorough screenings of the applicant pool before moving on to expensive in-person campus visits.

"Now we do Zoom interviews before we bring people in for an in-person visit and give them a chance even if they didn't stand out as much in the paper application," Dutch said. "It gives applicants an

extra chance to excel."

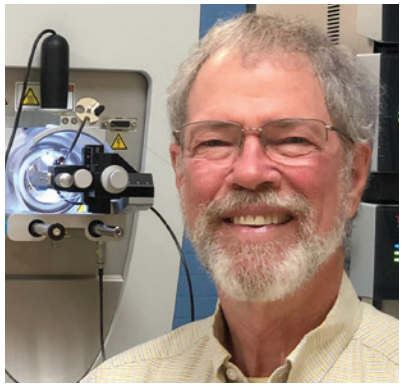
A preliminary Zoom interview allows certain applicants who might not have stood out on their CVs to show hiring committees what they have to offer instead of falling through the cracks. West was optimistic about the power of Zoom and other pandemic adaptations to improve the faculty hiring process at the University of Georgia.

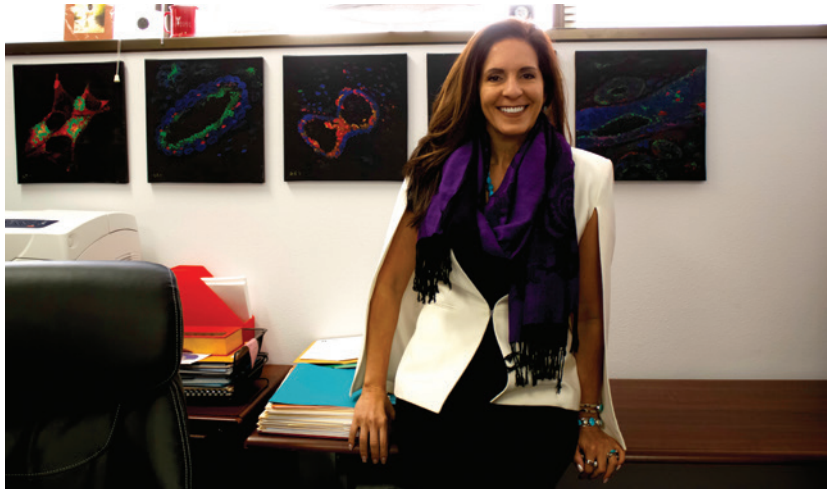
"I'd like to believe the pandemic is something we can leave behind, hopefully enriched by knowing all these other forms of communication," West said.

The pandemic also has influenced priorities in research focus and outcomes, and it has highlighted the importance of faculty diversity and how it benefits institutions. Geoffrey Kapler at Texas A&M University said he came to realize how important it is to shift his department's historical emphasis on basic science to pursuing real-world applications.

"COVID really brings being able to move fast and respond to problems that arise quickly in public health into focus," Kapler said. "There's also the need to increase diversity — diversity that is gender-, race-, and ethnicity-based. We need to reflect the population of medical and grad students who are our trainees. They need mentors who look like them and share their perspectives."

Chris West of the University of Georgia said all formerly in-person steps in the hiring process were virtual over the past year and wondered, "who would want to accept getting hired without ever being there?"





Karlett Parra at the University of New Mexico said, "Zooms are great for a first screen, but they cannot replace face to face — never."

Advice and encouragement

Taking into account the difficulties and shifts in perspective presented by the pandemic, these AMGDB board members were optimistic about the future of the academic job market and wanted to encourage potential applicants.

"There's a lot of uncertainty now, everywhere, trying to emerge from the pandemic," Normanly said. "It's hard to predict the short term, but in the long term I think there will be plenty of opportunities."

When asked about advice for future faculty applicants, Normanly emphasized the importance of teaching as well as research. "Undergrad teaching is a priority," she said. "We expect (applicants) to have a commitment to solid, evidence-based teaching."

Parra emphasized that applicants ought to have grant writing experience, a passion for teaching, a three-year research plan and patience with the process. She also recommends

AMGDB board members were optimistic about the future of the academic job market and wanted to encourage potential applicants.

Geoffrey Kapler at Texas A&M University said that during the pandemic he realized how important it is to shift his department's historical emphasis on basic science to pursuing real-world applications.

that applicants come already thinking about potential collaborations at the institutions they apply to and seek out mentors who recently have gone through the faculty hiring process to support them along the way.

Even with demand for new faculty and more inclusive hiring practices, the job market will take time to recover from the harsh budget constraints and general delays of the past 16 months.

"Post-COVID, I doubt (hiring) will be that normal, because of finances," Parra said. Candidates "have to be flexible — don't take delays or unforeseen changes in the process as personal, because so many places are still in transition."

Hiring faculty has never been easy, even before COVID-19, but Parra believes that challenge is worthwhile. "Something that didn't change is the significance of the process. It's the most important thing I can do as chair — hire for the future."

Dutch echoed this sentiment. "Be patient, but persistent," she advised potential applicants. "The job market will open back up again."

Guananí Gómez–Van Cortright (guananigvc@gmail.com) is a teacher and freelance science writer.

Beyond hiring, eye-opening pandemic lessons

The past year has been difficult for department heads and prospective faculty alike, between ongoing delays, hiring freezes, budget cuts and the struggle to determine whether applicants are qualified without the benefit of extensive on-campus evaluations. Even so, the struggles and crises brought on by the pandemic also provided eye-opening lessons. Issues that had been chronically overlooked became impossible to ignore, and practices that once went unquestioned were met with new options and perspectives.

Rebecca Dutch at the University of Kentucky said she saw the needs of struggling students in a new light. "What (the pandemic) has done is really highlight what was known before — Kentucky has a lot of underprivileged and first-generation students," she said. "I heard stories of students driving an hour to a McDonalds parking lot for Wi-Fi, or living with eight people in a small space where it's very hard to study. These were big concerns, especially because we knew there were also many students facing food insecurity."

While these issues may have gone under the radar when classes were in person and students lived on campus, the pandemic brought them into focus and galvanized efforts to make higher education more accessible.

For Jennifer Normanly at UMass Amherst, inclusive teaching practices that help students feel welcome instead of alienated in introductory science courses became a priority. "Especially in STEM, we have so much melt in the first years," she said. "One thing I've realized during the pandemic is that students have so much going on beyond their classes."

Accessibility and inclusive practices toward staff and faculty also have become a priority. The University of New Mexico's Karlett Parra said she has been reflecting deeply on what can be reevaluated and rearranged to improve the well-being of her employees, taking into consideration their lives and responsibilities beyond teaching and research.

"I keep thinking, who can work from home a few days a week to make more effective use of people's time and the space?" Parra said. "COVID taught us to be more helpful to everyone … We're more adaptable to people's needs and families, and more inclusive in our searches than we used to be."

These department heads agreed that while recognizing such problems is a crucial first step, addressing deeply entrenched but ultimately exclusive ideas of what it means to be successful in science will be a challenging project for years to come.

Careers Issue
Outlook & Opinions

What to ask during your faculty interview

By Bill Sullivan

You've been preparing for your faculty interview for days. Your seminar presentation is a polished masterpiece, complete with slides that showcase ingenious future plans. You've studied the research interests of each faculty member and identified potential collaborations. You've spent hours trying to anticipate their questions for you and prepared thoughtful responses. But did you prepare questions for them?

A faculty interview is a two-way street. You are evaluating your future place of employment as much as they are evaluating you. It behooves you to be prepared with questions for the faculty members and students that you will be speaking with during the interview process. As a member of numerous search and screen committees over the past 20 years, I offer a few key items you should consider. Going into your interview armed with good questions not only will help you gather intel so you can make the best decision for your career but also will help you stand above the competition.

Ask about core facilities. Many colleges and universities house core facilities on campus where faculty can advance their research. These can include facilities that will perform proteomics, sequencing, animal or imaging studies. You not only should check if the core facilities you need are in place but also be sure to ask about their reliability, customer service and cost. Make sure they have a friendly and helpful staff that will help you and your trainees make sense of the data.

Ask about internal funding opportunities. If you want to land a large external grant, it helps to show reviewers that you have secured funding from your institution. This demonstrates that you have skill as a grant writer and that your school is invested in your research program. Many schools offer small internal grants for faculty, and you should have a sense as to which ones might be available to you. If the school offers grants that are restricted to new assistant professors, even better. Some schools offer internal grants that offset the charges to use core facilities as well. Also, ask if the department or school has an internal grant-reviewing committee that pre-reviews applications to external funding agencies. Pre-review committees can be invaluable in helping you craft a competitive grant proposal.

Ask about the tenure process and faculty mentor programs. It is useful to know the tenure success rate at your school; in other words, what percentage of faculty who go up for tenure actually get it? How long is the tenure clock, and does the school perform checkpoint evaluations such as three-year reviews? Assess whether the department is open to offering you immunity from teaching and service the first year or two, which will allow you to focus entirely on developing your independent research program. And check if the department has a faculty mentor program. It is extremely helpful to new faculty to form an advisory committee that meets twice a year to evaluate your progress and provide input on how to meet career goals; if your department does not have a formal advisory committee, you can assemble one yourself. Some schools offer workshops to guide new faculty through the tenure process.

Ask about student and postdoc life. You need to fill your lab with dedicated and talented individuals, so it is vital to learn as much as you can about the school's ability to recruit trainees. You should know how many students the school accepts each year and how many enter the department to which you are applying. What is the graduation success rate? Do trainees have access to funding opportunities within the department, such as travel awards? Does the department have training grants that support graduate students or postdocs? Does the school have a postdoctoral affairs office, and do they have the resources you may need to hire international fellows? Does the department have dedicated office space for trainees? Will your students be required to teach and, if so, how much?

Ask about team-building activities for faculty and trainees. The interview probably will give you a good sense of the degree of collegiality among the faculty,

but you should ask if programs exist to help build collaborations among faculty members. Does the department sponsor a seminar series to host visiting scholars? Do they hold a seminar series for students and postdocs? Do they have happy hours or brainstorming sessions, perhaps an annual retreat? These activities not only advance research by identifying new areas to be investigated but also build morale and increase job satisfaction. Finally, you can learn a lot by asking the chair about their philosophy of higher education and their vision for the department.

Ask about teaching, service and diversity. Research is not the only component of higher education, so you need to know what type of teaching you'll be expected to do, how much time this would take, and what level of student you'll be instructing. In addition, you might want to clarify what types of service activities are expected of faculty members and whether scientific outreach is assigned value at your institution. Ask what the school is doing to enhance diversity and equality among students and faculty.

Ask about campus life, including life in the city or town. It might seem trivial, but life outside the laboratory often affects life inside the laboratory. Schools in vibrant and affordable cities have much to offer for your work–life balance as well as your ability to recruit students and postdoctoral fellows. If you have children, ask about family-friendly activities and the quality of the nearby schools. Find out if the research buildings and classrooms that you need access to are in close proximity. At some larger schools, you can waste considerable time walking or taking a shuttle between buildings scattered across town.

Ask about the key strengths and weaknesses of the school or program. In my experience, most faculty are quite candid and objective concerning their institution's climate. You can gain important insights into the best features your potential academic home has to offer and what areas need improvement. During the interview, be sure to highlight how the positive features, such as the department's confocal microscope or the institute's access to patient samples, will enhance your research. Perhaps you can offer ways to remedy areas that require attention; for example, if there are deficiencies in graduate student training, state that you're willing to lead a student journal club or seminar series. No place is perfect, but having a list of the pros and cons will help you select which school is best suited to your objectives and style.

The candidates who stood out in my faculty interviews were those who expressed genuine interest in our department, school and city as shown by the thoughtful questions they asked. Put yourself in the interviewer's shoes: Wouldn't you prefer to work with someone who thinks ahead and comes prepared? Never let your response to "Do you have any questions?" be an awkward silence. As a prospective scientist, you are expected to be full of them.

Bill Sullivan (wjsulliv@iu.edu) is a professor at Indiana University School of Medicine and the author of several books. He is also a member of the ASBMB Today editorial advisory board. Follow him on Twitter: @wjsullivan.

Steps for getting started in science policy

By Adriana Bankston

According to Wikipedia, "Science policy is concerned with the allocation of resources for the conduct of science towards the goal of best serving the public interest." Working in policy offers an opportunity to contribute to and influence the landscape of issues you care about. Your work, in turn, can help you establish a reputation and provide credibility as you embark on this new career path.

Here are some steps to take if you want to enter a career in science policy:

- **Choose a policy issue** that you are passionate about or something that you want to change.
- **Make your specific interest known** in the policy community and start to build experiences around your issue that will get you noticed.
- **Volunteer** with organizations working on this issue, and offer to write blog posts for them or join a committee.
- **Try to move up** into leadership roles once you are on a committee, and learn from those at the top of your organization.
- **Network** with professionals who are in positions you might want to apply for one day, and don't be afraid to apply for opportunities that interest you.

Science policy comes in many forms and flavors, and policy work is done in several sectors. Some policy positions involve advocacy and pushing priorities, whereas others inform policy but do not include lobbying. Shifting from one sector to another is an acceptable and encouraged practice. For example, you can work in government or at think tanks, nonprofits or universities. Of course, Capitol Hill is where all the action is. Many of these roles provide opportunities to interact with Hill staff.

Science policy is a fast-paced field. You must be able to shift quickly between priorities and projects, sometimes in response to what's going on that week in federal policy. This can be stressful for individuals trained as scientists who are used to planning their work ahead of time and going deeply into a single topic. In policy jobs, you often scratch the surface of many topics on any given day. But the variety is interesting, and it is exciting to work on policy issues in real time.

Resources for getting started in science policy can be found in the Advocacy section at asbmb.org. Other resources include newsletters such as AIP FYI produced by the American Institute of Physics; relevant organizations such as the American Association for the Advancement of Science or the National Academies of Sciences, Engineering and Medicine; and listings such as the Genetics Society of America policy fellowships database. Additionally, the Journal of Science Policy & Governance provides opportunities to develop your skills in policy research and writing, which are essential for any policy career.

Read more about Adriana Bankston's career journey in science policy at asbmb.org/asbmbtoday.

Adriana Bankston (abankston81@gmail.com)is a principal legislative analyst at the University of California Office of Federal Governmental Relations. She is also chief outreach officer and managing publisher at the Journal of Science Policy and Governance. This story represents the writer's personal views and not the views of her employer. Follow her on Twitter: @Adriana Bankston.

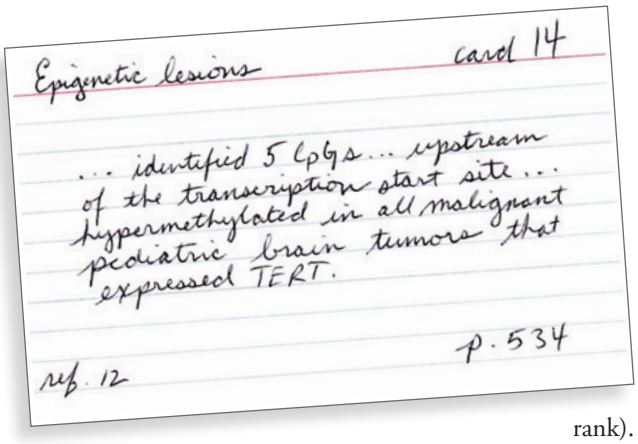
How to gather and organize information

Writing a paper in four steps

By Sumit Borah

Many scientists do not like to write. We would rather discuss and do experiments, attend lectures or teach. But scientists must write. Graduate students must write theses. Postdocs must write papers. Professors must write grant applications. Writing is a big part of what we do.

Some scientists struggle with gathering background information, an important stage of writing a scientific document. We also may struggle to organize this information, another important stage. But we need not struggle so much. With an effective method to gather and to organize information, we can write more quickly, more efficiently and more decisively.



If you do not use a method when writing grants and papers, I invite you to consider the one I share here. First, I will tell you where I got this method. Then I will illustrate how I use it for taking notes while reading articles (Step 1) and for organizing and using these notes to write (Steps 2 through 4).

My method is based on an old analog system for organizing information on three-by-five-inch notecards. It starts with writing a single, useful fact in the center of each notecard. In the corners, the writer indicates the source for that fact and the topic it addresses. Each notecard gets an ID number. As the writer reads more and gathers more facts, they accumulate a stack of notecards (like a deck of playing cards). They then deal the cards in the deck into three or four piles. Cards on topic A form one pile; cards on topics B, C or D, other piles. The writer then organizes the cards in each pile (as if organizing a hand by suit or by rank). In this way, they have organized information to plan each sentence and each paragraph of their paper.

I used a digital version of this method to write grants and papers when I was a research technician at the University of Pennsylvania, a graduate student at Yale University, a postdoc at University of Colorado at Boulder and a staff scientist at St. Jude Children's Research Hospital. By using this method, I became not only a more effective writer but also a more effective reader; this method can help in any endeavor that requires gathering and organizing information from many sources.

Here are the four steps I use.

Step 1: How to take notes while reading

Before you read an article, copy into a Word document the following information: the article title, the corresponding author's name, the publication year, and the figure titles or section titles (abstract, introduction, results, methods, discussion). As you read, copy words and phrases that capture the essence of important ideas from each section. Copy ideas from the article's abstract into the "abstract" section of your notes, from the introduction to the "introduction" section and so on.

Substitute ellipses for unnecessary words if you retype passages. Although you may trim sentences in this way, your Word document still will become very long as you read more articles (hundreds of pages). Save this valuable document for when you are ready to write. To stay fresh, alternate between reading a few pages of an article and copying passages from those pages.

Step 2: How to harvest from your notes

When you need to write a paper or grant, start by identifying articles that are clearly relevant to your subject. Not everything you have read will be relevant for every document. Review your notes from the relevant articles. Highlight passages with useful information.

After harvesting the most relevant notes from the most relevant articles, review notes from articles that may be only moderately relevant to your subject. These moderately relevant articles may contain useful information as well. You probably have forgotten the contents of many papers you have read. You may get excited by the richness of information and the granularity of details in your notes. Do not rush this step. Patiently harvest from your notes. If you have read many articles, you may need a week or more to finish Step 2.

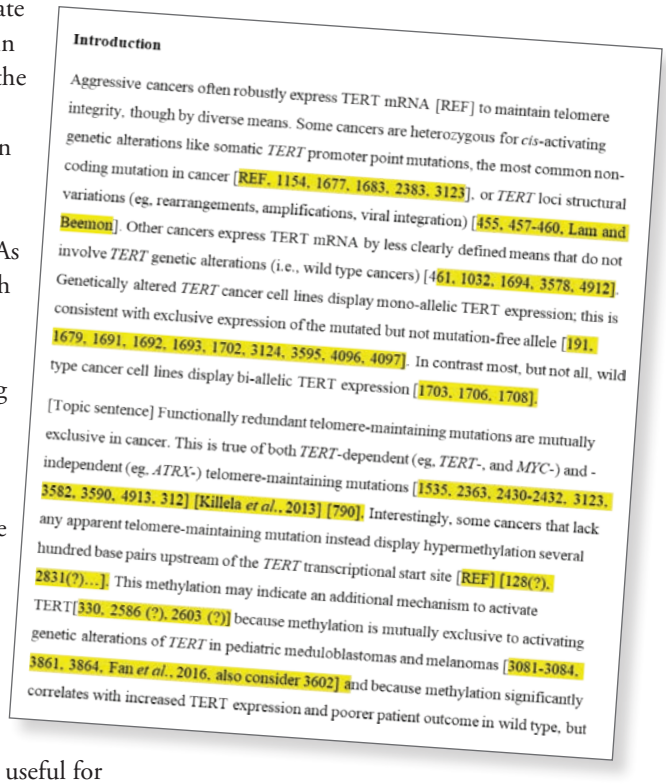
After methodically reviewing your notes, copy the highlighted parts into an Excel file. Copy each note into its own row, and indicate the source of the note. Assign each note a unique ID number.

Step 3: How to organize your harvested notes

Identify the key topics you are writing about. Color code your notes by topic. Then sort your notes by color. Determine whether you have read enough to write confidently about each topic by counting notes in each colored bin. You may need to pause here to research topics that are supported by too few notes. After you complete this step (refreshing your memory of the papers that you read and organizing your notes on these papers), ask whether the narrative that you envisioned for your document is the best possible narrative. If not, revise your narrative until you are satisfied.

Step 4: How to write using your organized notes

Begin each paragraph with a topic sentence. Build the paragraph, using your notes to write sentences that support, illustrate or expound on that topic. After using a note to write a sentence, indicate the note's ID number in brackets at the end of the sentence (for example, "It is the most common noncoding mutation in cancer [1154, 1677, 1683, 2383, 3123]"). As you write, record which notes have been used either by crossing the note off or by changing its color in the Excel file. If some notes remain unused, ask whether they should be used or, alternatively, discarded. Do not cite only a few articles; skillfully draw from the breadth of articles you have read. Your notes will be especially useful for writing your introduction, methods and discussion. Write these sections with confidence, because you have done your homework. Each sentence is based not on vague memories of the literature but on direct quotes from peer-reviewed articles.



Introduction

Aggressive cancers often robustly express TERT mRNA [REF] to maintain telomere integrity, though by diverse means. Some cancers are heterozygous for *cis*-activating genetic alterations like somatic *TERT* promoter point mutations, the most common non-coding mutation in cancer [REF, 1154, 1677, 1683, 2383, 3123], or *TERT* loci structural variations (eg, rearrangements, amplifications, viral integration) [455, 457-460, Lam and Beemon]. Other cancers express TERT mRNA by less clearly defined means that do not involve *TERT* genetic alterations (i.e., wild type cancers) [461, 1032, 1694, 3578, 4912]. Genetically altered *TERT* cancer cell lines display mono-allelic TERT expression; this is consistent with exclusive expression of the mutated but not mutation-free allele [191, 1679, 1691, 1692, 1693, 1702, 3124, 3595, 4096, 4097]. In contrast most, but not all, wild type cancer cell lines display bi-allelic TERT expression [1703, 1706, 1708].

[Topic sentence] Functionally redundant telomere-maintaining mutations are mutually exclusive in cancer. This is true of both *TERT*-dependent (eg, *TERT*-, and *MYC*-) and -independent (eg, *ATRX*-) telomere-maintaining mutations [1535, 2363, 2430-2432, 3123, 3582, 3590, 4913, 312] [Killela *et al.*, 2013] [790]. Interestingly, some cancers that lack any apparent telomere-maintaining mutation instead display hypermethylation several hundred base pairs upstream of the *TERT* transcriptional start site [REF] [128(?), 2831(?)....]. This methylation may indicate an additional mechanism to activate TERT[330, 2586 (?), 2603 (?)] because methylation is mutually exclusive to activating genetic alterations of *TERT* in pediatric medulloblastomas and melanomas [3081-3084, 3861, 3864, Fan *et al.*, 2016, also consider 3602] and because methylation significantly correlates with increased TERT expression and poorer patient outcome in wild type, but

Your Word and Excel files are proof of your scholarship. Your Excel file is also your citation key. Use it to find which article corresponds to which bracketed note number. Then use a citation managing program (like EndNote or Papers) to replace each bracketed number with the appropriate citation.

Conclusion

You cannot use this method if you are rushed. Long before you need to write, you should read articles continually at your own pace. Using this method, you can remember and methodically organize information from dozens or hundreds of articles. By taking notes while reading and by organizing your notes before writing, you will think and write about your research more clearly, more confidently and more skillfully. You may find writing to be more satisfying and manuscript and grant submissions to be more successful.

Sumit Borah (sumit.borah@oxford-square.com) is an editor at Oxford Square and a medical writing student at the University of Chicago Graham School of Continuing Education.

Writing it right

Strategic tips for formulating titles, abstracts, abbreviations, keywords and more in journal articles

By Robert Roskoski Jr.

Indexers use the title, abstract and keywords to categorize an academic paper, and these components should be created with the goal of attracting the relevant and maximal readership through search algorithms such as PubMed and Google Scholar. If someone performs research and nobody reads about it, it's as if the scientific results were nonexistent.

The fourth edition of "The Elements of Style" by William Strunk Jr. and E.B. White has many suggestions for writing with a design that is easily understood. Strunk wrote that the reader is in serious trouble most of the time, and it is the duty of the writer to help the reader. And we have it from Francis Crick that "There is no form of prose more difficult to understand and more tedious to read than the average scientific paper."

> "There is no form of prose more difficult to understand and more tedious to read than the average scientific paper."
>
> FRANCIS CRICK

Here are some do's and don'ts for writing a scientific article.

- Read the journal's directions for the author before writing and make a checklist just before submitting the paper to make sure all criteria are fulfilled.
- The title should convey the essential points of the study.
- The title should be informative, intelligible to readers who are not specialists in the field and jargon-free.
- The titles of the most cited articles contain 10 to 15 words or 31-41 characters.
- Indexers use the title to categorize an article, and it thus serves as a keyword.
- The summary/abstract should describe the background, methods used, major findings and conclusions drawn in the manuscript.
- Avoid specialized terms in the abstract.
- Minimize the use of nonstandard abbreviations throughout the text. They slow down the reader, who must translate each abbreviation mentally before proceeding, disrupting the train of thought. Standard abbreviations such as ATP, DNA and RNA don't have to be translated.
- Avoid abbreviations for phrases that are not onerous (for example, don't use AD for Alzheimer's disease).
- Use abbreviations for long phrases (for example, use PDGFR for platelet-derived growth factor receptor).
- Use keywords that target the subject matter.
- If the journal limits the number of keywords, use the maximum number allotted to maximize the potential readership without duplicating components of the title in the list of keywords.
- Keywords should not be too expansive or too selective. "Protein," for example, may be too broad when "protein structure" or "protein folding" is closer to the point. Similarly, "cancer" might be replaced by "breast cancer" or "cancer chemotherapy" to better target the subject matter.
- The introduction should state the objectives and reasons for conducting the study and provide references to the pertinent background literature.
- The methods section should describe how the experiments were performed with enough detail that the same study could be performed in another laboratory. Often, other laboratories will replicate experiments as an entryway to extend and explore wider research objectives.

- Results should be presented clearly and concisely, usually with the aid of tables and figures.
- Tables and figures should be self-explanatory and fully understandable without reading the text.
- The text should emphasize the important points contained within the tables and figures.
- Results should be presented objectively without interpretation; interpretations are reserved for the discussion section.
- Carefully choose your references and citations; many readers consult them to gain additional scientific insight.
- If several references can be used to substantiate a statement or finding, select the ones available through open access and those that are most recent.
- Make sure the reference title matches the original publication. The reference citation in PubMed may state beta, while the original publication has the Greek β. Also follow the original paper's use (or nonuse) of italics for such terms as in vitro and in vivo or for a gene name such as PDGFRA.
- Avoid complex sentence structures.
- Avoid monotonous presentations; write with variety to keep the reader's interest.
- The first sentence in a paragraph is the topic sentence. Read each topic sentence sequentially from the beginning of the paper to the end to ensure that the flow of ideas makes sense.
- Adopt the Goldilocks rule for each section of the paper: not too much or too little, not too long or too short.
- Strunk devotes a special paragraph to the vile expression "the fact that," an expression that should be "revised out of every sentence in which it occurs."
- Revise, revise, revise. In the first half of the 20th century, before the advent of word processors, Otto Warburg — the eminent biochemist, cell physiologist and Nobel laureate — reportedly stated that he rewrote his papers up to 16 times.

White wrote, "Vigorous writing is concise. A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, for the same reason that a drawing should have no unnecessary lines and a machine no unnecessary parts. This requires not that the writer make all sentences short or avoid all detail and treat subjects only in outline, but that every word tell."

Robert Roskoski Jr. (rrj@brimr.org) is the scientific director of the Blue Ridge Institute for Medical Research.

Biotech industry jargon: A primer for the curious

By Laurel Oldach

Last summer, I started a column that involves sitting down with scientists who work in industry — people from many types of companies and at many career stages — to talk about their working lives. One thing became clear: This is a sector with a language of its own.

The specific scientific and technical knowledge you need in an industry job depends on the role and will change over the course of your career. But it can help to know the basics — like what we mean when we say "industry."

Here are some fundamentals I've picked up.

1. Biotech, pharma, industry: What's the difference?

You'll find a lot of answers to that question. The pharmaceutical industry is the easiest to define: Pharmaceutical companies research, develop and market new approaches to treat diseases.

Biotechnology is the next-narrowest of these terms, and it's a little contested. It can describe a company using biology to make products, but in the pharmaceutical business, "pharma" means large multinational companies, and "biotech" means smaller startups pursuing new treatments for disease.

Sometimes you'll hear someone object to the label "biotechnology" for a company without medical applications. It all depends on whom you ask.

"Industry" itself is a vague term that many academics use to mean "not academia." Whether it includes only the pharmaceutical industry or other sectors such as agriculture, synthetic biology, food and beverages, and chemicals depends again on to whom you're talking.

2. Large and small companies

Large pharmaceutical companies can have thousands of employees around the world. They're always investing in developing new treatments to support the company when the patents on current drugs expire. In addition to multiple research programs, they frequently buy promising drug candidates from smaller companies — sometimes by acquiring the whole company.

Meanwhile, smaller companies, including startups, are generally more focused on testing, optimizing and commercializing one or a few molecules or a therapeutic approach. They may have a few employees or a few dozen.

Grant Blouse, a senior vice president at Catalyst Biosciences, who has worked at both large and small companies, said that startup employees take on more roles, which can give a lot of room to grow professionally.

At the same time, since small companies are often under pressure to demonstrate that a single treatment is worthwhile in a short time, they can be much riskier to work at: If the molecule fails, chances are good that the company will fold.

3. Burn rate

Startups are usually supported by investors, who essentially are betting that the company will come up with a profitable product. "Burn rate" describes the precarious predicament of a company that has secured some major investments but needs to demonstrate progress to get another round of funding. To get the data it needs, the company has to spend its startup funds, and the speed at which the money runs out is the burn rate.

4. Matrix management

More common at bigger companies, this is a project-management system in which people from different departments come together to work on a project as a team. In contrast with those in more hierarchical systems, a matrix team lead might not manage any of the rest of the members directly but is responsible for the success of the project.

This type of organizational structure means that any individual scientist might report to several people in different capacities and needs to think

about how to work best with each of them, making communication skills very important.

5. Research vs. development

In drug discovery, "research" is finding a drug target and coming up with a way to perturb it to treat or prevent disease. This could include searching for an inhibitor for a kinase, a receptor ligand, an antibody that targets a disease-specific protein or any of dozens of other drug modalities.

"Development" is the next stage: The therapeutic agent is known, and scientists start work to determine whether it can be a safe and effective treatment.

6. Therapeutic index

Most molecules have side effects, and just about everything — even water and sugar — can become harmful at high enough doses. Therapeutic index, also called a drug's safety ratio, is calculated by dividing the dose that causes toxicity by the effective dose. If it is low, a drug may be risky to administer and difficult to develop.

7. Phases of drug development

Most scientists are familiar with the three phases of drug discovery: A first small study in healthy humans to establish safety and dosage is called phase 1. In phase 2, researchers test for some evidence of clinical effect in a medium-size group of patients, sometimes adjusting the dose further. Finally, phase 3 is a placebo-controlled test for effectiveness and any side effects in a much larger patient population.

If the drug meets predetermined measures of efficacy, then the company can apply to the Food and Drug Administration or other regulatory bodies for approval to sell it. After a drug is approved, companies must continue to keep an eye out for adverse side effects in what can be called phase 4, or post-marketing surveillance.

8. SOP, GLP, GMP, GCP

TLA stands for "three-letter acronym," and fans of the form will be happy to know that there are plenty of them in pharmaceutical research and development and manufacturing.

SOP stands for standard operating procedure.

GLP stands for good laboratory practices — things like regularly calibrating instruments. It applies to preclinical laboratories.

GMP stands for good manufacturing practices, such as testing raw materials for purity and making sure that separate production lines aren't liable to cross-contaminate.

Meanwhile, GCP is good clinical practice for studies involving patients.

These standards are international. In the U.S., the FDA checks and certifies that workplaces use GLP, GMP

or GCP. People aren't kidding when they say that pharma is a highly regulated industry, and high-profile manufacturing failures show why: When you're making medicine, it's important to get it right.

9. Precompetitive collaboration

This is an industry term for when pharmaceutical companies team up to develop tools or standards that will help all of them.

For example, 35 companies participate in the Biomarkers Consortium, which is focused on developing quantitative molecular signatures for a variety of diseases. Similarly, the Pistoia Alliance of pharmaceutical companies sponsors projects ranging from how to notate a biomolecule to how to write an effective informed consent form.

These aren't the areas in which companies compete, but getting them right is very important for all companies in the sector. According to Mark Harpel, a director at GlaxoSmithKline, precompetitive collaborations have become more common in recent years.

10. Contract research organizations

Like a core laboratory in an academic center, contract research organizations, or CROs, are paid to do certain experiments on behalf of a commissioning organization, usually a pharmaceutical company. There are many types of CROs with expertise in different areas in research and development. Especially for startups, engaging a CRO is a way to carry out infrastructure-intensive experiments, such as pharmacokinetics studies in small animals, while saving on substantial upfront costs.

Laurel Oldach (loldach@asbmb.org) is a science writer for the ASBMB. Follow her on Twitter: @LaurelOld.

7 tips for preparing for science careers

By Martina G. Efeyini

Science careers too often are characterized as existing in only two sectors: academia or industry. In reality, people with scientific training are needed in a variety of fields.

I've been covering science careers beyond industry and the academy for ASBMB Today for almost two years now. During that time, I've interviewed legal professionals, education and diversity specialists, policy experts and advocates, research-development professionals, outreach and in-reach coordinators, artists, and many others who either have established or still are establishing satisfying careers that use their scientific training and knowledge.

Below are seven takeaways from those interviews — and tasks that job seekers (or future job seekers) can take to get closer to their dream jobs.

1. Embrace your science journey.

Having a nonlinear pathway is common. Most of the scientists I've interviewed have said every experience helped them learn a new skill, find their strengths and gain experience for their next role. Sometimes they volunteered or took a pay cut to gain experience.

Earlier this year, I interviewed Efraín Rivera–Serrano, who has a Ph.D. in comparative biomedical sciences. After graduating, he completed a postdoctoral fellowship and accepted a research associate position.

But when the COVID-19 pandemic started and he was spending a lot of time at home, he decided to explore what a life outside of academia could look like. He made a list of nonnegotiables, which included having time, flexibility and creativity.

He ultimately decided to become a science communicator. Today he writes about research for American Scientist magazine and handles social media for a peer-reviewed journal and scientific society.

He said that taking time to reflect on his science journey helped him see what he truly wanted.

TASK: Do a reflection exercise.

2. Use the MyIDP.

The MyIDP tool is an assessment that helps you explore your values, skills and interests to find science careers that suit you. This is useful for people on all science career paths but especially for those who are exploring careers outside of industry and academia.

The MyIDP showed me that my top matches were careers using science education, policy and writing. This made sense to me because it encompasses my interests, skills and values.

TASK: Set your SMART (specific, measurable, attainable, relevant and timely) goals.

3. Research before you pivot.

There are many ways to use your knowledge of and training in science to contribute to society.

Explore your top areas from your MyIDP assessment and dig deep. Do those areas fit you? Consider the transferable skills gained in different roles, such as project management, leadership and communication.

I interviewed Ernesto Chanona about a year ago. He has a Ph.D. in pharmacology and did a postdoctoral fellowship at the National Cancer Institute. Ultimately, "Laboratory work was not exactly where I wanted to be," he said.

He recognized his strengths in the business side of science, public speaking and networking. When I interviewed him last year, he was a senior manager in biohealth technology and life sciences at the Maryland Department of Commerce. Now, he has a

new position, director of business development at CSSi LifeSciences.

"I'm selling the state of Maryland as a place to come to do business," Chanona told me last year. "Having a Ph.D. allows me to really get the buy-in from our scientists and entrepreneurs. ... A Ph.D. gives us the trust as an economic developer who is a specialist in the biotech field … but more importantly, critical thinking."

TASK: Do your homework to find out what different jobs are like.

4. Learn to write in different ways.

Writing is essential in all science careers. Can you distill your research into a few minutes or less than a page for multiple audiences? That is a good way to start.

I interviewed science policy analyst Nicholas Jury at the National Heart, Lung and Blood Institute earlier this year. He has a Ph.D. in neuroscience and has held several positions involving science policy and advocacy.

"In my current job, we are responding to people inquiring about health, communicating about science to broad audiences, including Congress, writing reports and submitting standing documents," he said. "In a nutshell, I tell a really broad story about the successes of NHLBI-funded research and package it in a way that Congress can understand."

Jury emphasized the importance of persuasive writing in particular.

TASK: Learn a new form of writing.

5. Develop your own project.

Turn your research area or a cause you care about into a project you can share. Whether it is designing an app, creating a website or using your Twitter platform, projects make an impact. You never know who is watching.

Beata Mierzwa is a postdoctoral researcher in San Diego. In high school, Mierzwa enjoyed crafting and learned how to sew her own clothes. But, she told me, she did not know she could combine science and art in a career, so she focused solely on science. While working on her Ph.D., she noticed the beauty of cell division under a microscope and wanted to find a way to incorporate art into her work.

She went on to found Beata Science Art and today creates scientific illustrations and science-inspired clothing. Her website and her Etsy store are her primary platforms and attract new commissions.

TASK: Share your work.

6. Get involved.

Last year, I interviewed Lou Woodley, director of the Center for Scientific Collaboration and Community Engagement, to learn what it takes to be a scientific community engagement manager. Woodley told me that scientific community management requires interpersonal, communication, technical, program management and program development competencies.

"The interpersonal competency is especially important because it involves skills such as moderating, facilitating and integrating different perspectives — all essential for collaborative work," Woodley said.

The American Society for Biochemistry and Molecular Biology has many programs and service opportunities that can help you work on your interpersonal skills and other competencies.

Looking to enhance your public speaking? Enroll in the Art of Science Communication course. Want to chime in on various topics live? Join the monthly Twitter chats. If you want to stay up to date with science,

check out the ASBMB's recorded on-demand events.

TASK: Find at least one resource or event to check out.

7. Find mentors and sponsors.

Once you put your work out there, it is time to find some people who will guide and champion you.

Developing and maintaining relationships is essential when making a career pivot. Having an insider's perspective helps when you want to transition to a new field. And sometimes, as you search, people will start reaching out to you.

Christiane Stachl is director of education, outreach and diversity at the Center for Genetically Encoded Materials at the University of California, Berkeley. While in graduate school, she got involved in outreach through the Chemistry Graduate Life Committee at Berkeley, which works on diversity and mentorship.

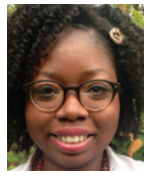
"I got super invested in it," Stachl said. "I started an effort to help improve mentorship in our department. I wrote this climate survey with one of my friends … and made sure the data would be useful to our department and to our administration."

She decided to look into how she could fit science education into her current research — and in doing so, she found allies she did not know she had.

"I was able to turn the survey into something that was more than just an exploratory thing," she said. "It became a real research project and a very systematic way to understand how our grad students were feeling. I was much more energetic and motivated to do that work."

Two chapters of Stachl's dissertation focused on science, and three chapters focused on education. In the end, her work helped inform the creation of interventions that were useful to her department.

TASK: Connect with at least one person who might be able to help you in some way on your journey.



Martina G. Efeyini (mefeyini@gmail.com)is a toxicologist, science communicator and advocate for the next generation of scientists. She works at the University of Maryland, Baltimore, CURE Scholars Program and is a careers columnist for ASBMB Today. Follow her on Twitter: @mefeyini.

InPrint offers opportunities to edit

By Himanshi Bhatia

I landed in St. Louis with a clear view of my goals and aspirations — to give undivided attention to my research and expand my viewpoint as a postdoctoral scientist. But I also had a side passion (albeit a major one) for scientific editing, and it turned out that my stint at Washington University has cultivated my editorial aspirations as well.

I always had loved working in a lab; troubleshooting experiments and analyzing data to understand the bigger picture gives me an adrenaline rush on par with caffeine. However, when a grad school colleague approached me for help with her manuscript, I realized my passion for scientific editing. In the ten years since, I informally have edited countless manuscripts and articles for my friends and colleagues. Still wary of pursuing editing as a full-time career option, however, I chose to focus on a research-based career.

A month into my new job as a postdoc at WashU, I came across a universitywide call for editors for a trainee-run group called InPrint. Established just a few months earlier, InPrint then had eight members and was seeking to expand. I applied in a heartbeat and soon found myself among budding editors and science communicators.

InPrint was established in early 2018 with the goal of providing free and confidential editing services to the WashU community. I was ecstatic and hardly could believe my luck when I passed the editing test as part of my InPrint application. I had dabbled with freelance editing jobs in the past and was on the lookout for something more permanent to satiate my editing appetite. Cutting out extraneous words, restructuring sentences — that's what I live for. My exchange visitor work visa did not allow me to pursue anything other than a postdoc in the United States. However, because it is associated with WashU and is volunteer work, I could join InPrint without jeopardizing my stay in the country.

During one of our monthly meetings, I was introduced to Deborah Frank, a full-time scientific editor in the obstetrics and gynecology department at WashU who assists department members with grant and manuscript writing. I was excited to learn that scientific editing could be a full-time career choice in academia. Until then, I was only aware of a few private firms offering such services, companies that could be called mid-sized at best with a primarily English-as-a-second language clientele. For someone who wants to do copy editing, such companies are ideal. However, copy editing jobs offer few opportunities to develop the skills needed for a concept-based scientific

editing career.

After a little digging into the academic science-communication job market, I found openings within WashU. In fact, the university has its own scientific editing core. As a graduate student from India, I had difficulty believing that, in the West, scientific editing had evolved into an academic career option. Given my visa status, I only could dream about applying for these jobs right at my doorstep. However, my association with InPrint gave me everything I was looking for — a platform to exercise and develop my editing skills and to network with people who shared my passion.

Any nonnative speaker pursuing a career as a scientist will tell you how challenging (and at times embarrassing) mastering English can be both in speaking and, especially, in writing. Grammar rules that come naturally to native English speakers can be hard for people like me to understand. As an avid reader, I'd been able to acquaint myself with the quirks of English grammar. However, interacting with peers from different ethnic backgrounds during our InPrint meetings and workshops gave me much-needed practice in applying these grammar rules to my spoken and written English language skills.

When InPrint receives an editing submission, the associate editor-in-chief assigns a first editor and a managing editor to the task. A two-week turnaround works for the majority of our clients, with a few requesting faster work. Our clients include faculty, postdocs, students and technicians.

Focusing only on editing does not do InPrint justice. Within a year of its formation, the group launched a parallel Schema Design service to help clients create graphics and scientific illustrations. By late 2020, this service boasted 30 clients in addition to 104 editing submissions since InPrint was founded.

Having no artistic aptitude, I was more attracted to writing for the InPrint blog. The group encourages each member to write about topics related to science communication, and we share these posts across all our social media handles. In addition to polishing writing skills, InPrint's blog is an opportunity to build a writing portfolio. I wrote a blog post focused on little-known grammar rules that routinely confuse scientists during manuscript and grant writing.

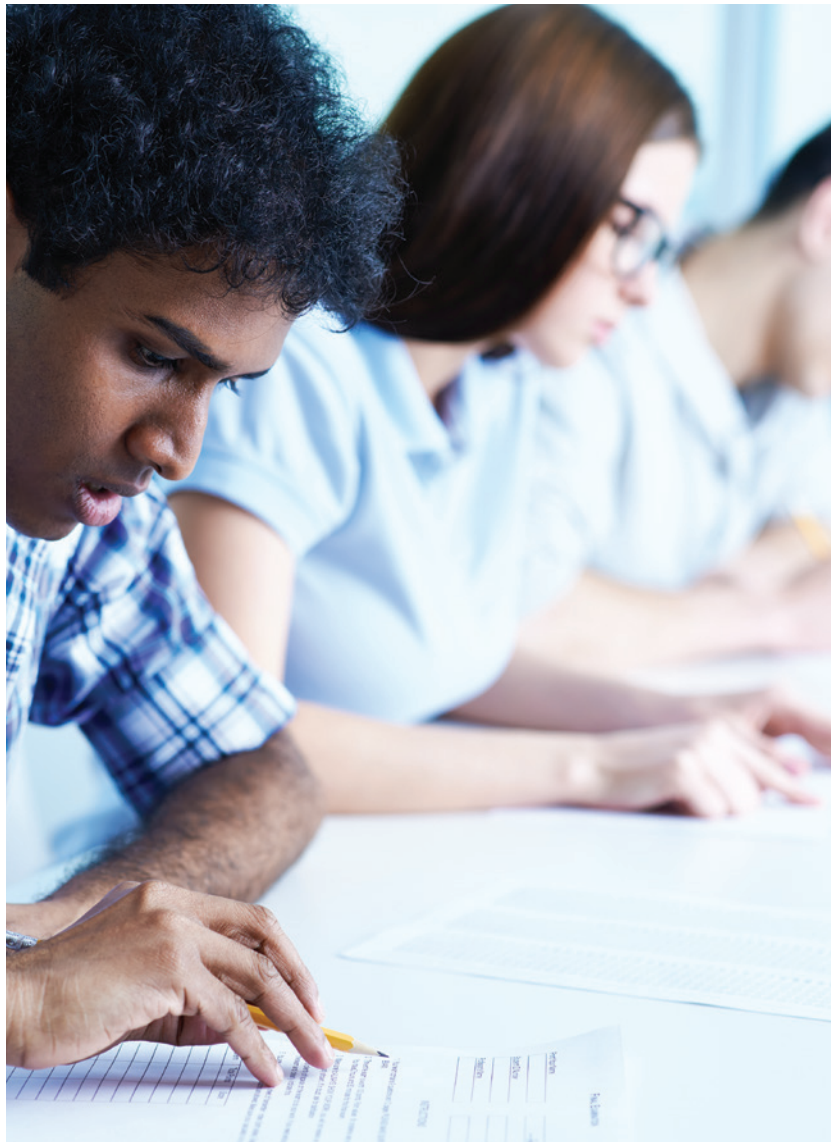
InPrint now has 75 members including editors, schema designers and presentation consultants. In just three years, our editing and graphic contributions have crossed the century mark. We have numerous recurring clients, and several InPrint alumni now hold high-profile jobs, including editor with CellPress, industry scientist and university professor. We take immense pride in being the inspiration for a similar group —ReVision — at Johns Hopkins University.

For me, InPrint is the stepping stone to my long-term career goal of being a journal editor. My association with InPrint has given me confidence in my science communication skills and has prepared me for the job market. Most of our founding members have moved ahead in their career paths, while those of us still at InPrint hope the group will add to our past success in the years to come.

Himanshi Bhatia (himanshi.b@gmail.com) is a postdoctoral research associate at the Washington University in St. Louis and is passionate about science communication.

Learning to love assessment

By Adele J. Wolfson



A saying goes around in academic circles: "I teach for free; they pay me to grade." There is truth in that — teaching is often fun, and grading is usually tedious. But as every scientist knows, there is no point in doing an experiment if you don't have a way to assess the result. So assessment is a crucial step in teaching and learning.

An enormous literature exists on assessment. And yet, reviewing materials from different sources, I see far too many exam items that simply test recall, a low-level and increasingly obsolete skill.

I recall the first time I was faced with an exam that wasn't simple regurgitation of facts. Like many biochemistry students, I had memorized the Krebs cycle: reactants and products, enzymes, coenzymes and effectors. But when I walked into the exam, I was presented with a page that outlined all that information. I thought, "But everything I know is on this piece of paper — what else can they ask me?" Then I realized that the information was just the starting point; the real test was understanding it in context and being able to apply that understanding.

Throughout my teaching career, I sought that moment of realization for my students. I used to tell them that every exam was a learning experience; one student told me that she wished there was not so much learning on my exams.

Assessing collaboration

I found that figuring out what I wanted students to learn and how to measure that learning is an essential and creative activity. I experienced an epiphany when I realized that if I wanted students to value collaboration, I would have to include teamwork on exams in some way — if something doesn't count toward a grade, many students believe it has no value. Of course, it is one thing to decide what you want to measure, another to design an instrument to do the measuring.

I first heard about pyramid testing from a group of math faculty at Smith College. They gave their exams in three parts (individual, small group, full class), with a diminishing number of points for each part. I tried that but found it took enormous amounts of class time and the students' enthusiasm diminished as

the points went down. My goals and my testing scheme then went through multiple iterations.

I finally settled on giving a take-home individual exam followed by a class period spent discussing the exam in small groups and ending with giving the students an opportunity to revise one section of the exam after this discussion. These group discussions had a greater level of engagement than any other classroom activity I assigned, which I saw as a first step toward recognizing and rewarding collaboration.

Similarly, my colleagues Don Elmore and Adam Matthews and two of their students, Valentina Alvarez and Julie Bocetti, developed an assessment of discussion-based activities in introductory courses. Their approach melds quantitative survey and qualitative student response data to determine whether the activities achieve the goals of building student community and perseverance.

Over the years, I began to think that constructing an exam was as intellectually stimulating and time-intensive an activity as writing a research grant proposal, and it had much the same goal: testing a hypothesis.

Authentic assessment

Assessments often have been used as a tool, especially in K-12 education, by politicians, school boards and accrediting agencies to reward and punish teachers as well as students. Whatever the original worthy goals of these bodies in setting standards, many frontline educators see such assessments as tests imposed by agencies external to the school and classroom. Just using the word "assessment" can get faculty up in arms. The same principles of assessment should apply to teachers and institutions as to student learning. Defining goals is the first step; figuring out how to assess whether you have met them is the next.

The American Society for Biochemistry and Molecular Biology has developed a set of requirements for biochemistry and molecular biology undergraduate programs and outlined a method to assess their success in meeting those goals toward accreditation. Resentment can arise when standards are set by outsiders, but our goals and rubrics are the result of discussion and sometimes argument among our members, so the assessment tools feel authentic.

The economist James Gustave Speth wrote, "We tend to get what we measure, so we should measure what we want." He was talking about economic growth and environmentalism and how we get sidetracked by measuring what is measurable rather than what we really care about, but the statement is true of all kinds of assessment. We need to figure out what we want students to learn as well as what we value about our institutions and programs and then set about developing ways to measure how close we come to achieving our goals.

Jenny Loertscher made valuable contributions to this essay.

National assessment projects

Several national organizations are working to set academic goals and ways to assess student progress toward those goals. The Association of American Colleges and Universities developed the Liberal Education and America's Promise, or LEAP, rubrics with broad input from faculty across disciplines. They measure learning outcomes in several areas, including quantitative literacy, teamwork and ethical reasoning. Training on the rubrics ensures fidelity of evaluation of student work.

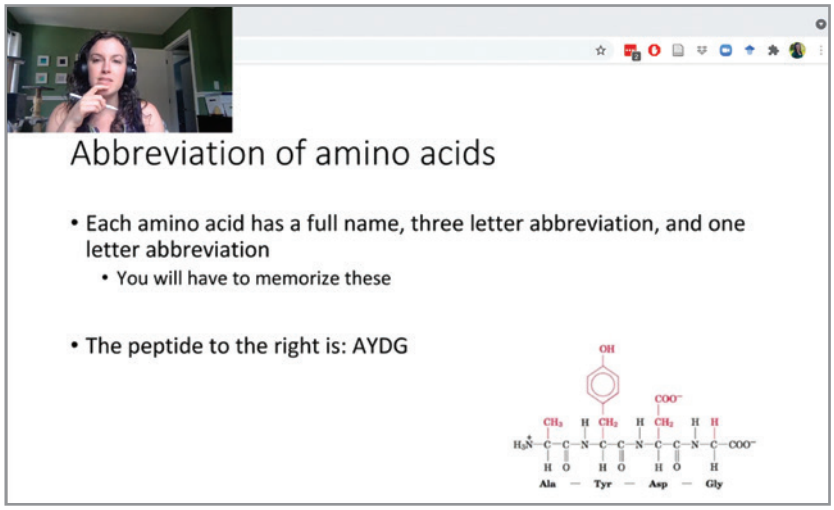
More directly relevant to biochemistry and molecular biology is the BioSkills guide. These rubrics were designed to align with the learning goals of Vision and Change, the American Association for the Advancement of Science report on transformation of biology education. Another project is the move toward specifications grading, an assessment system based on students' arrival at defined learning outcomes, by some in the chemistry community.

The committee that developed the ASBMB certification exam recently published a paper on its origins and evolution. I urge all instructors to read that paper and look at sample questions on the ASBMB website, even if your program is not yet accredited. The questions on the exam test conceptual knowledge yet are amenable to large-scale evaluation. The committee's work writing questions, editing, developing grading rubrics and evaluating answers not only has created an exam that tests what we value in a biochemistry program but also has created a community of educators who have a deep understanding of authentic assessment.

Adele J. Wolfson (awolfson@wellesley.edu) is a professor emerita in the physical and natural sciences and professor emerita of chemistry at Wellesley College.

Surviving the pandemic as pretenure faculty

By Mara Livezey



COURTESY OF MARA LIVEZEY

The author teaches an online class.

In March 2020, I had finished training my research assistants in cell culture technique, and, together, we just had reached the point of being able to gather publication-quality data. Then the pandemic hit. Not even one year into my career as an assistant professor at a primarily undergraduate institution, I shut down my lab, packed my bags and transitioned to teaching remotely. For more than a year, I haven't stepped into my lab to run an experiment or into a classroom to teach, and neither have my students.

What has been going through my mind in the past year, and what might be going through the minds of your pretenure colleagues?

Here is a short list of some anxieties we face:

- I just spent a year learning how to teach online and gaining great skills. Will this make up for my lack of research productivity?
- Will my efforts creating an inclusive online classroom be noticed?
- All my trained researchers just graduated. Will I be able to train new students and publish wet lab data before I apply for tenure?
- At the beginning of the pandemic, someone told me to be creative in adapting my research. Have I done enough remote research over the past 18 months?
- Will the tenure and promotion committee recognize the impact of COVID-19 on my research productivity when I am up for tenure?

Yes, many of us were offered a one-year tenure clock pause. But in many ways, tenure clock pauses don't equitably address the needs of pretenure faculty, and they only delay our promotion because of something out of our control.

So, how did I survive the pandemic? And how will I continue in the hope of successfully applying for tenure in a few short years?

My colleagues.

Since March 2020, my colleagues at University of Detroit Mercy have been my saving grace. When I have doubts about my progress, tenured faculty in my department remind me of my successes in the classroom and offer opportunities for collaboration. When I want to integrate what is happening in society into the scientific curriculum, faculty and staff at the university form book clubs, and we discuss how to become more anti-racist inside and outside the classroom. When I am struggling, I am invited to join an all-female pretenure group where we commiserate about our challenges and hold one another accountable to goals we set for ourselves. My colleagues, my community, have supported me through this pandemic, and their behavior reinforces why I chose Detroit Mercy as my home.

This year has been trying for us all and especially for pretenure folks facing the unknown. Reach out to us, ask us how we are doing, rally around us and, together, we will get through the rest of the pandemic.

Mara Livezey (livezemr@udmercy.edu) is an assistant professor of biochemistry at the University of Detroit Mercy. Follow her on Twitter: @MRLivezey.

Back to class

College faculty prepare for a return to in-person teaching

By Pam Mertz & Craig Streu

The past 17 months have brought immense challenges to academic institutions. During the pandemic, administrators weighed difficult choices related to safety, student engagement and maintaining enrollment. Some colleges and universities or individual faculty members opted to go completely virtual, others continued in-person teaching and many navigated a hybrid of the two.

Now that effective vaccines are readily available, we may be turning a corner on the pandemic, and more faculty and students will be able to return to in-person classes in the fall semester. We were interested to know how our fellow faculty members feel about making this transition, and we wanted to get their advice and input if they are already back in the classroom, so we surveyed instructors who have been involved in American Society for Biochemistry and Molecular Biology undergraduate events this past year. Respondents included faculty members across many types and sizes of institutions with a breadth of experiences teaching during the pandemic, as well as faculty members at various stages of the transition back to campus.

Despite that breadth of experiences, some clear themes permeated the responses. Most notably, nearly every faculty member wrote that they primarily are looking forward to face-to-face interactions with both students and colleagues.

Dan Dries, an associate professor of chemistry at Juniata College, cited casual conversations as a key reason he is excited to return to the classroom, writing, "I've lost my sense of connection to the college and its students and employees."

The challenges of teaching in a pandemic reminded some faculty members of what's important to them about their profession. Curtis Henderson, a professor of biology at Houston Baptist University, wrote, "This past year has helped me realize how much I value interacting with students."

Faculty members are excited to return to the classroom for many reasons. For some, a return to fully in-person instruction signifies the end of the challenges of remote instruction. For others, in-person instruction in any form brings a valuable social outlet.

Cheryl Kozina, associate professor of biology at Saint Leo University, wrote, "I miss my students! I miss them dropping by my office unannounced just to chat or to give exciting news about new internships or acceptance to medical/vet/etc. schools. I miss the camaraderie with my colleagues as we have random conversations at the mailboxes or as we transition between classes. I miss the social aspect of my job."

Becky Miller, a lecturer at the University of Massachusetts Amherst, is looking forward to "being in the same physical space as my students. Getting energy from their presence."

Some are motivated by the desire to reengage in other ways. Martin Hicks, an assistant professor of genetics at Monmouth University and an ASBMB Student Chapter adviser, is "looking forward to a return to in-person events, reach-out programs in the local community and traveling to regional conferences, as well as ASBMB 2022!"

Others expressed excitement about returning to the research lab with their students.

Concerns and challenges

Despite general enthusiasm about returning to the classroom, faculty members also shared concerns about the challenges they face in the transition. Many instructors have questions about safety issues, such as who will be vaccinated, whether the vaccines will be effective against new variants and whether vaccination and/or masks will be required.

Specifically related to academics, some wonder what will happen if institutions plan for in-person teaching but then need to pivot again in response to the pandemic. Some of the challenges of the past year likely will carry over, including having students in and out of quarantine and issues with family members having COVID-19. Anxiety may be high for instructors and students, and we may see an increase in other mental health issues, which

will require careful monitoring.

Survey respondents expressed concern about issues associated with students readjusting to in-person teaching such as work ethic, interactions with peers and class attendance. Many instructors provided more flexibility with assignment deadlines over the past three semesters, and they now wonder how this will translate to the next academic year.

Instructors wonder what prerequisite knowledge students will bring to their classrooms based on their virtual or hybrid learning experiences. Lab skills are one area of concern. And some question the level of preparedness of new first-year students after more than a year of remote learning in high school.

For some students, attending class virtually became more than just a pandemic safety measure as they balanced family and work responsibilities. Anita Nag, assistant professor of chemistry at the University of South Carolina Upstate, wrote, "Students are now used to taking up jobs during course hours. They connect from their job site. Some of them study only at night. Their work ethics have changed. Many students with family responsibilities found (the) asynchronous format more convenient and will have difficulty going back (child care, job, caregiver-related issues)."

Providing equitable access to all students while offering environments that foster student engagement and learning may be one of the biggest issues instructors and institutions will need to weigh moving forward. Many faculty members reported that hybrid learning models, where instructors taught in-person and virtual students simultaneously, did not work well — it was challenging to engage both groups. If they have the option, instructors need to decide whether they will allow students to attend classes virtually, perhaps under special circumstances such as illness, and whether they will record classes for later access.

'A larger toolkit'

The past year was challenging, but, in many areas, changes made for the pandemic have been for the better. For example, many instructors indicated that they have integrated technology more fully into their repertoire and that it is here to stay. This includes virtual office hours, prerecorded videos, online simulations, methods for digitally annotating slides in real time, increased use of learning management systems, virtual guest speakers and electronic lab notebooks.

Henderson wrote, "This past year has given us a larger tool kit. Feel free to pick and choose what did work to augment prior methods of teaching."

Incorporating these technologies might increase student learning, access and equity, but student engagement remains a persistent problem. Students have unfathomable amounts of information at their fingertips, so the real challenge for instructors may be devising ways for them to engage

with the material.

One solution to this issue has been the flipped classroom. By making students responsible for studying material before each class, instructors can spend time leading discussions or have the students work to solve problems related to the material. Some instructors experimented with flipped classrooms in the past, but a number indicated that pandemic restrictions caused them to flip their classes out of necessity — and they now plan to stick with that change.

Susan Walsh is an associate professor of molecular/cell biology and director of the life sciences concentration at Soka University of America. "I'm grateful for the certainty that my institution had in saying we will be online so that we could take the time to really work to understand how best to shift our pedagogy for that situation," Walsh wrote. "I finally flipped my class and got to practice that. As the data suggest, it works. I'm going to try to keep it."

Others wrote that the wholesale changes necessitated by the pandemic caused them to reevaluate fundamental aspects of their teaching. They included Katherine Hoffmann, associate professor and chair of the chemistry department at California Lutheran University.

"I ended up reflecting on how I have them spend their time (in class, in lab) and whether that actually aligns with my priorities and learning goals," Hoffmann wrote.

'Be flexible, be patient, be kind'

In the end, students are likely to benefit from all this self-reflection and experimentation in the classroom. As Jennifer Bennett, associate professor and chair of biology and earth science at Otterbein University, put it, "Teaching during a pandemic has been extremely challenging with a much higher workload. At the same time, I believe that I have grown more as an educator over the past year than at any other time."

With shifting public health policy and continued absences due to illness or quarantine, the pandemic will continue to affect classrooms for some time, so instructors will need to remain flexible. The faculty members we surveyed provided good advice on this theme.

> "Things will be different on the other side. Nothing is back to normal."
>
> JOHN TANSEY
> PROFESSOR OF CHEMISTRY
> OTTERBEIN UNIVERSITY

Christopher Berndsen, associate professor of chemistry at James Madison University, wrote,

"Be flexible, be patient, be kind. Building community is more important than pressing through content."

And Hoffmann advised, "Realize that the students are with you, even if it isn't polished."

Whether they already returned to the classroom or are planning to return this summer or fall, these instructors know they should expect some level of continuing uncertainty. John Tansey, professor of chemistry at Otterbein University, put it succinctly: "Things will be different on the other side. Nothing is back to normal."

Pam Mertz (psmertz@smcm.edu) is a professor of chemistry and biochemistry at St. Mary's College of Maryland and chair of the Student Chapters Committee.

Craig Streu (cstreu@albion.edu) is an associate professor of chemistry and biochemistry at Albion College and a north central director for Student Chapters.

Productive mentoring meetings: A conversation

By Irina Duff, Jenifer Calvo & Rajini Rao

We recently participated in a moderated session titled "How to have a productive meeting with your mentor/mentee" hosted by the Johns Hopkins University Postdoctoral Association, or JHPDA. Our discussion covered best practices and proposals for better mentoring of postdocs. The event originally was aimed at the Hopkins community, but we believe this is an important topic beyond our institution. One takeaway message is that postdocs need structured access to mentors because they fall into a mentoring gap.

(Editor's note: This conversation has been edited.)

ID: What is the best way to approach a potential mentor?

RR: This depends on career stage. Predoctoral students have structured access to mentors through thesis committees, rotation advisors and teachers. Junior faculty may have mentoring committees and department chairs to advise them on career development. Unfortunately, postdoctoral fellows fall in between and often lack access to mentors, especially outside their lab. We can change this.

ID: What are signs of a good mentor? How do you recognize them before reaching out to a faculty member?

JC: For me, a good mentor is one who would not only guide my growth as a scientist but also help and support me in reaching my career goals. I don't think this is something you can easily determine from their publications or websites, so you really need to talk to them and to their lab members. You need to discuss their mentoring style and expectations and see if these match your needs and personality.

RR: A good mentor must make time for their mentee. If they are too busy to meet with you, then find someone else. A mentor may have expertise in a scientific field that complements that of your lab mentor (typically the principal investigator) and model a shared life experience (for example, as a woman of color) or specific career that matches your aspirations.

ID: How frequently do you meet? Do you meet regularly or at the mentee's request? How do you prepare for these meetings?

JC: I meet with my mentor, who is also the principal investigator of my lab, every week at a fixed day and time. The day before, I send them a weekly report, which includes a summary of the previous meeting, updates, other issues that need to be discussed and plans for the following week. This gives me a chance to organize my results and plan for the meeting, while it allows my PI to prepare by giving them time to look at my data and think about any issues. This is also a good way to make sure I

am on track and goals are being met.

RR: I individualize the frequency of meetings depending on the mentee's needs and career stage so that there continues to be growth and development in our discussions. I prepare for the meeting by reviewing any notes from prior meetings and going over their research plans. If the mentee is not a trainee in my lab, I may ask for an updated CV to review their career trajectory.

ID: Do you set a mentorship plan with goals and milestones to be accomplished every month/year and follow it, or is it more on a question/answer basis?

JC: When I started, my PI and I discussed not only my project goals but my professional goals as well. This allowed us to tailor my research projects so that I can gain skill sets beneficial for my next career step after this fellowship. Postdocs are also required each year to accomplish an individual development plan with their PIs, so this is a great opportunity to plan and think about goals and milestones.

RR: I strongly recommend separate plans for short-, medium- and long-term goals that can be tracked at different intervals. It's important to develop your career in the direction of your long-term goals. For example, if you would like a job at a predominantly undergrad institution, such as a liberal arts college, get a teaching certificate and real-world experience teaching at a local college. Find a mentor who is already in the career that you want.

ID: How do you handle conflicts and disagreements in mentor–mentee relationships?

JC: Fortunately, I haven't had any major conflicts, and this is mainly because I always had a chance to share my opinions and be listened to with an open mind. Disagreements are normal, but if you talk about them and each party has a chance to explain their thoughts, then hopefully you can agree on a solution. Most of the conflicts I've seen are usually due to lack of communication, and so I think this is key in maintaining a good relationship with your mentor or PI.

RR: In addition to good communication, mutual respect and trust are also important in mentor–mentee relations. If you find yourself in a toxic relationship, be sure to seek advice from other mentors and peers. It may be better for your career and health to move on, however hard and scary that may seem.

ID: How can you foster interdepartmental mentorship programs? What might faculties do for that? How can postdocs take initiative to seek expertise outside of their department/school?

JC: I only had opportunities to have interdepartmental collaborations from my research projects. I also look out for seminars from other departments that interest me. Additionally, our professional development and careers office at Hopkins has useful seminars about career options. However, you really have to take initiative and use spare time for these seminars, so I think it would be very useful if there were a system in place for postdocs to find mentors.

RR: We should normalize having a mentoring committee for each postdoctoral fellow, as is required for the National Institutes of Health Pathway to Independence (K99/R00) award. This committee could provide feedback on research proposals, practice job talks and offer networking connections. Departments that are recruiting new faculty could allow postdocs to view candidate chalk talks. To build a mentoring network outside of their institution, postdocs should join a professional society in their field, regularly attend the society's annual meetings and volunteer on society committees.

Irina Duff (iduff1@jhmi.edu) is a postdoctoral fellow in the psychiatry and behavioral science department at the Johns Hopkins University School of Medicine. She serves as co-chair for the JHPDA policy and advocacy committee. Follow her on Twitter: @IrinaDuff1.

Jenifer Calvo (jcalvo3@jhmi.edu) is a postdoctoral fellow in Svetlana Lutsenko's lab in the physiology department at the Johns Hopkins University School of Medicine. Follow her on Twitter: @JenCalvoPhD.

Rajini Rao (rrao@jhmi.edu) is a professor of physiology at the Johns Hopkins University School of Medicine and chair of the ASBMB Today editorial advisory board. Follow her on Twitter: @madamscientist.

What we've learned about careers in industry

By Courtney Chandler & Laurel Oldach

While writing about industry careers for ASBMB Today, each of us has talked to dozens of scientists who work in various sectors and in jobs ranging from regulatory affairs to research. And during those interviews, we've heard certain refrains. When our editors asked what we've learned about industry careers from our many conversations, we put our heads together and came up with this list.

Landing the first industry job

The transition between fields can be intimidating, especially if you haven't had exposure to the field you're pursuing. We often ask our sources how they started thinking about going into industry and how they prepared for and landed their first jobs. Networking, internships and recruiting are common answers.

Networking is as important as people say.

Professional contacts can give you a glimpse of what it's like to do a specific job. They also can help by telling you about job opportunities or bringing your application to a hiring manager's attention.

Genenetch's Wayne Fairbrother didn't land a job for which he applied, but the company approached him a few months later because someone they trusted mentioned him. It turned out to be a great fit; he's worked there since 1992.

Brandon Anjuwon–Foster, who until recently worked at Pharmaceutical Product Development, conducted more than 30 informational interviews (!) before even beginning to apply for jobs in industry. These interviews helped him figure out what kind of job he would find most fulfilling and gave him a better idea of what kind of companies to consider.

Short-term stints can open doors.

Internships are a great way to get experience and exposure to new job types. They don't always promise a full-time position at the end, but at the very least the connections made and knowledge gained can give you a leg up.

Jenna Hendershot, a senior scientist at the diagnostic testing company Progenity, signed up for an internship aimed at undergrads when she couldn't find any for Ph.D. students; she said she found it life-changing.

Kendra Seckinger realized she wanted to go into industry after a summer research internship at Genentech. The next year, after graduating, she started another internship at Genentech, this time in regulatory affairs, and ended up loving the work. The timing worked out, and she's now a full-time associate program manager of regulatory affairs.

Sometimes you have to sacrifice seniority.

This relates to the previous point about internships but warrants its own discussion. Sometimes going into a completely different sector or position type means you have to start at the beginning. This can be hard to do, but — if you're willing to make the sacrifice — it can be a great way to set forth on your new path.

Renee Yura said this strategy worked for her: She took a temporary contractor job after graduate school and worked her way up from there. Although overqualified for that first job, Yura is now a director at Pfizer.

Seckinger, mentioned above, landed her job in regulatory affairs by starting at the bottom as an intern, despite having already earned a Ph.D. and completed a separate internship at Genentech. She said the internship was key to learning the landscape and lingo of the new field.

How to use what you were taught in grad school

We've heard a lot about how people didn't think they were prepared for industry jobs due to lack of industry-focused training in graduate school. There are usually a lot of skills they wish they'd learned — but there are opportunities to learn them along the way.

Teamwork is essential.

In grad school, project collaboration greatly depends on your specific project, lab and principal investigator.

To illustrate this point, we'll take a minute to talk about our own grad school experiences. Courtney felt she constantly was working on collaborative projects (sometimes to the detriment of her own), but Laurel had the opposite experience: Her project belonged only to her, and she reported only to her PI, and if somebody else was helping her, it was a one-off favor.

Laurel's experience is not uncommon in academia but is very unusual in industry. At most companies, you're working on a team, and everybody has to pull together to get things done. "Teamwork" may be the No. 1 industry buzzword we've heard in almost every interview.

Sadiye Amcaoglu Rieder loved the teamwork aspect of her job as a senior scientist at Viela Bio. She said bringing diverse perspectives and expertise together helped increase efficiency and make creative solutions.

If your story is similar to Laurel's, fear not — try to think about how you can spin your experience for an industry audience. Did you have a collaboration? That's teamwork. Did you finish a project? There's timeline and project management. Use the experiences you did have to your advantage.

Communication is key.

In most academic departments, even if your lab studies something unique, you can rely on your colleagues to share a lot of background knowledge. In contrast, most companies include workers with different backgrounds and areas of expertise. It's important to know your audience and be able to talk about your work without boring people or giving them too much information.

In his role as a project analyst at Emergent BioSolutions, Surya Sundar has to interact with a lot of nonscientists. It's just as important that they understand the projects as it is that

the researchers understand it themselves, and that can be achieved only through clear communication.

If you want to improve your scientific communication skills (for industry or really any job), science communication classes can help.

Adaptability is a must.

Things move faster in industry than they do in academia. Project timelines are shorter and more targeted, and teams are bigger, with more distributed responsibility. If a project isn't working out, it's much more common in industry than in academia to drop it and work on something with better odds. Industry trends also are evolving constantly, so it's important to be willing to switch gears as needed.

Mark Harpel, a scientific leader in the novel human genetics research unit at GlaxoSmithKline, said: "There's no guarantee that what we're working on today will be of interest three months from now." That means scientists have to be willing to pick up new things.

Damini Agarwal, director of product development at Infinite Biomedical Technologies, said she loves that the biotech and healthcare industries are expanding rapidly. This creates a lot of opportunity for jobs, and she urges people to remain lifelong learners to help them stay on top of current trends and data.

You are not your project.

Industry is a vast field with so many different types of jobs. Several people we've interviewed emphasized that it's important to cast a wide net when applying for jobs and not to limit yourself to what you think you're qualified for based on your past experience.

Did your grad work focus on cell biology but you see an awesome industry job in cancer therapeutics? Don't hesitate to apply — your critical thinking and scientific skill set will carry you farther than the specific details of your project or field.

Biogen's Cherié Butts said that embracing diversity in industry is critical to coming up with creative solutions and advancements. Remember that you have something to bring to the table beyond your science.

Courtney Chandler (courtneyec19@gmail.com) is a postdoctoral researcher at the University of Maryland, Baltimore, and an industry careers columnist for ASBMB Today. Follow her on Twitter: @CourtneyCPhd.

Laurel Oldach (loldach@asbmb.org) is a science writer for the ASBMB. Follow her on Twitter: @LaurelOld.

Variety in academia

What I've learned covering academic careers

By Elizabeth Stivison

By far my favorite part of writing the academic careers column for ASBMB Today over the past two years has been interviewing people. I still get a little nervous right before, when the phone is ringing, but I love all the conversations. It surprises me how much I love the interviews, because I think of myself as an introvert, but getting to know people, even if only for 15 minutes or an hour, has been rewarding and enlightening.

I love hearing everyone's unique story and point of view. I find that in every interview I genuinely do not know what people's answers will be to my questions. When I go in with assumptions about what people probably will say or think, I am almost always wrong. While sometimes that leads to me pausing awkwardly and self-consciously while I think of how to follow up, I love being truly surprised by people's thoughts and experiences. It feels like it's opening my world, and I hope I've been able to convey that in my articles.

Besides being mind-opening, the unexpected answers and stories I hear during interviews also can be comforting and encouraging. Sometimes I feel like I don't fit the mold of a good academic, but after all these interviews, it seems to me that there is perhaps no mold. Instead, there is a truly wide range of experiences, opinions and personalities — more than I expected — and science is better for that.

The three takeaways that I want to share are:

1. No two people's paths are the same.
2. Even two jobs with the same job title can be very different.
3. There are lots of academic careers besides professor.

No two paths are the same.

I know when I interview professors there is certainly survivorship bias making it look like a more accepting field than it is. If you want to know what it's like to try to be an actor in Hollywood, for example, it may be inspiring to read about Jennifer Aniston getting discovered and cast in "Friends." But it may be more accurate to interview any of the thousands of actors who are still currently waiting tables while they wait to be discovered. And I've been interviewing a lot of Anistons.

A friend of mine on a search committee for a small school said they recently got more than 200 applicants for a professor job opening, making each candidate's chance of getting hired 0.5%, and I've been largely, though not exclusively, interviewing those who got those jobs.

Even with this bias in mind, I've been happily surprised and encouraged at how different each person is and how different their individual career trajectories are. Everyone has their own ideas about research and about their jobs. They all have different strengths and weaknesses, different favorite parts and least favorite parts of the job. They each found their job in different ways.

No one's career is really like anyone else's.

I've spoken with people who have done things I didn't think were possible, like moving from industry to

a teaching job, as Cheryl Bailey did when she moved from Promega to Midland University. (She's now a dean at Mount Mary University in Wisconsin.) Or moving almost straight from a Ph.D. to a professorship, like Sam Sternberg did when he started his lab at Columbia University.

Each professor builds their lab slightly differently too: Some PIs want someone who has expertise or knowledge they need; others want only enthusiasm.

The variety of direct and circuitous paths, paths that ended up where people expected and paths that led to unforeseen changes, are good reminders that there isn't necessarily a standard way to make a career in academia. You might end up working on something because of a simple but inspirational interaction, as in Manajit Hayer–Hartl's case: A colleague told her over the phone that the problem of synthesizing rubisco outside of chloroplasts had not been solved, so she set out to do it, and did, winning the ASBMB–Merck Award for it!

Or you might start out wanting to do only research, thinking that teaching is a chore, only to discover along the way that teaching is your true passion, as did Ruby Broadway at Dillard University. She now devotes most of her time to student programs at the university, something she didn't expect at the beginning.

There is variability within jobs with the same title.

I've also been happily surprised to find how many different niches there are in any given job in academia. Even being a professor varies quite a bit from institution to institution, and there are many different types of professor positions with different responsibilities, including differing amounts of teaching and grant writing.

Even among the professors at primarily undergraduate institutions whom I interviewed last year, each had a different job with different amounts of teaching, which meant each school was seeking something different. Jen Schroeder at Young Harris College, for example, focuses almost entirely on teaching and campus life, while Alex Purdy at Amherst devotes more of her time to research. This was reflected in the job search process: At Young Harris, teaching experience is weighed more heavily in the application process, while at Amherst the search committee looked more closely at the research plan and required less teaching experience.

Positions such as technician, research associate and research specialist vary dramatically between institutions too. They can vary even between labs at the same institution, as Minakshi Poddar experienced in her career at the University of Pittsburgh. She has been a research specialist in three different labs and found each to be a different environment and work style.

A fascinating discovery came from interviewing many people on a given topic, such as working at a PUI, how PIs hire postdocs, leaving and returning to the academy, or how PIs start their own lab. The people I spoke with had such an assortment of experiences that it often was hard to find commonality or consensus for the articles. This was really refreshing and encouraging because to me it means there are a lot of different niches out there, and it's possible to find yours. If one institution or job isn't a good fit, another might be perfect.

There are so many other jobs in academia besides professor.

People are drawn to different aspects of academia, and people have different skills and strengths and weaknesses. Some love the teaching

and school community, so they do just a bit of research. Some love the research and teach if they have to. Some love writing grants and getting their ideas down on paper but hate wet lab work. Others love seeing the raw results in lab, but writing grants is a drag for them. Some love being in charge of a lab, and others prefer to let someone else make the big decisions.

This is reflected in the many different kinds of workers in academia, including professors, technicians, lab managers, research specialists, core managers, senior research scientists, associate scientists and lecturers. There isn't just one mold that everyone must fit.

Over the past two years of covering academic careers, I've been happy to discover that your career truly can be your own.

Elizabeth Stivison (Elizabeth.stivison@gmail.com) is a postdoctoral researcher at Vanderbilt University studying inositol signaling and an ASBMB Today careers columnist. Follow her on Twitter: @E_Stivison.

ASBMB
American Society for Biochemistry and Molecular Biology

ASBMB FELLOWS

Call for nominations: 2022 ASBMB fellows

Selection as a fellow of the American Society for Biochemistry and Molecular Biology is an honor to be bestowed upon our most distinguished members. Fellows will be recognized for their meritorious efforts to advance the molecular life sciences through sustained outstanding accomplishments in areas such as scientific research, education, mentorship, commitment to diversity and service to the society and scientific community.

The ASBMB Fellows Program encourages nominations that reflect the breadth and diversity of the society's membership.

asbmb.org/fellows

Sharpening professional skills to sustain science

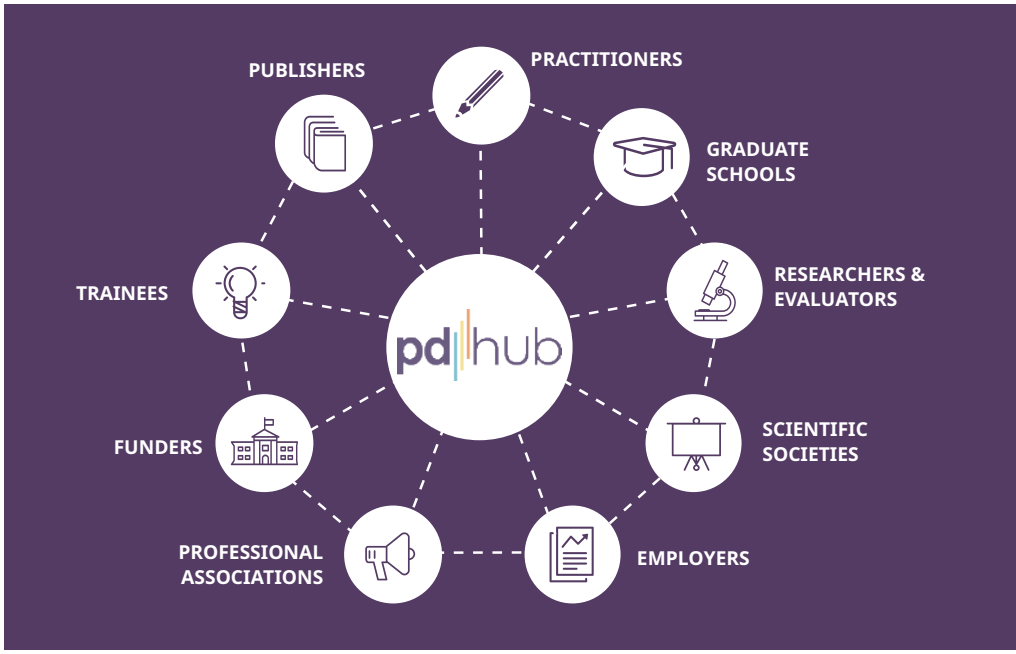
By Erica A. Gobrogge & Suzanne Barbour

For science to be sustainable, all entities involved in the scientific enterprise must be able to recruit, train and retain scientists who can adapt to the evolving needs of the scientific workforce and society. Graduate students and postdocs in biochemistry and molecular biology increasingly express interest in a variety of roles within and beyond academia, and the COVID-19 pandemic has emphasized the value of scientists in diverse roles.

Scientists working in academic and industry labs, in policy and in communications all have made valuable contributions to the fight against SARS-CoV-2. To thrive in their future careers, trainees need to learn both technical and professional skills — from experimental design to written and verbal communication to specific scientific techniques to working in diverse teams.

This vision underlies many of the American Society for Biochemistry and Molecular Biology's activities, particularly those related to professional development. However, much remains to be done. Looking across the scientific training landscape, approaches remain disparate, leading to inefficiencies in implementation and lack of systematic change.

Many graduate programs require individual development plans, but not nearly as many offer training on how to create and use these plans effectively. Those programs that offer training have had to develop it themselves without a tried and tested method for peer review or dissemination. This also has been our experience as we work to develop high-quality career and professional development at our own institutions; we find it difficult to identify published best practices and efficiently implement new curricula and training.



These systemic challenges were discussed at the ASBMB's 2016 Summit on Sustaining the Biomedical Research Enterprise, where participants recommended forming a national hub to offer curated, evidence-based resources to catalyze change in biomedical research training. This idea has come to fruition with the creation of the Professional Development Hub (pd|hub).

Forming pd|hub

The organizers of pd|hub aim to effect change with input from the full range of stakeholders for graduate and postdoctoral education. A 2019 workshop organized by pd|hub assembled university leaders, career development professionals, scientific societies, publishers of science and education journals, education researchers, employers, funding organizations,

professional associations, and trainees to discuss the challenges and opportunities associated with preparing graduate students and postdocs for diverse career paths.

The workshop identified four key challenges to systemic change and five critical actions for advancing evidence-based practices in Ph.D. career and professional development. Read the full report at pdhub.org.

Challenges to change

- The need for a trainee-centered perspective in Ph.D. training.
- Undervaluation of Ph.D. career and professional development as a core component of training.
- Misaligned incentive and reward structures for enacting change in graduate and postdoctoral education.
- The need for communication and collaboration among stakeholders across local and national efforts to modernize graduate and postdoctoral education.

Critical actions

- Creating incentives for change at institutions and programs and establishing accountability.
- Curating and disseminating resources for evidence-based career and professional development models in a way that supports widespread implementation.

"Many of the skills graduate students need to develop and challenges they may face in their training are not unique to any one discipline. Additionally, many scientific societies develop similar strategies to support career and professional development or encounter similar struggles in addressing the needs of these members. In this regard, it has been incredibly helpful to collaborate with other scientific societies and pd|hub to share resources and experiences as well as to develop new content that can reach all of our respective audiences."

KIRSTEN BLOCK
DIRECTOR OF EDUCATION
PROFESSIONAL DEVELOPMENT AND OUTREACH
ASBMB

"I never expected that the ideas of a few dozen biological science professionals in a room, invited by the ASBMB in 2016, would generate such momentum resulting in the creation of an impactful organization, pd|hub, which is primed to significantly enhance training of the next generation of biomedical and behavioral scientists in the U.S. and beyond."

KENNETH I. MAYNARD
SENIOR DIRECTOR
TAKEDA PHARMACEUTICALS INC.

"It is very gratifying and exciting to see how the seed planted at the 2016 Sustainability Summit has grown, through the hard work of many, into such a powerful professional development network that will help the next generation of scientists navigate into satisfying and productive careers in all different aspects of the scientific enterprise."

WES SUNDQUIST
PROFESSOR AND CO-CHAIR OF BIOCHEMISTRY
UNIVERSITY OF UTAH SCHOOL OF MEDICINE

"The pd|hub's integration of equity frameworks along with facilitating collaboration across stakeholder groups has the potential to be transformative for graduate students and postdocs, particularly the most marginalized. Career and professional development opportunities that I pursued while I was a graduate student and postdoc have absolutely positioned me for my current role focused on driving systemic equity in the STEM academy, in my work on an NIH working group, and much more. pd|hub is working to make that the norm."

STEPHANI PAGE
COMMUNITY ENGAGEMENT MANAGER
ADVANCE RESOURCE AND COORDINATION NETWORK

- Broadening and deepening evidence for effective training and mentoring practices that promote career and professional development.
- Improving communication within and across stakeholders in science, technology, engineering and mathematics Ph.D. education.
- Creating standards and defined expectations for STEM Ph.D. career and professional development.

Taking action

pd|hub is taking several actions.

First, organizers are working to develop peer-reviewed collections of evidence-based practices in graduate/postdoctoral education, specifically in professional skills development. pd|hub is collecting submissions now, and the first collection will be available in 2022. These collections will be a resource for universities, programs and departments seeking to implement or enhance professional skills training for their graduate students and postdoctoral scholars.

Second, six scientific societies, including the ASBMB, have formed a partnership with pd|hub to share ideas and resources and collaborate on a series of projects. Students, postdocs, educators and mentors face similar challenges across scientific disciplines, so it makes sense to work together to address the challenges and take the critical actions that are described. The group's current project is a series of professional development webinars on graduate student mental health in partnership with the National Academy of Sciences, Engineering and Medicine. The group also hosted a webinar on the art of storytelling in STEM in June 2020.

To learn more or get involved, visit pdhub.org.

Erica A. Gobrogge (erica.gobrogge@vai.org) is program director in the office of postdoctoral affairs at Van Andel Institute and former education and professional development manager for the ASBMB. Follow her on Twitter: @ericasieb.

Suzanne Barbour (barbours@email.unc.edu) is dean of the graduate school and a professor of biochemistry and biophysics at the University of North Carolina–Chapel Hill.

Six scientific societies, including the ASBMB, have formed a partnership with pd|hub to share ideas and resources and collaborate on a series of projects.

"Very, very luckily for me, this project is going well"

By Laurel Oldach

Vijayakanth Pagadala was a postdoc in Jian Liu's lab at the University of North Carolina at Chapel Hill when he got an exciting opportunity: running the science at Liu's startup, Glycan Therapeutics. He's been there for five and a half years, working on in vitro production of a glycan drug that currently comes from animal sources. This interview has been condensed and edited.

Vijayakanth Pagadala

CURRENT POSITION
Principal scientist, Glycan Therapeutics

CAREER PATH
Ph.D.: Rosalind Franklin University, 2009
Postdocs: National Institute of Environmental Health Sciences, 2009–2013; University of North Carolina at Chapel Hill, 2013–2015

FAVORITE MOLECULE OR PROTEIN
Adenosine triphosphate synthase. "It is the most fascinating molecule."

1 Glycan makes synthetic oligosaccharides. What are they useful for?

We're trying to produce synthetic heparin. Heparin is the oldest and best known anticoagulant, a blood-thinner injectable that is purified from animal gut. It is made from cheap, easily available raw material, manufactured on a scale of tons. But there have been instances where contaminated heparin killed people. Also, 80% of global heparin comes from pigs, and swine flu is decimating the pig population, which risks the supply chain. Pharmacologically, the synthetic drug we are making is a single-molecule entity, whereas heparin is a mixture of approximately 30 different oligosaccharides.

2 Do you spend most of your time engineering heparin and heparin producing enzymes?

I want to spend more time on engineering, but there are some financial and deliverable constraints that won't let me. I am working on optimizing production: how to grow cells, how much protein we get out of each batch, how much starting material we can convert into product, how many rounds of synthesis we can do in a year and so on. I do some process engineering, some enzyme engineering and strain screening. In the near future, I hope that we'll tie up with some bioprocessing giant where enzyme engineering and production is a push of a button.

3 What made you want to work at a startup?

A confluence of factors and being in the right place at the right time. I'm happy I made the choice to join a startup. Very, very luckily for me, this project is going well. Unfortunately, only one in 10 postdocs get a chance for an equitable share of the academic research pie. I think I will continue to be in entrepreneurship, because you can come out with real, life-changing products.

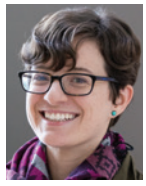
4 You're the PI on a couple of Small Business Innovation Research grants. How do they compare to academic funding?

In a way, there is a simpler scientific goal in the SBIRs. But reproducibility, scalability and execution have to be 100% or else the product will fail. The emphasis is on execution and commercialization rather than proof of concept.

5 What skills have you needed to develop on the job?

People skills. You can work in relative isolation in a big lab. But in a small startup where you build everything from scratch, everybody in the team has to work with each other and wear multiple hats. Academics do wear a lot of hats, but, generally, people skills are less important in an academic lab. Also, a deep-seated can-fix-anything mentality is critical for navigating the demands of a job in a startup.

Laurel Oldach (loldach@asbmb.org) is a science writer for the ASBMB. Follow her on Twitter @LaurelOld.



CLASSIFIEDS

Postdoctoral Associate
Yale University

The laboratory of Enrique M. De La Cruz, in the Molecular Biophysics and Biochemistry (MB&B) Department, is looking for a Ph.D. in (bio)chemistry, (bio)physics, engineering, molecular/cell biology, or computational biology. The individual's personal characteristics should include: highly self-motivated, independent, and enthusiastic. The individual should be ready to actively engage lab members and participate.

https://careers.asbmb.org/job/postdoctoral-associate/57589548/

Research Nutritionist
Grand Forks Human Nutrition Research Center

The Grand Forks Human Nutrition Research Center is seeking a highly qualified candidate for a permanent full-time Research Nutritionist to help us with our food-based agricultural research. The selected candidate will serve as a Research Nutritionist in the research management unit entitled, "Dietary Prevention of Obesity Related Disease Research."

https://careers.asbmb.org/job/research-nutritionist/57791036/

Senior Scientist
Ibex Biosciences, LLC

Ibex Biosciences, LLC, a pharmaceutical research company in Cumberland, MD seeks a full-time Senior Scientist to work at its offices in Cumberland, MD and Rockville, MD. Perform gene cloning, RNA extraction, qRT-PCR, DNA gel electrophoresis and purification, western-blot analysis, immunohistochemistry, etc. Provide support in writing and reviewing grant/fund applications. Travel between worksites in Maryland as needed. Requirements: PhD in Biology or related field. Email resume to: careers@ibex.bio.

https://careers.asbmb.org/jobs/view/senior-scientist/57453837/

Postdoctoral Associate/Research Scientist
Texas A&M University

Wenshe Ray Liu Lab at Texas A&M University in the department of chemistry, the department of biochemistry and biophysics, the department of molecular and cellular medicine, and the department of translational medicines is seeking two highly motivated postdoctoral fellows for pathogenic and drug development research for COVID-19 and cancer. Qualified candidates should have strong research experiences in biochemistry and molecular and cellular biology and either have or be willing to learn protein crystallography and cryo-EM techniques for structural characterizations of biomacromolecules.

https://careers.asbmb.org/job/postdoctoral-associateresearch-scientist/57686890/

To see a full list of jobs, please visit careers.asbmb.org