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ASBMB TODAY

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

THE CAREERS ISSUE

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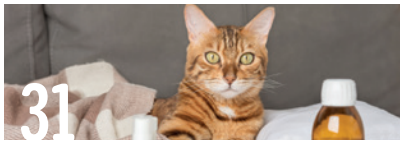
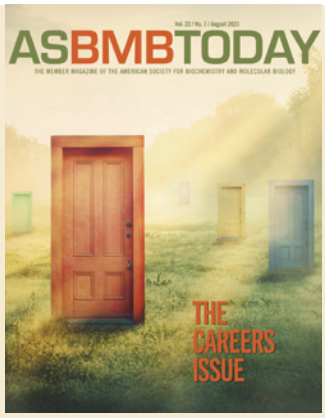
CONTENTS

NEWS



FEATURES



PERSPECTIVES

ASBMBTODAY
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Talking about science outreach and communication

By Ann Stock

To increase awareness of American Society for Biochemistry and Molecular Biology activities, I've been talking to chairs of the committees that steer the society's initiatives.

I recently spoke with Christina Swords of the Science Outreach and Communication Committee. A graduate medical education coordinator at the University of Wisconsin–Madison, she has chaired the committee since 2022.

This conversation has been edited.

AS: When did you become an ASBMB member — and what attracted you to the society?

CS: I was finishing my Ph.D. work in 2018 at the University of North Carolina at Chapel Hill. Throughout grad school, I had been involved in a lot of science outreach efforts, and I wanted to integrate outreach into my future career.

I read about SciOut18 (an initiative of the ASBMB Science Outreach and Communication Committee), applied, was accepted and attended the two-day conference in New York City. There I networked with committee members who encouraged me to keep in touch, and I did. A trainee position on the committee opened while I was a postdoc at the University of Wisconsin–Madison, and I've been a member since then.

AS: What motivates you to participate in society activities?

CS: In my current role, I support postdoctoral fellows. ASBMB membership allows me to stay connected with scientists and the research community even though I'm no longer at the bench every day. I keep up with the scientist part of my personality through activities such as reading ASBMB Today articles or going to science sessions at the annual meeting. It's important for my continued development as a scientist, and it makes me a better science communicator because it keeps me up to date on new research and helps maintain my credibility.

AS: What activities of the committee are you most excited about?

CS: At DiscoverBMB, we welcomed about 30 high school students and their mentors from the Seattle area into the conference space for a new initiative called Community Day. We designed programming specifically for them, including science talks by ASBMB members, hands-on demos by committee members, innovation discovery at exhibitor booths and conversations with scientists, all geared toward introducing them to what happens at a scientific conference and paving the way for their future in science.

Also, the Art of Science

Communication course, which the committee has been passionate about since its launch in 2015, was updated this year.

AS: For members unfamiliar with this course, what does it provide?

CS: The course provides the foundational knowledge for any scientist to communicate their work to a nonexpert audience. It's open to scientists at any career level living anywhere in the world.

It's a flipped classroom model. Participants watch online content asynchronously and do small assignments. Then they come together in small groups with a facilitator to discuss the content and workshop their science communication pieces. This format provides an opportunity to network with other scientists who are interested in science communication and an opportunity to practice. For most folks, science communication does not come naturally. It's a skill that we develop, and just like running a PCR gel, it gets better with practice.

AS: What's new in the updated course?

CS: How the material is presented is new, although a lot of the fundamental content is the same. We know from best practices that information is retained better when it's gleaned from a dialogue or a conversation.

We also involved more members of the committee in the videos. The modules present a greater diversity that better reflects the nature of science and scientists.

There is one new module on storytelling. The structure of a story can engage an audience because it's ingrained in us as humans. Stories help start dialogues and conversations, which is really the goal of many science communication initiatives.

Christina Swords

The course is offered twice a year. Summer enrollment begins in June, and the session runs through July and August. Winter enrollment begins in January, and the session runs through February and March.

AS: How can ASBMB members get involved with your committee?

CS: We encourage participation in almost all initiatives. We want members to meet students at Community Day. Just let us know, and we'll keep names on a list for next year's meeting in San Antonio.

We've started a member spotlight initiative. Through short interviews shared on the website and social media, we aim to highlight and celebrate ASBMB members engaged in outreach. We know they're out there, and we know they're passionate about what they do. We want to help demonstrate their work.

We offer grants for outreach projects that might need a little help with funding. The application window is late summer through October, and we encourage everyone to apply.

Finally, the Art of Science Communication course would not exist without facilitators. These are folks who have completed the course successfully and then return to lead the weekly discussion sessions. We ask for volunteers twice a year. It's a great way to keep up science communication skills.

AS: What do you find rewarding about being an Art of Science Communication facilitator?

CS: For me, it's being part of a team that offers science communication training so broadly. We hear from many participants that if it weren't for this online course, they would not have had the opportunity to develop skills that are important to them professionally, educationally or personally. The ASBMB is filling an important gap in the scientist training space.

The course addresses current societal challenges — mistrust of science and misinformation. We hope we're developing scientists who are sensitive to this and can be part of the solution. I'm proud to help facilitate that conversation.

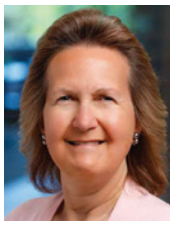
Ann Stock (stock@cabm.rutgers.edu) is a professor of biochemistry and molecular biology at the Robert Wood Johnson Medical School at Rutgers and resident faculty member at the Center for Advanced Biotechnology and Medicine. She is the ASBMB's president.

Teaching honors for Corbett, Dahms, Volkman

John Corbett, Nancy Dahms and **Brian Volkman** were awarded Teacher Recognition Pins during the Medical College of Wisconsin's Outstanding Medical Student Teacher Awards. The researchers were recognized for contributing to the advancement of medical student learning.

CORBETT

Corbett is a professor and chair of biochemistry at MCW. His research focuses on pancreatic beta cell death during Type 1 and Type 2 diabetes mellitus. Corbett recently published a study in the Journal of Biological Chemistry on the DNA damage response in pancreatic beta cells and its impact on glucose uptake.



DAHMS

Dahms is a professor of biochemistry at MCW. Her lab studies the biochemistry of lysosomes and lysosomal storage diseases. She recently published a study on an animal model of Fabry disease, a genetic disorder that can lead to heart and kidney malfunction. Dahms served as the president of the Society for Glycobiology in 2021.

VOLKMAN

Volkman is a professor of biochemistry at MCW and his research aims to create novel cancer therapeutics using rational drug design. The lab recently published a study describing a method to distinguish various forms of the chemokine CCL20. In 2020, he received a MERIT award from the National Institutes of Health.

Maquat receives Gruber Prize

Lynne Maquat, a distinguished chair and professor of biochemistry and biophysics at the University of Rochester Medical Center, has won the 2023 Gruber Prize in Genetics. She shares the award with Alan Jacobson of the University of Massachusetts Chan Medical School. The two independently helped identify and describe nonsense-mediated mRNA decay, a pathway that degrades mRNA transcripts with premature stop codons and averts production of truncated, potentially toxic bits of protein. Maquat worked with mammals, and Jacobson worked with yeast. Their discoveries could help to spur treatments for diseases such as fragile X syndrome and Duchenne muscular dystrophy.

MAQUAT

Maquat began her studies of nonsense-mediated mRNA decay by characterizing human patients with hemolytic diseases. Her work established that mRNAs with a premature stop codon were less stable. She clarified the mechanisms of nonsense-mediated mRNA decay in mammalian cells and also showed how it disables faulty transcripts that arise from errors in human gene expression. Cells also use the process, Maquat found, to adapt to environmental shifts.

Among her awards, Maquat previously received the 2021 Wolf Prize in Medicine, 2021 Warren Alpert Foundation Prize and 2018 Federation of American Societies for Experimental Biology Excellence in Science Award.

Teaching awards for Medlock

Amy Medlock, an associate professor of biochemistry at the Augusta University/University of Georgia Medical Partnership, recently received the 2021–2022 Peer-Nominated Teaching Award for Small Group Teaching and the Medical College of Georgia's Excellence in Teaching Award.

These awards recognize outstanding educators and are selected from faculty nominations and student evaluations, respectively. This is Medlock's fourth consecutive year receiving the MCG Excellence in Teaching Award. She also received a peer-nominated award for her large group teaching in 2020–2021. She and other faculty members were honored during a ceremony in February.

Medlock earned her Ph.D. at UGA and completed postdoctoral work at UGA and the University of Cape Town, South Africa. Her lab focuses on the synthesis of heme and regulation of the heme biosynthesis pathway. Heme is important in processes including central metabolic pathways, oxygen binding and transport and reduction/oxidation reactions. Medlock recently published a paper on the enzyme ferrochelatase in erythroid and nonerythroid cells. She also researches science education and pedagogy.

MEDLOCK

Bagde wins grad student award

Saket Bagde has received a 2023 Harold M. Weintraub Graduate Student Award from the Fred Hutchinson Cancer Center. This award recognizes exceptional achievement in graduate studies in the biological sciences. Bagde was honored at a symposium on May 5 at Fred Hutch, along with the other 11 recipients.

Bagde is a graduate student at Cornell University. He works with thesis adviser Chris Fromme, a professor of molecular biology and genetics. Bagde's research focuses on how antibiotics are synthesized using molecular machines known as modular polyketide synthases. He also studies lipid and protein cellular transport.

BAGDE

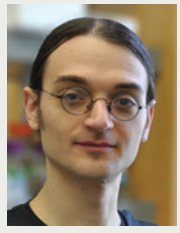
Bagde earned his undergraduate and master's degrees at the Indian Institute of Science Education and Research, Pune, India, and worked as a research assistant at the University of Texas at El Paso.

RNA Society announces awards

Four members of the American Society for Biochemistry and Molecular Biology have received awards from the RNA Society this year. Charles Bou–Nader, Wendy Gilbert, Nicholas Ingolia and Amanda Hargrove are among those who were honored at the 2023 RNA Society annual meeting in Singapore in June.

Charles Bou–Nader, a postdoctoral fellow at the National Institute of Diabetes and Digestive and Kidney Diseases at the National Institutes of Health, received the Scaringe Young Scientist Award, which recognizes outstanding research achievements in RNA biology by a junior member. Bou–Nader uses structural biology and biochemistry to study the functions of RNAs and RNPs with Jinwei Zhang, a senior investigator at the NIDDK. The team recently demonstrated how HIV co-opts host transfer RNAs to control virion biogenesis and published an article on the structural basis of R-loop recognition by the S9.6.

Wendy Gilbert, an associate professor of molecular biophysics and biochemistry at Yale University School of Medicine, was given the Award for Excellence in Inclusive Leadership, which recognizes a scientist who fosters inclusivity and promotes the training and professional development of underrepresented scientists. Her research focuses on regulatory elements in messenger RNA that control gene expression. This award is her second from the RNA Society; in 2017, she received the Early Career Award.



Nicholas Ingolia, an associate professor of molecular and cell biology at the University of California, Berkeley, received the Mid-Career Research Award, which highlights exceptional RNA researchers during their first 15 years as independent scientists. He studies translational control of gene expression during the cellular stress response using sequencing techniques. The group recently published a global survey of regulatory proteins affecting messenger RNA stability and translation.

Amanda Hargrove, an associate professor of chemistry and biochemistry at Duke University, was awarded the Elisa Izaurralde Award for Innovation in Research, Teaching and Service, which highlights a mid career researcher who excels in these areas. Her lab researches the basic biology of long noncoding RNAs, their role in diseases such as cancer and how they can be targeted with small molecules. Hargrove and her team recently published an article on using machine learning and computation to design small molecules with RNA targets.

AAAS names 2022 fellows

Nine members of the American Society for Biochemistry and Molecular Biology are among 505 scientists named 2022 fellows of the American Association for the Advancement of Science. ASBMB members who are AAAS fellows in chemistry are Vahe Bandarian, Alexander Drohat, Elizabeth Komives, Audrey Lamb and Juliette Lecomte. Fellows in medical sciences are Gerard Blobe, Thirumala-Devi Kannegante and Ghislain Opdenakker. Bonnie Firestein is a fellow in neuroscience.

Vahe Bandarian is a professor of chemistry and associate dean for student affairs at the University of Utah, where he has been reconstructing the biosynthetic pathways for various natural products. His lab explores the molecular basis for radical-mediated modifications that lead to complex peptide and nucleic acid-based molecules. He is a 2022 ASBMB fellow and serves as chair of the ASBMB Meetings Committee and on the editorial board of the Journal of Biological Chemistry.

Alexander Drohat is a professor of biochemistry and molecular biology at the University of Maryland School of Medicine, where he studies the structure and mechanism of DNA base excision repair enzymes. His lab investigates how DNA glycosylases recognize and remove mutagenic DNA lesions, to guard against cancer and other diseases and how they affect epigenetic regulation by mediating active DNA demethylation.

Elizabeth Komives, a distinguished professor of chemistry and biochemistry at the University of California, San Diego, studies the biophysics of protein–protein recognition. Komives' team studies the transcription factor nuclear factor kappa B's interactions with DNA and coactivators. She has contributed to a deeper understanding of the dynamics of serine proteases and recently has focused on the cullin 5 family of E3 ubiquitin ligases, which use combinatorial protein–protein interactions to mediate the degradation of a large number of cellular proteins.

Audrey Lamb, chemistry professor and department chair at the University of Texas at San Antonio, studies how bacterial pathogens make the molecules that they need to survive and infect humans. Her lab explores how bacteria produce metallophores and riboflavin (vitamin B2) — pathways that are potential targets for the design of new antimicrobials. Lamb also has joined with other labs to study cancer and diabetes. She is a member of the ASBMB Council.

Juliette Lecomte, a professor of biophysics at Johns Hopkins University, probes the structure, function and evolution of the hemoglobin family of proteins. Of particular interest are the thermodynamic and dynamic aspects of protein–cofactor interactions. Her team taps X-ray crystallography, nuclear magnetic resonance spectroscopy and optical spectroscopy to achieve their goals.

AAAS names 2022 fellows CONTINUED

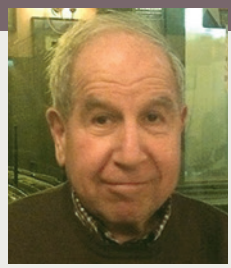
Gerard Blobe is a professor of medicine, pharmacology and cancer biology at Duke University. He studies how transforming growth factor-beta, or TGF-β, signal transduction pathway affects cancer. His research has established novel paradigms for TGF-β co-receptor function in regulating the trafficking and signaling of associated receptors, as well as the role of these TGF-β co-receptors in cancer biology.

Thirumala-Devi Kanneganti is a member, vice chair and endowed chair of immunology at St. Jude Children's Research Hospital. She provided the first genetic evidence for NLRP3 inflammasome activation in response to microbial components and elucidated its roles in diseases, contributing to the inception and expansion of the inflammasome field. Her lab also discovered Z-DNA-binding protein 1 as an innate immune sensor that activates PANoptosis, a form of inflammatory cell death implicated across the disease spectrum, pioneering a new research area.

Ghislain Opdenakker is an emeritus professor at and former chairman of the Rega Institute for Medical Research at Belgium's University of Leuven. He introduced the concept of how extracellular proteolysis and other posttranslational modifications lead to autoantigen repertoires in susceptible hosts and thereby helped to identify preventive and better treatments for autoimmune diseases.

Bonnie Firestein, a professor of cell biology and neuroscience at Rutgers University, studies how guanine metabolism impacts neuron development and recovery from injury. Her lab identified the postsynaptic density protein-95 interactor cypin as a regulator of neuronal development that influences the cytoskeleton and its function. She is a member of the Journal of Biological Chemistry editorial board.

Lawrence Rothfield



Lawrence I. Rothfield, a professor at the University of Connecticut Medical School, an expert on cell division and a member of the American Society for Biochemistry and Molecular Biology since 1966, died in December in Bloomfield, Connecticut, from pancreatic cancer. He was 94.

Rothfield was born Dec. 30, 1927. He attended the Bronx High School of Science and enrolled at Cornell University at age 16. After graduating from Cornell in 1947, he earned his medical degree at the New York University School of Medicine, where he also completed postdoctoral training mentored by former ASBMB President Bernard L. Horecker. Rothfield established a private practice, where he once treated Marilyn Monroe, but his passion for discovery outpaced his enthusiasm for practicing medicine.

In 1968, Rothfield became a founding faculty member of the UConn medical school. During his more than 50-year tenure, he was the first chair of the microbiology department for 12 years and maintained a research program investigating membrane and cytoskeletal remodeling during bacterial cell division.

His seminal work unraveled how the MinCDE system regulates the precise spatial and temporal polymerization of FtsZ that establishes the division septum and splits a cell in two; this established him as a leading authority on cell division, and in 1992 he became a fellow of the American Association for the Advancement of Science. His 94 publications have been cited more than 10,000 times.

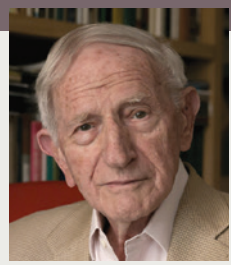
In retirement, Rothfield remained engaged with UConn research as professor emeritus. At Duncaster, an independent living facility in Bloomfield, he was first in line of over 250 residents to receive the COVID-19 vaccine in February 2021.

"I know some people are worried about taking the vaccine, but the data are very clear," he told the Jewish Ledger. "This vaccine is remarkably successful in protecting against serious life-threatening disease."

Rothfield is survived by his wife of 69 years, Naomi, a rheumatologist; four children and six grandchildren.

— Christopher Radka

Michael Sela



Michael Sela, an immunologist and synthetic chemist who helped develop drugs to treat multiple sclerosis and cancer, died May 27, 2022, in Rehovot, Israel. He was 98.

A member of the American Society for Biochemistry and Molecular Biology since 1968, Sela was the sixth president of the Weizmann Institute of Science and founding director of its immunology department.

Sela was born Miechzslaw Salomoniwicz in Poland on Feb. 28, 1924. Antisemitism drove his family first to Romania, and then to Palestine, where Sela arrived at age 17. He earned a master's degree in chemistry at the Hebrew University in 1946 and then moved to Italy to help resettle Jewish refugees and served as a diplomat in Prague. In 1950, he went to the Weizmann Institute as a doctoral student of Efraim Katzir, who was later a president of Israel. Sela earned a Ph.D. in chemistry through Hebrew University.

Sela's work on synthetic antigens helped illuminate how genes control the immune response. He was one of the first chemists to create multichain polymers of amino acids and polypeptide proteins. This basic science indirectly led to his co-inventing a drug for multiple sclerosis and three cancer drugs.

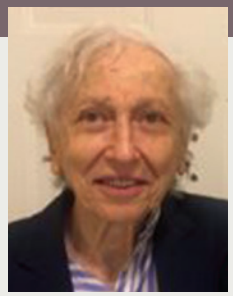
In addition to serving as president of the Weizmann Institute from 1975 to 1985, Sela led the International Union of Immunological Societies, chaired the Council of the European Molecular Biology Organization and joined the Global Advisory Committee of the World Health Organization. He was a member of the Israel, U.S. National, Russian, French and Pontifical academies of sciences.

Sela received the 1980 Gairdner Foundation International Award, UNESCO's Albert Einstein Golden Medal in 1995 and the 1998 Wolf Prize in Medicine, shared with his first grad student, Ruth Arnon.

Sela enjoyed the performing arts, the Batsheva Dance Company and classical music, jazz, theater and opera. He was a gifted linguist who mastered Polish, Romanian, Hebrew, German, Russian, French, English, Italian and Czech.

Sela's first wife, Margalit Liebman, died in 1975. He is survived by his wife, Sara Kika; daughters, Irit, Orlee and Tamar, and their spouses; grandchildren; and great-grandchildren.

Beverly Peterkofsky



Beverly Peterkofsky, a former section chief at the National Institutes of Health and a member of the American Society for Biochemistry and Molecular Biology since 1970, died in Bethesda, Maryland, on June 13, 2022. She was 90.

Born Beverly Ann Heiden on July 26, 1931, she grew up in the Pennsylvania coal mining region, where her family ran a store. The Great Depression drove the Heidens to Brooklyn, where she attended high school and went on to Brooklyn College to study chemistry.

After earning an undergraduate degree, Heiden worked as a technician at New York University before starting graduate studies in biochemistry there. At NYU, she met a fellow grad student, Alan Peterkofsky, who would become her husband of 66 years. Heiden left NYU with a master's degree when the couple moved to Maryland, where Alan Peterkofsky served as a Public Health Service officer at the NIH.

Beverly Peterkofsky earned a Ph.D. in biochemistry at George Washington University, which launched her career of more than four decades at the NIH. She became a lead scientist at the National Cancer Institute at a time when few women achieved that status. Over the years, she served as a role model and mentor for numerous scientists, notably women.

Peterkofsky made pioneering contributions to the study of connective tissues. She showed how factors including collagen and metabolites contribute to the growth and survival of cells such as fibroblasts. She also studied the role of the connective tissue during disorders such as scurvy. Later in her career, she explored cell culture models and aging.

Peterkofsky played the violin with the NIH Orchestra and local string quartets. She also spent her free time as a sculptor, graphic artist and genealogist. She is survived by her husband, Alan, and their sons, Don and Roy.

Sorina Popescu

Sorina Popescu, a plant biologist and biochemist, died on Dec. 19 in Starkville, Mississippi. She was 53. In the last year of her life, while battling breast cancer, she saw six of her research studies published, attended her daughter's wedding, learned of her son's acceptance to Duke University and visited her native Romania.

Popescu was born March 4, 1969, in Brasov to Lazar and Elisabeta Cristea. She earned a master's degree in biology at the University of Bucharest, where she met her future husband, George Popescu, a physics and engineering student. The two joined marches for freedom as the 1989 Romanian Revolution erupted.

In 1995, Sorina gave birth to their daughter, Medeea, before the Popescus left for the United States. She earned a Ph.D. in plant molecular biology at Rutgers University in 2003 and then conducted postdoctoral research on calcium signaling and mitogen-activated protein kinase signaling networks in plants at Yale University. A second child, Nicholas, was born in 2005.

In 2008, Popescu secured a faculty job at the Boyce Thompson Institute for Plant Science at Cornell University, where she co-directed two National Science Foundation studies on plant disease resistance and signaling networks. After seven years in Ithaca, the Popescus moved to Mississippi State University. There she taught general biochemistry and created graduate cellular signaling and plant biochemistry and molecular biology courses. She directed NSF Rules of Life studies on plant proteomics and redox signaling and launched new research on microbial communities and plant–pathogen relationships.

Among Popescu's last studies were several melding science and agriculture on topics ranging from crop stress resistance to plant root microbial community control. Key discoveries on thimet oligopeptidases, or TOP, control of redox waves in systemic acquired immunity and TOP immunoregulatory activity in effector-triggered immunity are awaiting publication.

Popescu enjoyed hiking, biking and cross-country skiing with her family. She is survived by her husband and longtime research partner, George; children, Medeea and Nicholas; her mother, Elizabeta Cristea; and her sister, Luminita.

Don Voet (1938–2023)

By Charlotte Pratt

With the death of Donald Voet in April, the biochemistry community lost one of its stars. Don's many accomplishments were the product of his deep love of biochemistry as well as his remarkable dedication.

After receiving a bachelor's degree in chemistry from the California Institute of Technology (where Linus Pauling was his chemistry professor) and a doctorate in chemistry from Harvard, Don conducted postdoctoral research at the Massachusetts Institute of Technology and spent the rest of his academic career as a professor of chemistry at the University of Pennsylvania.

Don's research in X-ray crystallography, his understanding of a wide array of topics in biochemistry and his years of experience as an instructor impelled him to collaborate with his wife, Judith Voet, a biochemistry professor at Swarthmore College, to write a comprehensive textbook called simply "Biochemistry." Legions of graduate and undergraduate students have benefitted from this work, first published in 1990.

Don's commitment to education went far beyond textbooks. He and Judy Voet served as co-editors-in-chief of the journal Biochemistry and Molecular Biology Education, and in 2012 they received the American Society for Biochemistry and Molecular Biology Award for Exemplary Contributions to Education. In addition, both Voets were longtime judges for the Undergraduate Poster Competition at ASBMB meetings, where they were treated like celebrities by the students and former students who had read their textbooks.

I write this tribute as the third partner in a textbook collaboration that extended for roughly 25 years; I will allow others to speak more knowledgeably about Don's life as a researcher, professor and collaborator in other ventures.

Like many biochemists in the 1990s, I was familiar with "Biochemistry," my go-to source for all biochemical wisdom. It stood out from other books because the authors focused on chemistry and refused to reduce the mechanistic details of biochemical processes to black-box status. I was both thrilled and intimidated to be invited in 1996 to join the Voets in producing a smaller textbook, "Fundamentals of Biochemistry."

ASBMB

Don Voet co-authored the textbook "Biochemistry," first published in 1990, with his wife, Judith Voet.

Don's work over the years demonstrated his conviction that biochemical knowledge has limited value unless it is transmitted fully and honestly to the next generation of scientists. His writing style was intentionally aimed at students of all levels, never dumbed down, and straightforward — a way to invite readers to enter a conversation among professional scientists.

Ever collegial, Don insisted on dropping names into the text, referring to the discoveries of specific researchers wherever possible and borrowing figures from the original publications rather than rendering simplified versions. In cases where visual information was lacking, Don created his own molecular graphics, at a time when modeling software was not accessible to amateurs.

From my perspective, Don had an unlimited appetite for acquiring information. I can only imagine the vast size of his library of research papers. At our occasional in-person meetings, I was invariably impressed by his erudition in a variety of nonscience areas. His curiosity extended far beyond the molecular world; he went on expeditions to Antarctica, up mountains, under the sea, and to other destinations too numerous to list, where he

swam, skied, hiked and dived.

As a writer, Don was exacting and precise. Although I doubt that anyone keeps track of such things, I believe his written works were largely error-free. He was unwilling to compromise on quality or accuracy, no matter how anxious the pleas of editors who were focused on deadlines and page counts.

In the early years, we shipped paper manuscripts back and forth. Some of those pages made their way to my scrap paper pile, and I occasionally find that the reverse side of a sheet on which I am scribbling bears Don's edits in red ink, often liberally applied. These bring a smile to my face and remind me to attend to the details in my own work.

I consider myself fortunate to have been able to collaborate with and learn from Don, and I will miss him.

Charlotte Pratt (prattc1@spu.edu) is an associate professor of biology and director of the Pre-Professional Health Sciences Program at Seattle Pacific University.

ASBMB

Judith Voet, Suzanne Pfeffer (ASBMB president 2010–2012) and Don Voet at the ASBMB annual meeting in 2012, the year the Voets received the society's Award for Exemplary Contributions to Education.

REMEMBRANCES

I have such fond memories of Don and Judy Voet at ASBMB meetings, graciously posing for photographs with flocks of admiring students. As the chair of the Undergraduate Poster Competition Committee, I appreciated Don and Judy's support of the event. In recent years, when they no longer judged, they attended as the honored guests that they were, engaging students who were thrilled to present their research to their textbook authors.

— Kathleen A. Cornely
Providence College

I used the Voet and Voet "Biochemistry" textbook in graduate school. I recall it being my bible, especially during the roughly three weeks I took off from lab work to study for my preliminary exams in graduate school. I still have that book on my bookshelf in my office at work.

I also recall getting bored with studying and teaching myself how to see protein structures in 3D by crossing my eyes looking at stereo images in the textbook, long before the days of programs like Chimera and PyMOL.

I also used the Voet, Voet and Pratt textbook, "Fundamentals of Biochemistry" for many years when I first started teaching.

— Pamela S. Mertz
St. Mary's College of Maryland

My first encounter with Don was at the inaugural Undergraduate Poster Competition, when it was a satellite session of the main ASBMB meeting. Don was one of the first faculty members from a research university to serve as a judge. He added his voice to others, advocating for the poster competition, and helped make it a part of the main meeting.

Each year I could count on seeing Don at the poster competition, serving as a judge and interacting with undergraduates. Along with his tireless service, Don brought his smile and clever sense of humor. Don always had time for the students I brought to the meeting and took an interest in their research and their careers.

— Chris Rohlman
Albion College

CONTINUED ON PAGE 12

I first met Don more than 20 years ago. Like many people in the field, I was more than a bit starstruck. But, from our first conversation, I realized that he was gentle, kind and had a VERY clever and subtle sense of humor.

*Over time we shared many conversations, and when he and his wife, Judy, passed the editor's baton of Biochemistry and Molecular Biology Education to me, I was overwhelmed by the implications. In my mind and those of many others, BAMBEd was *their* journal. Due to their hard work and vision, BAMBEd had become the preeminent journal in the field, and I was fearful that I would not be able to do it justice.*

During that transition, I came to appreciate what a fine man Don was. Throughout that time, and ever since, he never hesitated to share insights, answer questions and provide encouragement. He was a gentleman and a fine mentor; his scientific and educational contributions will live on in me and many other biochemists, and I will forever be thankful for his impact on my life and career.

— Phil Ortiz
State University of New York

As an undergraduate biochemistry student, I am fortunate to have encountered Professor Voet's influential textbooks early on in my studies. They became my constant companions, offering clear explanations of complex concepts.

The problem-solving approach in these books, akin to the "Lehninger Principles of Biochemistry" textbook, promotes critical thinking and the practical application of learned concepts to real-world research scenarios. By presenting these diverse problems, Professor Voet stimulated creative thinking and fostered the development of essential analytical skills in undergraduate students like me, while simultaneously demonstrating the practical applications of biochemistry across various fields and cultivating an appreciation for its relevance.

As someone who is deeply inspired by his textbooks on biochemistry, I feel a profound sense of loss. Although I never had the opportunity to interact with and learn directly from Professor Voet, his books provided unwavering guidance and knowledge throughout my undergraduate studies.

— Neelabh Datta
Asutosh College/University of Calcutta

Upcoming ASBMB events and deadlines

AUGUST

1	Molecular motifs art contest deadline
16–18	CoA and CoA-derivatives conference

SEPTEMBER

6	Serine proteases conference early registration deadline
6	Serine proteases conference abstract submission deadline
15	ASBMB accreditation applications due
18–22	National Postdoc Appreciation Week
25–29	Peer Review Week
27	Lipid Research Division Seminar

OCTOBER

1	Student Chapter Outreach Grant fall deadline

ASBMB

Fred Goldberg (1942–2023)

By George N. DeMartino

Alfred L. "Fred" Goldberg, a pioneer, champion and major contributor to the field of intracellular protein degradation, died on April 18 at age 80 from complications of lymphoma.

Fred spent his entire academic career at Harvard. As an undergraduate, he was introduced to research in modern molecular biology in the lab of James Watson. After a brief fellowship as a Churchill scholar at Cambridge University in the United Kingdom, he entered Harvard Medical School, but he abandoned his medical studies after two years to pursue what he found to be the more intellectually exciting world of full-time research. Upon completing his Ph.D. in 1968, Fred was appointed to the faculty at HMS where he spent the next 55 years, altering only his professorial titles with the successive changes in his department's name from physiology, to cellular and molecular physiology, to cell biology.

Fred's graduate work demonstrated that changes in muscle mass associated with many physiologic and pathologic conditions were mainly a consequence of altered rates of protein degradation rather than the expected changes in protein synthesis. These surprising results revealed the importance of protein degradation and showed it to be a highly regulated physiologic process. These discoveries formed the basis of the topic that absorbed Fred for the next 60 years and spawned a field whose biologic breath and medical relevance validated the prescience of his decision to study it.

Fred held an unwavering focus on protein degradation but applied an uncommonly broad approach to its study. Model systems in the Goldberg lab ranged from bacteria to mammals; experiments were conducted on both purified proteins and whole animals. With intellectual curiosity and encyclopedic knowledge, Fred toggled easily between the types of data generated by these diverse experiments, and he often integrated their results in insightful ways. As the number of processes in which protein degradation was shown to participate expanded, so did his interests, including (he noted with surprise and a touch of trepidation) a foray into immunology.

Fred would often begin a question at a meeting by alerting the speaker to the fact that "(----) years ago, (----) in my lab showed that (------)," and then describe how a key finding in the just-presented talk had been made years earlier in the Goldberg lab. Although some participants reacted with wry smiles or eye-rolls, the statement was typically accurate and revealed how frequently his insights and observations were far ahead of their time.

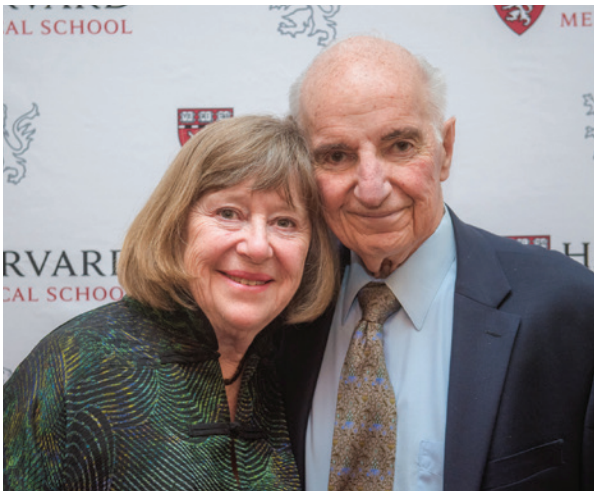
COURTESY OF GEORGE N. DEMARTINO

While attending the 2007 Chinese Academy of Science Symposium "Ubiquitin and Protein Degradation" in honor of Fred Goldberg's 65th birthday in Beijing, the DeMartinos and the Goldbergs enjoyed a pedicab ride. Pictured, from left to right, are George and Kathy DeMartino and Fred and Joan Goldberg.

For example, Fred's early work on the selective degradation of structurally abnormal proteins in bacteria, as well as the protein aggregation that resulted from defects in this process, presaged contemporary discoveries about mechanisms of protein quality control and the consequences of protein misfolding, now appreciated to be linked to the pathogenesis of neurodegenerative and other human disorders. These findings also had practical implications for bacterial protein expression systems vital for the commercial production of medically important proteins and drugs.

Other early work demonstrated the then-surprising finding that intracellular protein degradation was regu-

GRETCHEN ERTL



Fred and Joan Goldberg at the Harvard Medical School celebration for the establishment of the Alfred and Joan Goldberg Education and Fellowship Fund for Cell Biology in April 2019.

lated by hormones, growth factors, metabolites and nutrients. Researchers have since uncovered molecular details of the signaling pathways for such regulation and continue to investigate them.

Lacking mechanistic detail about the processes of protein degradation, Fred developed reductionist approaches using cell-free systems that mimicked important physiologic features, so he could identify and characterize many of the responsible proteins. One system, an extract from rabbit reticulocytes that catalyzed ATP-dependent proteolysis, formed a platform for the Nobel Prize-winning discovery and dissection of ubiquitin-conjugation and ubiquitin-dependent protein degradation. Fred's own work with this system led to the discovery of the proteasome, and much of his work over the past 30 years focused on the molecular features and physiologic regulation of the proteasome in health and disease.

In the early 1990s, Fred founded a small biotech company with the goal of developing therapies for diseases that featured dysregulated protein degradation. This effort led to the discovery and development of proteasome inhibitors, such as MG132, that are commonly used as research tools. These tools were rapidly developed into drugs, such as bortezomib, which is now widely used to treat multiple myeloma and has greatly improved the survival of patients with this hematologic cancer.

In addition to his own prodigious output (he published nearly 500 peer-reviewed research papers and ranks among the most highly cited biologists), Fred tirelessly advocated for and promoted the field, ensuring that it was appreciated by the entire scientific community. This was particularly important when the field was small and fragmented and most investigators ignored or discounted the topic. His early reviews not only organized a disjointed set of observations but also mapped a path for how the field should proceed by highlighting critical unmet issues and goals. He organized meetings that brought colleagues together to promote collaborations and collective advances. Even after the importance of protein degradation was firmly established, his reviews and work continued to affect thinking in the field. Fred trained over 125 scientists, many of whom have gone on to successful academic careers and remained in close contact.

Fred received many honors and awards. He was a member of the American Academy of Arts and Sciences, the National Academy of Medicine and the National Academy of Sciences and a fellow of the American Physiological Society. He delivered many keynote and honorific lectures and was the winner of the 2012 Warren Alpert Foundation Prize, the 2015 Ernest Beutler Prize for Basic Science and the 2022 Passano Award for Medical Research.

Though he was dedicated to serious science, Fred had an active and ever-present sense of humor. As an undergraduate, he was a founder and president of The Harvard-Radcliffe Gargoyle, a short-lived humor magazine. The opening line of Vol. 1, No. 1 stated, "Not enough people laugh in Cambridge. … The Gargoyle is intended to alleviate this need."

The transition from undergraduate to professor did not impede Fred's ability to have fun. He ended the second of his massive and influential two-part Annual Review of Biochemistry review articles, "Intracellular Protein Degradation in Mammalian and Bacterial Cells I and II" (1974, 1976) with the citation: "441. Neve, R. A., Gaini, L. L. (1975), Crit. Rev. Biochem. 1: 78–94." Somehow Fred convinced a very suspicious copy editor that the bogus citation was legitimate, and it was published as written. Fortunately, Fred did not adhere to this self-declared ban, and over the next 50 years, he continued to write important reviews that helped shape and guide the field.

Fred was an enthusiastic tennis player and a retired competitive–tiddlywinks player but had little interest in professional sports. Lab outings to Fenway Park for a Red Sox game typically devolved into lab research conferences as early as the third inning; for Fred, no

amount of on-field action was as interesting or exciting as science. Experienced postdocs would bring their latest results to the game, knowing there would be an opportunity for initial data analysis and discussion.

Fred faced his lymphoma with characteristic grace and good humor. He quipped that his disease and its treatments forced him to learn many of the things he had purposely avoided learning by dropping out of medical school. He admitted that his disease featured interesting biology and soon knew as much about its scientific basis as did his physicians. In fact, he delighted in describing how some of his more advanced treatments were based on research findings he had helped to discover.

During one of Fred's hospitalizations, a physical therapist was assigned to strengthen his muscles, which she explained had been weakened by steroids and inactivity. After he mentioned that he had discovered the mechanisms of these phenomena, she was surprised to find a citation to her patient's work in her physical therapy textbook.

Fred also used his illness as an opportunity to invent the new genre of what he called "lympho-poetry," as he directed his long-standing predilection for writing occasion-specific doggerel toward documenting and making light of his condition.

Although his illness finally forced him to close his lab and transition to emeritus status in 2022, Fred continued to write and publish research papers. Thanks to Zoom, he attended departmental seminars, journal clubs and group meetings, and even delivered talks at research conferences.

As an associate editor of the Journal of Biological Chemistry, I helped recruit Fred to write a "Reflections" article for the popular journal series that recounts the personal histories of eminent biochemists. Although he agreed, and despite repeated assurances that submission was imminent, the article was never completed because he deemed it a low priority. Fred was more focused on the future than on the past, and he preferred to devote his time and energy to analyzing, discussing and reporting his latest research findings rather than reminiscing about old news.

Fred is survived by his wife, Joan Helpern Goldberg; a son, Aaron; a daughter, Julie; and many grateful trainees, colleagues, and friends around the world. He will be missed by all.

George N. DeMartino (George.DeMartino@UTSouthwestern.edu) is a professor of physiology at the University of Texas Southwestern Medical Center.

To grow a chapter, build a network

By Christopher D. Radka

When a member of Megha Patel's family was diagnosed with medullary thyroid cancer, Patel, who was then in middle school, watched videos and read online to learn about the disease. When another relative had a kidney and pancreas transplant, but the patient's body rejected the pancreas, Patel listened to conversations at the teaching hospital where the relative was treated, hoping to make sense of what was happening.

These experiences inspired Patel to focus on studying science. In a high school advanced placement biology class, she said, she finally began to understand her family members' conditions. She also took AP chemistry and competed in the Science Olympiad, a national K–12 team program encompassing a variety of fields.

Patel, who grew up in Lexington, South Carolina, recently graduated from the University of South Carolina as a biochemistry and molecular biology major. She was a four-year member of the USC Student Chapter of the American Society of Biochemistry and Molecular Biology. She served as the chapter's secretary in her sophomore year, treasurer in her junior year, and president in her senior year.

The chapter met online during the 2020–2021 school year, but over the next two years, Patel worked with the USC Undergraduate Research Office to organize panels of alumni and experts across multiple industries to discuss their career pathways. The chapter also participated in community outreach, judging middle and high school science fairs. These activities provided networking opportunities for members, but the chapter's leaders thought something seemed to be missing.

While studying science in high school, Patel had cultivated a parallel humanistic interest starting with an AP course in geography that introduced her to concepts in sociology. She built on this in college by pursuing a minor in anthropology.

"Learning about different cultures is a nice switch from hard science classes," she said.

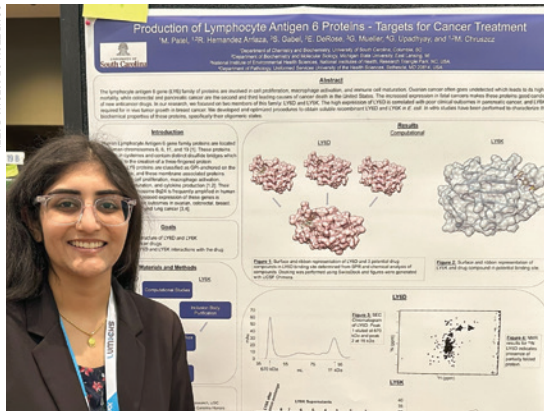
Her interest in social connections guided her effort to address two challenges for the USC chapter: member recruitment and engagement.

In March, Patel attended Discover BMB in Seattle. It was her first ASBMB meeting, and she was the only USC chapter member there. "I felt tremendously overwhelmed," she said. "Our chapter has roughly 20 members, whereas other schools have much larger chapters."

Networking with undergraduate leaders from around the country and learning how they grew their ASBMB chapters provided Patel with a new vision for the USC chapter — community building.

"We need to distinguish ourselves from other organizations that specifically appeal to medicine, like premed fraternities, and more clearly show the value of our organization," she said.

Patel decided the chapter should partner with other science, technology, engineering and mathematics organizations such as the American Chemical Society and Women in STEM to create a network that enhances the visibility of the individual groups. This network can collaborate on recruiting within the undergraduate population, provide members with resources such as fellowship and professional school application materials, and mentor fellow undergrads to get them started in research. Also, members are encouraged to explore each national society's professional development resources.



COURTESY OF MEGHA PATEL

Megha Patel presents her research at Discover BMB, the ASBMB meeting in Seattle in March.

Having launched this partnership, Patel now aims to enroll in a two-year postbaccalaureate program at the National Institutes of Health to help her discover what science topics she is passionate about before she commits to graduate school.

"I am excited to explore a new city," she said, "and have the independence to lead my own project that will allow me to continue my passion for structural biology while exploring a new research area of glycobiology."

Christopher D. Radka (christopher.radka@uky.edu) is an assistant professor studying lipid signaling in the microbiology, immunology and molecular genetics department at the University of Kentucky.

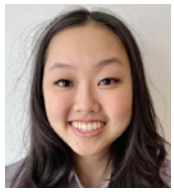
ASBMB inducts honor society members

By Hailey Reiss

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

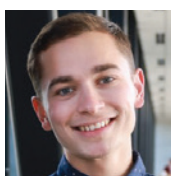
The honor society inducted 20 new members this year. Meet them below. Learn more about each of them at asbmb.org/education/student-chapters.

Olivia Brickey is a 2023 graduate of Otterbein University with a double major in biology and biochemistry and molecular biology. She intends to take a gap year to work in a research lab before pursuing her goal of becoming an infectious disease physician–scientist.



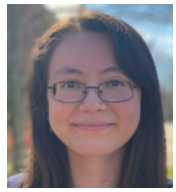
Peggy Chen is a rising senior with a major in biomedical sciences at the Rochester Institute of Technology. She hopes to attend medical school to become an obstetrician–gynecologist with her own private medical practice.

Kaitlin Dean is a 2023 graduate of Otterbein University with a major in biochemistry and molecular biology and psychology. She intends to continue working in patient care for the next year before applying to medical schools and is also looking at graduate programs in the fields of public health and nutrition.



Dalton Dencklau is a rising senior with a major in biochemistry at Grand View University. He hopes to pursue a Ph.D. in a biochemistry-related field using machine learning while continuing to promote mental health.

Danielle Etiel is a 2023 graduate of the University of San Diego with a major in biochemistry. She hopes to become a dentist in the future to foster her passion for immersion in art and science.



Melinda Huynh is a 2023 graduate of St. Mary's College of Maryland with a double major in biology and biochemistry. She plans to pursue post-baccalaureate research at the National Institutes of Health before applying to medical school with the intention of becoming a family physician.

Aidan Jones is a 2023 graduate of Wesleyan University with a double major in molecular biology and biochemistry and integrative sciences with a minor in chemistry. He plans to pursue a Ph.D. in molecular biology.

Lauryn Magwaro is a 2023 graduate of Hamline University with a major in biochemistry and minors in digital media arts and computational data science. She hopes to attend medical school and become a doctor or pursue a career in industry.

Jennifer McPeek is a 2023 graduate of Otterbein University with a double major in biochemistry and molecular biology and equine preveterinary/pre-graduate studies. She hopes to combine her passions for science and the equine community by furthering her biochemistry education and becoming involved in equine research.

STUDENT CHAPTERS

Olivia Miller is a 2023 graduate of Otterbein University with a major in biochemistry and molecular biology. She plans to attend graduate school for biochemistry and eventually pursue a career in biotechnology to contribute to the advancement of therapeutics.

Mason Nolan is a rising senior with a major in biochemistry and molecular biology at Otterbein University. He plans to attend Ohio University's Heritage College of Osteopathic Medicine in the fall of 2023 through the Early Assurance Program to pursue a career in the medical field.

Ashni Patel is a rising senior with a major in biochemistry and molecular biology and a minor in business administration and management at Otterbein University. She will begin medical school in the fall of 2024 through the B.S./D.O. program with the Ohio University's College of Osteopathic Medicine.

Lora Randa is a 2023 graduate of Carleton College with a major in biology and a minor in biochemistry. She plans to matriculate to medical school next year with the intention of pursuing a career as a physician practicing and teaching in an academic medicine setting.

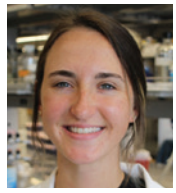
Laurel Robbins is a 2023 graduate of Lake Forest College with a major in biochemistry and molecular biology and a minor in history. She intends to begin her graduate studies at the University of Colorado Boulder in the Interdisciplinary Quantitative Biology graduate certificate program before beginning her Ph.D. in biochemistry.

Reed Rohr is a rising senior with a major in biochemistry and minors in chemistry, psychology and humanities in medicine at the University of Nebraska–Lincoln. She hopes to continue her education to become a health-care provider in the future.

Kylie Ross is a 2023 graduate of Hamline University with a major in biochemistry. She plans to find a job in research or the biotechnology industry along with pursuing her interest in printmaking.

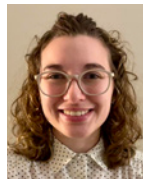
Anna Schultz is a 2023 graduate of Hamline University with a major in biochemistry and minors in forensic science and computational data science. She hopes to pursue a career in research in the biochemistry and microbiology industries.

Grace Thornhill is a 2023 graduate of Stephen F. Austin State University with a major in biochemistry and a minor in biology. She plans to pursue a Ph.D. in microbiology and study antibiotic resistance or the biochemistry of pathogenic bacteria.



Karlie Tischendorf is a 2023 graduate of Purdue University with a major in biochemistry and minors in aquatic sciences and Spanish. She plans to take a gap year to focus on scuba diving for research purposes before applying for Ph.D. programs in ecotoxicology or related fields to achieve her goal of running a research lab in marine sciences and influencing positive environmental change.

Martina Videva is a rising senior with a major in biochemistry at the Rochester Institute of Technology. She hopes to matriculate into a M.D./Ph.D. program.



Hailey Reiss (hreiss@asbmb.org) is the ASBMB's undergraduate education coordinator. She holds a B.S. with honors in immunology and infectious disease from Pennsylvania State University's Schreyer Honors College.

ASBMB on the Hill

In meetings with lawmakers, scientists advocate for federal agency budget increases

By Marissa Locke Rottinghaus

Sixteen members of the American Society for Biochemistry and Molecular Biology from 16 states held 48 meetings with elected officials and their staffers during the society's annual Capitol Hill day.

Members of the ASBMB Public Affairs Advisory Committee and governing Council went to the nation's capital to make sure lawmakers understand the importance of protecting and sustainably funding fundamental research.

"These ASBMB members are all very engaged and passionate about advocating not just for science funding but for the people who are doing science," Sarina Neote, public affairs director of the ASBMB, said. "I am very excited that we are able to collaborate and hopefully change some hearts and minds on Capitol Hill."

ASBMB

Nadia Laniyan, a staffer for U.S. Sen. Cory Booker, D-N.J., meets with ASBMB President Ann Stock, ASBMB Science Policy Manager Raechel McKinley and Public Affairs Advisory Committee member Kevin Gardner.

Robust funding requested

The 2024 budget was front and center as ASBMB members emphasized that the budgets of the National Institutes of Health, the National Science Foundation and the Department of Energy Office of Science (the largest supporter of fundamental research in the physical sciences in the U.S.) must increase to sustain the U.S. scientific enterprise and keep up with inflation.

Rick Page, a professor at Miami University in Ohio and chair of the PAAC, said he stressed how "necessary sustainable investments in science are in order to keep the U.S. globally competitive in research and development."

Specifically, the ASBMB members asked legislators to:

- Protect fundamental scientific research funding.
- Separate funding for the Advanced Research Projects Agency for Health, or ARPA-H, from the NIH core budget.
- Ensure funding for the NSF's new Directorate for Technology, Innovation and Partnerships boosts, not replaces, fundamental research funding.
- Appropriate $3.56 billion for the National Institute of General Medical Sciences, $50.9 billion for the NIH base budget, $12 billion for the NSF and $8.8 billion for the DOE Office of Science.

NIGMS is the largest funder of fundamental science research but has been historically underfunded. Over the past decade, its budget has increased only 21% compared with more than 40% for other institutes' budgets. The requested $3.56 billion represents a 10% increase.

Seeking common ground

PAAC members met with policymakers on both sides of the

ASBMB

PAAC members Shantá D. Hinton, left, and Karen Lewis meet with Brent Robinson, deputy chief of staff for U.S. Rep. Rob Wittman, R-Va.

aisle representing 16 House and 32 Senate districts.

Ann West, a professor at the University of Oklahoma, spoke with staffers for Sens. James Lankford and Markwayne Mullin as well as Rep. Tom Cole, all Republicans from Oklahoma. West said she tried to convince policymakers and their staffers to "support basic research to fuel translational research down the road."

Mary Lipton, a staff scientist at the Pacific Northwest National Laboratory, met with Sen. Patty Murray, D-Wash., chair of the Senate Appropriations Committee. Murray, a supporter of scientific research, helped pass the Creating Helpful Incentives to Produce Semiconductors, or CHIPS, and Science Act, which aimed to lower the cost of science in the U.S.

ASBMB members asked policymakers to allocate funds outlined in the CHIPS and Science Act for the NSF TIP directorate. The society wants to ensure that funding the TIP directorate will not take away funds usually allocated for fundamental science research, Neote said.

Another goal is keeping the ARPA-H budget separate from that of the rest of NIH to protect fundamental research funding in other sectors of the agency.

As a follow-up to Hill Day meetings, the ASBMB launched a letter-writing campaign, inviting members to ask their elected officials to support research funding. Society members sent 373 messages to congressional members in 33 states.

Marissa Locke Rottinghaus (mlocke@asbmb.org) is the science and policy communications specialist for the ASBMB.

ASBMB

PAAC member Ron Wek, left, and PACC chair Rick Page stand outside the U.S. Capitol, where they met with U.S. Sen. Mike Braun, R-Ind.

Meet the 2023 ATP delegates

By Marissa Locke Rottinghaus

Twelve members of the American Society for Biochemistry and Molecular Biology are participating in the society's 2023 Advocacy Training Program.

This three-month summer externship, run by the ASBMB public affairs department, provides hands-on science policy and advocacy training and experience. After completing the program's educational component, delegates will visit Capitol Hill to meet with policymakers in 2024.

Meet this year's participants:

Benjamin Duewell, a Ph.D. candidate at the University of Oregon, studies protein biochemistry and is interested in the mechanisms that enzymes leverage to localize to subcellular areas.

"As a child of schoolteachers, I grew up seeing the effect that public policy had on classrooms," Duewell said. "I have since focused my time working to understand the systems that create barriers between people and education. I hope to continue learning about these systems as an ATP delegate while gaining new knowledge and skills to better advocate for their reform and restructure."

Chloe Kirk, a Ph.D. candidate at the University of Miami, is studying how cells respond to stress and the cellular disassembly of physiological amyloids. Kirk participates in the UM student government, volunteers with Skype a Scientist and writes for ASBMB Today.

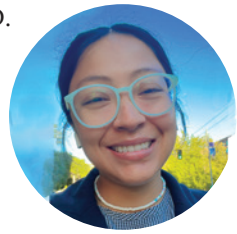
"As an Advocacy Training Program (delegate), I plan to learn how I can harness my experience in science research and communication to advocate for increased funding in biomedical research and STEM education resources," Kirk said.

Faith Bowman, a Ph.D. candidate at the University of Utah, researches the role of a potential nutrient sensor and its effects on glucose metabolism in diabetes and heart failure. Bowman is an Indigenous scholar from the Stockbridge–Munsee Band of Mohican Nation in Wisconsin.

"As an ATP delegate, I hope to gain critical skills in initiating and engaging with public policymakers, aligning the community's needs with policymakers' goals and distilling those ideas into actionable plans to improve health equity with policy grounded in evidence-based research," Bowman said.

Isha Verma, a postdoctoral fellow at the University of Michigan, investigates epilepsy mechanisms using patient stem cell–derived neural cells and brain organoids. Verma earned her Ph.D. in stem cell biology at the Indian Institute of Science and conducts scientific outreach with K–12 students through Skype a Scientist.

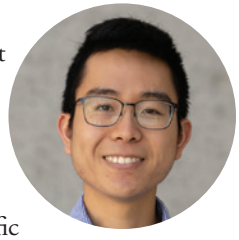
"As a part of the ATP, I am excited to learn about the opportunities to interact with congressional members and advocate for research funding," Verma said.



Joselyn Landazuri Vinueza, a Ph.D. candidate at the University of Washington, researches how viruses cause cancer with the goal of discovering new therapeutic treatments. She is a member of the diversity committee in her department and has volunteered with Seeds of Success, mentoring Puerto Rican girls who are interested in science.

"I am looking forward to learning how to advocate for federal funding to increase minority representation in STEM fields through the ATP," Landazuri Vinueza said.

Justin Wang, a Ph.D. candidate at Scripps Research in La Jolla, California, studies how to inhibit cancer growth and metastasis by exploiting transfer RNA synthases. He served as president of the Graduate Student Council



at Scripps and advocates for a more equitable and inclusive environment for trainees of all backgrounds.

"By participating in the ATP, I hope to gain the skills and know-how to improve research culture through policy and translate scientific findings into impactful policy changes," Wang said.

Katie Scott, a neuroscience Ph.D. candidate at the University of Iowa, studies novel gene therapies for genetic neurodevelopment disorders with a focus on sodium channels. She also volunteers as a swimming teacher and as a caregiver at an animal rescue.

"I am hoping to build my knowledge on how to create an inclusive and inviting atmosphere to learn about science for my community," Scott said. "I am passionate about accessibility and advocating for inclusive learning spaces."

Kira Mills, a Ph.D. candidate at the University of Texas at Dallas, uses computational biochemistry to understand the mechanism of ion-transporting proteins. They received their bachelor's degree in chemistry from Texas A&M University–Commerce in 2018 as a McNair Scholar.

"As a first-generation student from a low-income background, I have seen firsthand the disparities in public school education throughout the U.S., within Texas specifically, and want to work toward bridging the gap and ensuring all students have access to quality science education," Mills said.

Maksim Dolmat, a Ph.D. candidate at the University of Alabama at Birmingham, conducts research at the intersection of polymer chemistry, nanotechnology and biomedical science. He previously worked as a chemist in academia and industry in Belarus.

"I hope to bring attention to the complex relationships between climate change and cancer risks through modifiable risk factors," Dolmat said. "I aim to become well versed in scientific policy, develop a well-placed network that will enable me to obtain the resources to implement changes and understand the intricacies of the federal government."

Mericka McCabe, a Ph.D. candidate at Albert Einstein College of Medicine, studies small molecule regulators of autophagy. She is involved in Women in Autophagy, a nonprofit that provides free resources and programming to support young scientists globally.

"Through the ATP, I hope to gain the confidence and skill set to work with policymakers and advocate on behalf of my fellow scientists," McCabe said.

Nidhi Shukla, a postdoctoral fellow at Case Western Reserve University, focuses on how protein sequence variants affect disease and is interested in exploring the amino acid compatibility between virus and host. Last year, she served as the president of the CWRU Postdoc Association.

"I hope to gain a deeper understanding of the policymaking process and develop the skills and knowledge necessary to advocate for policies that align with my values and priorities," Shukla said. "I also hope to build connections with other advocates and gain insights into best practices for community building and policy advocacy."

Sydney Haas is an undergraduate at the New College of Florida, majoring in marine biology. She conducts research on the nutrient concentrations in Sarasota Bay.

"With ATP, I have three main goals: learn what strategies are most effective for fighting for educational freedom and prosperity for both the students and professors, learn how to communicate well with legislators and decision-makers and learn how to help others at the New College of Florida," Haas said.

Marissa Locke Rottinghaus (mlocke@asbmb.org) is the science and policy communications specialist for the ASBMB.

ASBMB announces 2023 SOC grant awardees

By Jelena Lucin

The American Society for Biochemistry and Molecular Biology has awarded six 2022–2023 Science Outreach and Communication grants.

The grants of up to $1,000 each fund new and existing public engagement activities that foster the appreciation of science — particularly biochemistry and molecular biology — in informal settings. Recipients are chosen by the ASBMB Science Outreach and Communication Committee, whose mission is to expand the effectiveness of inclusive and accessible science outreach and communication activities. Since the grant's 2021 inception, the committee has received 65 applications.

Odaelys Pollard is chair of the ASBMB science outreach subcommittee. "It is important for scientists and STEM professionals to know that they have the ability and responsibility to encourage their community members to engage in the scientific process, especially those in underrepresented and underresourced groups. We've been really impressed with the proposals that have come forward with this in mind," Pollard said.

"We can see the passion that ASBMB members share in public engagement, and we're really impressed by their work. We hope that these well thought-out and captivating outreach programs motivate others to get involved in their communities."

Here are this year's projects and recipients.

DNA Discovery Day and Museum DNA Discovery Center

Emmett Smith, Earlham College

Undergraduate students in an upper-level biology class develop and present informational exhibit panels on DNA, its structure and function and its role in inheritance. This exhibit includes a 3D DNA model, hands-on activities and posters. It will be displayed permanently at the Joseph Moore Museum, a local college natural history museum that is open to the public. The unveiling of the exhibit includes students presenting their posters to the public and leading hands-on activities to introduce the audience to DNA base pairing and double helix structure.

Through this exhibit, Smith's team aims to improve informal science learning for the local community, particularly students. Science, technology, engineering and math proficiency has been dropping in Indiana; only 19.2% of high school students demonstrate proficiency in biology, according to a 2021–2022 assessment.

As the only regional institution offering free STEM programming, the museum serves about 13,000 visitors a year. A field trip to the museum comprises a large portion of many elementary-age students' science curriculum, Smith said. "Incorporating a DNA exhibit at the museum will have a large, and lasting, impact on the local community."

ASBMB funding primarily goes to the costs of materials for the DNA exhibit.

Emily K Center Science Night

Emily Cannistraci, Duke University

The nonprofit Emily K Center in Durham, North Carolina, provides educational experiences for students who are traditionally underrepresented in higher education. Science Night, held in Duke University laboratories,

shows students why a protein's structure is important for its function, for example, by heating an enzyme and testing its activity at different temperatures using a fluorescence-based assay. Students observe a protein's characteristics and analyze its structure using circular dichroism spectroscopy and X-ray crystallography and learn how changes in the structure can lead to diseases. They also get to see other instruments used at Duke to analyze protein structure.

The target audience is high schoolers in the Scholars to College program, which focuses on exploring students' educational interests and identifying the topics they wish to study in college.

"A hands-on research experience would typically be inaccessible for our targeted students," Cannistraci said. "We hope this event will expose them to new techniques used to answer scientific questions and get them excited about biochemistry and careers in scientific research."

ASBMB funding primarily goes to the costs of materials needed for the experiments.

Exploring antibiotic resistance in the high school lab with hands-on experiments and molecular visualization software

Josh Beckham, University of Texas at Austin

This outreach program aims to bring together high school and undergraduate students to explore the mechanisms of antibiotic resistance and potentially identify novel compounds.

The students collaborate on a research study involving molecular visualization of an enzymatic interaction associated with antibiotic resistance. They then present their work to their peers.

The target audience is high schoolers who are part of an existing STEM biomedical engineering program at Akins High School. Many students at this Title I school come from low-income households and are members of groups that are underrepresented in the sciences.

According to Beckham, "High schoolers have the benefit of role models while the undergrads benefit from guiding and teaching to the younger students."

ASBMB funding primarily goes to the costs of materials needed for the experiments.

Total Experience Learning summer program

Amy Greene, Albright College

As part of Albright's Pre-College and Summer Program, students aged 10–18 participate in a three-day, 1.5-hours-per-day lab workshop on parasite biochemistry. The objective is to determine whether a common drug or herbal remedy, chosen by the student, kills a non-pathogenic parasite. The student defines the compound's chemical structure and function. Students also learn about a neglected tropical disease, such as Chagas (Trypanosoma cruzi), which infects about 6 million people in Latin America. The program implements data sharing; students upload the data collected from the workshop onto the biology education and resource platform QUBES.

The students work in campus labs with state-of-the-art equipment including cell culture hoods and research-quality microscopes. They can attend seminars and enroll in mentored after-school research programs.

"Understanding drug structure–function relationships doesn't sound like something a middle-school student could grasp," Greene said, "but I have found that the students in this program are really engaged and ask surprisingly sophisticated questions."

Pennsylvania state testing focuses on biology, and students often have little exposure to chemistry. Many students in the program come from the high-need Reading School District, which is within walking distance from Albright.

ASBMB funds mainly go toward obtaining higher-quality medicinal chemicals for testing.

Out of the lab and into the classroom: Sharing science with underserved students

Mandy Eckhardt, University of Texas Southwestern Medical Center

This program aims to expose students aged 10–18 in under-resourced schools to research opportunities and careers in science. It includes a presentation to highlight opportunities and careers in science and a hands-on activity that demonstrates a genetic phenomenon. Using paper strips of phenylthiocarbamide, a harmless chemical that

tastes very bitter to some and not others, students will learn how dominant and recessive genes are associated with experiencing taste.

The students are from the Tulsa Virtual Academy, a Title I school where at least 40% of students come from low-income backgrounds and 78% are from ethnically underrepresented groups in science. Most have been suspended or expelled from other schools, Eckhardt noted. "Requiring that these students learn online prevents them from being able to do in-person science experiments, creating an inequitable science education."

Many students face similar difficulties, particularly in rural communities, so Eckhardt plans to mobilize this program to bring it to rural schools.

ASBMB funding goes to workshop supplies and travel costs for Eckhardt.

Unraveling the message: A DNA Day crime scene investigation

Chloe Kirk, University of Miami

As part of an ongoing collaboration with a local high school science club, this program aims to bring high schoolers to the University of Miami Medical Campus for a day to learn about being a scientist and about DNA on DNA Day. The goal is to show how a working knowledge of DNA biology applies to specific biomedical fields such as epigenetics, cell biology, microbiology, immunology and neuroscience. The program includes career development discussions and hands-on workshops led by graduate students at UM. Students rotate through interactive lab demonstrations and an integrated crime scene investigation activity. Demos include DNA fingerprinting, DNA base biology, liquid nitrogen ice cream and agar bacteria microbiology.

Participants attend a public high school in North Miami that draws from underserved communities; 62% of students are economically disadvantaged. Kirk said the UM grad students have connected with the students by going to their school for demonstrations; "however, due to time constraints and many students not always being able to stay after school for science club, we try and find alternative ways we can engage more students."

By providing transportation and a field trip during school hours, Kirk aims to engage 50-plus students; whereas they had attracted only about a dozen to after-school activities.

Organizers intend to develop a long-term collaborative relationship between the university and local high school science programs, keeping the dialogue open with both students and educators.

ASBMB funding primarily goes to the costs of materials for the workshops and providing food for the students.

Jelena Lucin (jlucin@asbmb.org) is the ASBMB's outreach and education coordinator. Follow her on Twitter: @Jelena23Lucin.

2023 PROLAB winners named

By Paula Amann

Science again crisscrosses the Americas this year, as 10 early career researchers receive travel grants from Promoting Research Opportunities for Latin American Biochemists, a program that helps grantees further their research by working in laboratories in North America.

Since 2012, the American Society for Biochemistry and Molecular Biology, the Pan-American Society for Biochemistry and Molecular Biology and the International Union for Biochemistry and Molecular Biology have given 103 biochemists these awards. The program welcomes applicants from Argentina, Brazil, Chile, Peru, Uruguay, Cuba, Panama, Mexico, Spain and Portugal. Awards support travel and related expenses.

This year's PROLAB travel grants go to doctoral students, postdoctoral fellows and early career scientists from Argentina, Chile, Mexico, Uruguay and Spain. Grantees will work in Canada and the United States.

The 2023 recipients are:

María Vanesa Amarelle Larrosa

Project title: Functional genomics of alternative SynBio chassis: shortening the gap for developing synthetic biology hosts

Amarelle is a research assistant in the microbial biochemistry and genomics department at the Clemente Estable Institute of Biological Research in Montevideo, Uruguay. She works on synthetic biology, searching for new biological parts (such as promoters, terminators and coding sequences) and developing a new bacterial chassis. She earned her Ph.D. in basic science development from Montevideo's University of the Republic.

Amarelle is committed to science outreach and belongs to ComicBacterias, a group promoting microbiology education through comic books. She coordinated two of these: "Bacteria: Lights in the Sky" and "Who Are They? Twelve Uruguayan Women in STEM."

Amarelle will work with Federico Rosconi and Juan Ortiz–Marquez in the Microbial Systems Biology Lab at Boston College. The research team offers broad experience in functional genomics, from transposon insertion sequencing to CRISPR interference.

"This grant opens up the possibility for me to enhance my expertise in functional genomics, be trained in cutting-edge technologies and collaborate with a research group with great expertise," Amarelle said. "It is an incredible chance to not only expand my knowledge but also to make meaningful contributions to the field of synthetic biology."

Andrea Celeste Arismendi Sosa

Project title: The effect of dehydroleucodine on mast cell function and responses to Helicobacter pylori infection

Arismendi works on a research project to combat hunger, "Sustainable Productive and Regional Development to Incorporate Added Value to Dairy Products." She is a lecturer in microbiology at the National University of San Luis and is studying toward specialization in university teaching at the National University of Cuyo, both in Argentina. She earned her biochemistry Ph.D. at San Luis and then had a postdoctoral fellowship with Alicia Penissi and Alba Vega at the National Scientific and Technical Research Council studying how virgin olive oil combats Helicobacter pylori infections in mice and inhibits H. pylori–induced mast cell activation.

Arismendi will work with Marianna Kulka, team lead of biomedical nanotechnologies at the National Research Council Canada's Nanotechnology Research Center. Kulka oversees four laboratories that probe molecular biology, nanomedicine, synthetic organic chemistry and cryogenic electron microscopy.

"This opportunity means a lot to me, since it allows me to continue training and have the possibility of ties with other research groups," Arismendi said.

Viviana Andrea Cavieres Risco

Project title: Possible role of membrane contact sites between the endoplasmic reticulum and lysosomes in resistance to chemotherapeutics in breast cancer cell models modulated by key ER proteins

Cavieres is a postdoctoral fellow in Patricia Burgos' lab at the Center for Cell Biology and Biomedicine at the University of San Sebastián in Providencia, Chile, where she studies the potential involvement of endoplasmic reticulum quality control in resistance to chemotherapy for breast cancer. She previously served as a staff scientist for a project on selective catabolic degradation of the endoplasmic reticulum by an Atg5-independent mechanism.

Cavieres earned her Ph.D., specializing in cellular and molecular biology, at the Austral University of Chile, in Valdivia. She investigated the role of the GOLPH3 oncoprotein in the function of lysosomes in breast cancer cells, mentored by Gonzalo Mardones.

Cavieres will work in Juan Bonifacino's lab at the Eunice Kennedy Shriver National Institute of Child Health and Human Development, which is part of the National Institutes of Health. She will study correlative light electron microscopy.

"This travel grant will provide me with an opportunity to learn a complex technique firsthand, which will greatly contribute to the advancement of my scientific career," Cavieres said. "It will enable me to implement a novel approach for evaluating cell morphology in Chile."

Andrés Di Paolo

Project title: Disruption of organelle interaction in the long axis of neurons in vivo and in vitro

Di Paolo heads the fluorescent microscopy platform while doing postdoctoral work in the genomics department at the Clemente Estable Institute of Biological Research in Montevideo, Uruguay. He studies subcellular localization of protein translation and earned his Ph.D. at Uruguay's University of the Republic.

Di Paolo received a 2022 award from the Jacobo and Estela Klip Fund at the Hospital for Sick Children in Toronto, Canada. With that grant and his PROLAB travel award, he will work in Peter Kim's cell biology lab at the University of Toronto. In 2024, with an Alexander Von Humboldt fellowship, Di Paolo will study with Markus Sauer, an expert in (d)STORM super-resolution microscopy techniques, in Wurzburg, Germany.

Di Paolo aims to use his training in super-resolved structured illumination microscopy to study the interactions of organelles in axons at basal and injury conditions and bring his skills to Uruguay, which is developing its first super-resolution microscope.

"Thanks to the PROLAB fellowship and the Jacobo and Estela Klip scholarship, I have the incredible opportunity to learn different super-resolution microscopy techniques and apply them in the study of organelle interactions in axons," Di Paolo said.

María Victoria Gutierrez

Project title: Effects of nitrolipids on lipid metabolism and scavenger receptor expression in monocytes, and their links to atherosclerosis

Gutierrez is pursuing a Ph.D. in biochemistry at the National University of Córdoba in Argentina while also serving as an assistant professor. She holds a master's degree in biochemistry with a concentration in molecular biochemistry from the same institution.

Gutierrez will work in Francisco José Schopfer's lab in the pharmacology and chemical biology department at the University of Pittsburgh. Schopfer's team discovered nitrated fatty acids in the early 2000s and continues to study their formation and metabolism. Gutierrez hopes to learn more about nitrolipids using new skills in mass spectrometry.

"The PROLAB program will allow me to boost my knowledge in mass spectrometry techniques and lipid metabolism in monocytes and macrophages," Gutierrez said. "I am very grateful for this opportunity and think it will greatly impact my academic and personal growth."

Susana Guzmán Puyol

Project title: Full characterization by solid-state nuclear magnetic resonance spectroscopy of suberin-based films obtained from suberin monomers

Guzmán is a postdoctoral researcher at the Institute for Mediterranean and Subtropical Horticulture in Spain. As

a chemist, she specializes in the production of sustainable packaging from discarded plant biomass. She earned her Ph.D. in nanosciences at the University of Genoa in Italy, with a focus on developing novel bioplastics from vegetable wastes. She holds bachelor's and master's degrees from the University of Málaga in Spain.

Gúzman will work with Ruth Stark, director of the City University of New York Institute for Macromolecular Assemblies at the City College of New York. They plan to conduct solid-state nuclear magnetic resonance tests of suberin polymers from the epidermal tissues of potatoes, with an eye to developing more bio-based materials.

"This grant is a fantastic opportunity for my research career," Guzman said. "The visit to the Stark lab will allow me to learn about cutting-edge characterization techniques of the chemistry behind complex bio-based materials."

Coral Martínez Martínez

Project title: Subcellular distribution of an intrinsically disordered protein involved in desiccation and drought tolerance in plants

Martínez is pursuing a Ph.D. at the Institute of Biotechnology at the National Autonomous University of Mexico, in Cuernavaca, where she earned a master's degree in biochemical sciences. Her master's thesis dealt with the localization of transcripts and proteins of family 4 LEA genes of Arabidopsis thaliana. In addition to her studies, Martínez works as a research assistant on stomatal development and physiology in Phaseolus beans.

Martínez will work with Marisa Otegui at the Center for Quantitative Cell Imaging in the botany department at the University of Wisconsin–Madison. She aims to perform live and electron microscopy cell imaging to analyze the function of late embryo-genesis abundant proteins in protecting plant cells against desiccation and drought.

"The PROLAB grant will provide me with the opportunity to learn complex microscopy techniques that will be of critical importance for the successful completion of my Ph.D. project," Martínez said. "It will also allow me to continue learning more about microscopy applied to plants, a field of study that has interested me since I started my scientific career."

Camila Oses Oliveto

Project title: Effects of mechanical forces on the nuclear organization of pluripotency transcription factors in stem cells

Oses is working toward a Ph.D. in biological chemistry at the University of Buenos Aires in Argentina, where she earned the equivalent of a master's degree in chemistry. She plans to focus on the biophysical study of the dynamical organization of pluripotency transcription factors in embryonic stem cells.

Oses will work in Carlos Bustamante's lab in the molecular and cell biology department of the University of California, Berkeley. She will test the thesis that mechanical cell perturbations can be transduced to the nucleus, with impacts on the chromatin of embryonic stem cells.

"This opportunity will elevate my research and personal growth and enable me to learn cutting-edge techniques," Oses said. "I am deeply grateful for this life-changing experience."

Maria Julia Pimentel Solá

Project title: Autophagy pathways triggered by Leishmania parasites isolated from mucosal leishmaniasis patients

Pimentel studies leishmaniasis, a serious parasitic disease that occurs in parts of the tropics, subtropics and southern Europe. She is completing her Ph.D. at the National Council of Scientific and Technology Research at the Institute of Experimental Pathology in Salta, Argentina. Pimentel also teaches high school biology. She earned a bachelor's degree in biology at the National University of Salta.

Pimentel will work with John H. Brumell, co-director of the SickKids Inflammatory Bowel Disease Centre and senior scientist with the cell biology program at the Hospital for Sick Children, both in Toronto, and a professor of molecular genetics in the Institute of Medical Science

at the University of Toronto.

"I want to express my gratitude to the ASBMB for this fellowship and the opportunity given to other young researchers to expand their investigations," Pimentel said. "This training at Dr. Brumell´s lab on autophagy in Leishmania infection will help me increase my knowledge of this exciting topic."

Victoria Rozés–Salvador

Project title: Contribution of the CREB3 transcription factors family to the modulation of the secretory pathway and their involvement in early neuronal development

A cellular neurobiologist, Rozés–Salvador is an assistant professor at the Center for Research in Clinical Biochemistry and Immunology at the National University of Cordoba in Argentina, where she also earned her Ph.D. in chemical sciences and completed two postdoctoral fellowships at the university's Mercedes y Martin Ferreyra Institute.

Rozés–Salvador will work at the NIH's Eunice Kennedy Shriver National Institute for Child Health and Human Development with Juan Bonifacino, where she will study the expression of exogenous CREB3L1, as well as short hairpin RNA or CRISPR-mediated silencing of CREB3L1 in human iPSC-derived neurons or rat hippocampal neurons, using lentiviral vectors. She will also probe the effects of these manipulations on gene expression and the secretory pathway in the neurons.

"Celebrating the chance to advance professionally and personally, I am grateful for this grant, which opens doors to new approaches, techniques and boundless opportunities," Rozés–Salvador said.

Paula Amann (pamann@asbmb.org) is the ASBMB's science writer.

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Seeking to cure a coronavirus that's fatal to cats

By Sneha Das

All of us have witnessed the impact of the COVID-19 pandemic caused by the SARS-CoV-2 coronavirus that claimed more than 6 million lives worldwide. The coronavirus family is made up of RNA viruses that infect many mammals and birds. In humans, outcomes can range from the common cold to fatal pandemics.

Like humans, cats can be infected by coronaviruses. Most cats are exposed as kittens to the feline alphacoronavirus, or FCoV. One study found that 40% of domestic cats in the United Kingdom had antibodies for FCoV, suggesting prior infection. Most FCoV infections are asymptomatic or cause mild disease in the gastrointestinal tract. However, in 5% of cases, the virus spreads and results in a fatal disease called feline infectious peritonitis, or FIP. Experts believe that the gastrointestinal coronavirus strain can mutate into the more virulent virus that causes FIP.

Sheema Mir, an assistant professor at the Western University of Health Sciences in California studies infectious diseases caused by RNA viruses.

"FIP is a devastating disease that affects cats worldwide," Mir said, "and currently, there are no effective treatments available for this condition."

A coronavirus enters a host cell and multiplies there before exiting to infect new cells. Before the virus exits, it makes multiple copies of its RNA and packages it into its nucleocapsid, an outer shell that protects the viral RNA outside the host.

Mir's group found that a novel compound called K31 targets the nucleocapsid protein of FCoV and stops it from multiplying. In cell culture models, the virus was undetectable 24 hours after treatment with a single dose of K31. The researchers reported this discovery in a recent paper published in the **Journal of Biological Chemistry**.

How does K31 inhibit the virus at the molecular level? When nucleocapsids are packaged with viral RNA, they form ribonucleocapsids, which coronaviruses rely on to make more copies of the viral RNA. K31 disrupts the structural integrity of these ribonucleocapsids, and this has a catastrophic effect on the virus within the host.

"Cell culture studies are useful for the initial screening of potential compounds, and this study provides a promising starting point," Mir said. "The identification of K31 is an exciting development, but more research is needed to evaluate its effectiveness and safety in living animals."

Mir's group previously found that K31 inhibits the Andes virus and a new world hantavirus that causes hantavirus cardiopulmonary syndrome in humans. Initial cell culture studies suggest that K31 is well tolerated by host cells and might be developed into a broad-spectrum antiviral as well as an anti-coronavirus drug.

Previous drug development for coronaviruses has focused on targets such as RNA-dependent RNA polymerase, spike protein, and envelope protein Mir said, but this study shows the nucleocapsid is also a druggable target.

FIP kills one in every 100–300 cats worldwide. According to Mir, targeted therapies with compounds like K31 could soon be an effective treatment with minimal side effects.

"It is exciting to see that our research project has identified a novel molecule that has potential for further development as an antiviral therapy," Mir said. "It offers hope to cat owners."

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Sneha Das is a Ph.D. candidate in microbiology at the University of Illinois at Urbana–Champaign. Follow her on LinkedIn: Sneha Das. https://www.linkedin.com/in/sneha-das-6b5a46a1/

Gut microbes could be key for cancer therapies

By Oluwadamilola "Dami" Oke

Microorganisms produce substances that play a role in several of the human body's metabolic processes. In some cases, the specific function and mechanism of action of these metabolites still mystify scientists. Uncovering these mysteries could lead to groundbreaking targeted therapies for cancer and other diseases.

The short-chain fatty acid butyrate is a bacterial metabolite involved in intestinal homeostasis that provides energy and initiates differentiation in epithelial cells. Because low cell differentiation is a characteristic of cancer cells, researchers try to understand how bacterial metabolites such as butyrate affect epithelial cell differentiation and molecular phenotype.

Katarina Madunić and a team of scientists in the Netherlands investigated the effect of bacterial butyrate on glycosylation and differentiation in an epithelial cell line derived from a human colorectal carcinoma in 1977 and known as CaCo-2. They recently published their findings in the journal **Molecular & Cellular Proteomics**.

Mass spectrometry, or MS, separates molecules based on their mass-to-charge ratio and is frequently used to study metabolites. However, Madunić's team was analyzing glycans that had identical masses, so the usefulness of MS was limited. To overcome this limitation, they used a unique separation technique called porous graphitized carbon nano-liquid chromatography with electrospray ionization tandem MS.

Manfred Wuhrer, corresponding author of the study, explained that this method uses a "high-end charcoal variant that separates the sugars one by one, resolving the isomers for mass spectrometric characterization."

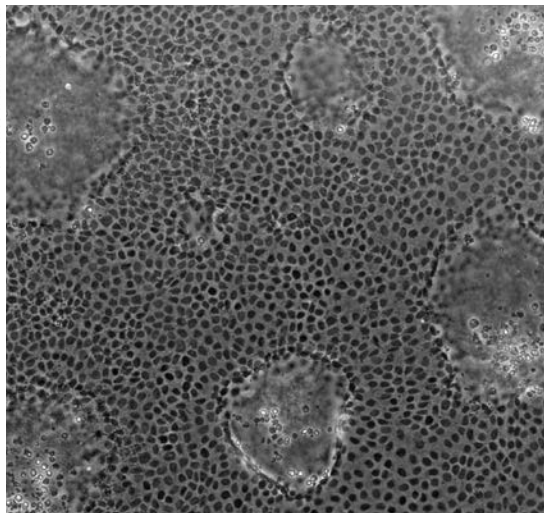
This unique approach was pioneered by a group of Australian researchers who published about it in 2004. It proved to be a technique that Madunić's team could build upon for their investigations.

The researchers were surprised to find that the glycosylation of differentiated cells from the CaCo-2 cell line was substantially different from the glycosylation of other differentiated colorectal cell lines from their previous work.

Madunić said this finding "made us look into the changes in the cell proteome, from which we formed interesting hypotheses about the importance of glycan building block availability in the cell culture media influencing the cell glycosylation changes."

In this study, the researchers wanted to investigate changes in glycosylation that occurred during differentiation in a particular cancer cell line. They did so, identifying specific O-glycans along with specific protein expressions that mark butyrate-induced versus spontaneous epithelial cell differentiation.

These findings are a step toward creating a repository of cancer-implicated metabolic and associated glycomic signatures. Such a repository can be used to further study the pathophysiology of various cancers and, consequently, to help develop targeted cancer therapies.



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A contrast microscopy image of cells from the Caco-2 cell line.

In future studies, the researchers hope to use more robust multiomics analysis to provide more depth to their findings and provide more mechanistic insights, Wuhrer said.

"We would like more information on the cellular metabolic signature and the expression of the glycogenes, which shape the O-glycans. How is this evolving and changing upon bacterial metabolite exposure?"

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Oluwadamilola "Dami" Oke (okeo@gwu.edu) is a Ph.D. candidate of biomedical engineering at George Washington University and recently became a contributing writer to ASBMB Today.

High-fat diet turns up the heat on atherosclerosis

By Marissa Locke Rottinghaus

Obesity and a high-fat diet are both risk factors for atherosclerosis. Certain obese individuals are two and a half times more likely to develop heart disease than healthy people of normal weight. However, the link between obesity and atherosclerosis has eluded scientists.

Researchers at UCLA recently determined that phospholipid derivatives found in Western diets worsen atherosclerosis by promoting gut bacteria interactions with the immune system. The team, led by Srinivasa Reddy, a professor of medicine at UCLA, published their results in the **Journal of Lipid Research**.

"The gut is the dietary window to the body," Reddy said.

Atherosclerosis is caused by fatty plaque buildup in blood vessels and can interfere with blood flow to critical organs, which can result in heart attack or stroke.

Alan Fogelman, a UCLA professor of medicine and the project supervisor, explained that phospholipids are natural emulsifiers in the diet.

"If you look at salad dressing and shake it up, it is the phospholipids that keep the oil in globules," Fogelman said. "Those emulsifiers can get modified by specific enzymes in the intestinal cells into very potent pro-inflammatory molecules in the body."

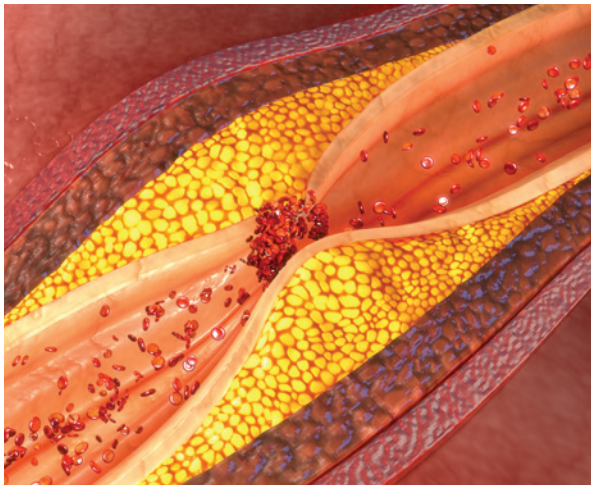
To study the connection between diet and atherosclerosis, the scientists used mice that had been genetically altered to recapitulate the high levels of low-density lipoprotein seen in atherosclerosis patients. The researchers found that when the mice were fed a high-fat diet, the cells that line the small intestine churned out reactive phospholipids that made the intestinal lining more susceptible to invasion by gut bacteria.

"The normal defenses for intestinal lining cells to keep bacteria in the lumen of the intestine are reduced when they take up large amounts of cholesterol and fat," Fogelman said. "This also results in bacteria being able to come in direct contact with the cells lining your intestines. Without those defenses, this results in more bacterial products getting into the bloodstream to cause inflammation."

The release of bacterial products from the gut into the bloodstream sounds an alarm in the immune system, which deploys immune cells into the blood to eliminate the potential threat.

"People who are obese and people eating high-fat, high-cholesterol diets have higher levels of endotoxin in their blood," Fogelman said. "When the cholesterol and fat come into the mix, the endotoxin kind of turns up the thermostat on inflammation, and that accelerates atherosclerosis and leads to increased heart attacks and strokes."

The team is looking for ways to reduce the phospholipid derivatives that cause endotoxin, a bacterial toxin, to enter the bloodstream. One method is using a mimetic of high-density lipoprotein.



Arnab Chattopadhyay, a project scientist at UCLA and lead author of the study, explained that his lab has created transgenic tomatoes that mimic high-density lipoprotein.

"These tomatoes, when added to a high-fat, high-cholesterol diet, help lower cholesterol and triglycerides and also lower the inflammatory derivatives of the phospholipids," he said.

According to the researchers, this method of lowering cholesterol levels and triglycerides could benefit people who are obese and at risk for inflammatory diseases such as atherosclerosis, arthritis, lupus and multiple sclerosis.

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Marissa Locke Rottinghaus (mlocke@asbmb.org) is the science and policy communications specialist for the ASBMB.

From the journals

By Ken Farabaugh, Anna Hu & Swarnali Roy

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

An alternate approach to finding alternative proteins

In molecular biology, the open reading frame, or ORF, is the portion of DNA between the start and stop codons, and one reference ORF is typically associated with one mRNA. Translation of the mRNA leads to a reference protein. However, alternative open reading frames, or AltORFs, may be in what was formerly mislabeled as the "untranslated region" and can be initiated by codons other than AUG. Translation of these reading frames results in alternative proteins, or AltProts, which researchers have implicated in physiological processes and diseases, as well as embryonic development. While bioinformatics predicts the presence of thousands of AltProts, existing mass spectrometry-based techniques have identified an order of magnitude fewer.

Ying Yang, Hongwei Wang and a research team in China describe a more efficient method for identifying AltProts in a recent paper in the journal **Molecular & Cellular Proteomics**. Their approach starts with ribosomal profiling for AltProt prediction and mass spectrometry for detection. After a process of trial and error that included testing 10 AltProt enrichment techniques (size exclusion chromatography won out) and various optimizations, they settled on a workflow that allows for enrichment and fractionation from the proteome.

With this method, the scientists discovered 89 novel alternative proteins in embryonic and adult mouse livers. Many of these AltProts were involved in RNA processing, including splicing and regulating the cell cycle — biological pathways associated with development. The researchers noted that while their optimized workflow is more comprehensive than previously published ones, more sensitive mass spec instrumentation would improve future identification of alternative proteins.

DOI: 10.1016/j.mcpro.2022.100480

DNA damage and repair in the 3D genome

Ultraviolet ray–induced DNA damage is a significant risk factor for skin cancer and other diseases. Studies have previously shown that DNA mutations caused by UV damage are repaired more efficiently in an open chromatin state, where repair enzymes can more easily access the DNA strands. However, researchers do not yet know whether UV-induced DNA damage or subsequent repair is affected by the 3D organization of the genome itself within the nucleus.

In their recent paper published in the **Journal of Biological Chemistry**, Ümit Akköse and Ogün Adebali at Sabanci University in Turkey describe how they investigated the synergistic effects of UV damage and 3D genome organization. They integrated chromosome conformation capture sequencing, excision repair sequencing, damage-seq and in silico simulations, and confirmed that the peripheral genomic elements shield the central genomic DNA from UV-induced damage, particularly the formation of pyrimidine-pyrimidone [6-4] photoproducts. Furthermore, they found no difference in repair efficiency between DNA at the core and the periphery of the nucleus after 12 minutes of irradiation compared with two hours of irradiation, suggesting that the 3D organization of the genome is altered by UV exposure in this window.

This study provides insights into the complex interplay between 3D genome organization and environmental sources of DNA damage such as UV rays. Further research in this area could lead to the development of new strategies for preventing DNA damage and subsequent genomic instability.

DOI: 10.1016/j.jbc.2023.104679

Learning about eye disease with lipidomics

The eye disease age-related macular degeneration, or AMD, can cause severe loss of central vision and generally affects people over the age of 50. According to a study at Cleveland Clinic, almost 20 million U.S. adults have AMD, and a predicted 288 million will be affected by 2040.

A recent article in the **Journal of Lipid Research** by Glenda Vasku of Université de Bourgogne Franche–Comté and a team of researchers in France describes creating a comprehensive lipidomic profile to identify the lipid classes responsible for AMD progression. The team used complementary reversed-phase chromatography, or RPC, and hydrophilic interaction liquid chromatography, or HILIC, to evaluate the lipid profile of retina and retinal pigment epithelium/choroid tissues and erythrocytes in

A mid-life crisis in the eye

Much of what we see depends on a small, flexible, transparent tissue that focuses light onto our retinas to produce sharp images. This is the ocular lens, and its transparency is essential for clear vision. Experts believe a "microcirculation" system maintains this transparency as it shuttles antioxidants to the older lens center and carries away waste products. But as oxidative stress occurs over time on lens cells, it likely contributes to the formation of age-related nuclear cataracts. These cataracts are a major cause of blindness and can only be treated surgically.

In a paper in the journal **Molecular & Cellular Proteomics**, Lee S. Cantrell and a team from Vanderbilt University describe performing specialized mass spectrometry on lenses of 16 people aged 15–74 to elucidate proteomic differences by age. After measuring several thousand protein groups and tens of thousands of peptides with the data-independent acquisition method of mass spec, they found a distinct point at which shifts in the eye proteome can be distinguished — around 50 years of age.

Comparing hierarchical clusters of protein groups from the lens samples, the researchers showed for the first time that the clusters below and above 50 years are different. This time point is significant because at about this age, lenses lose the ability to change shape and people notice an inability to focus on near objects, a condition known as presbyopia. This is why many people around this age need reading glasses.

They hypothesize that a biological event occurs around this age that causes remodeling of the lens proteome.

Specific changes in the clusters include depletion of aquaporin-5, a water channel protein involved in microcirculation. This decreases the permeability of the lens fiber cells and the abundance of SLC24A2, a calcium transporter. The resulting overaccumulation of calcium ions further interferes with the lens microcirculation system and response to oxidative stress. Proteins may then be misfolded or may aggregate, leading to cataract formation.

Looking forward, the Vanderbilt team highlighted a proteomic comparison between human lenses with and without cataracts as an important next step.

DOI: 10.1016/j.mcpro.2022.100453

— Anna Hu

plasma obtained postmortem from 10 healthy human donors with a median age of 87.5 years. They found that RPC is more sensitive in water-repelling lipid separation, whereas HILIC effectively separates polar lipids such as phospholipids.

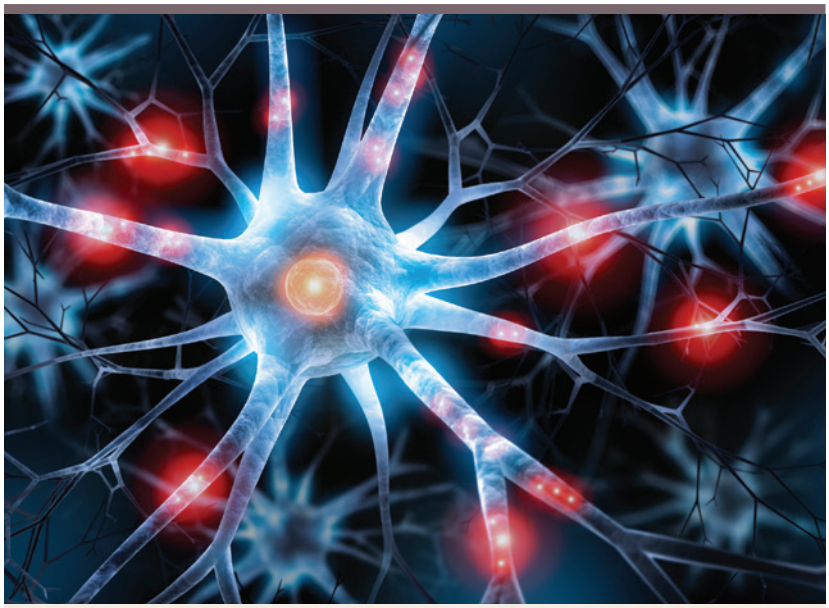
Using these complementary analytic tools, the researchers identified and quantified about 15 lipid classes and 500 lipid species with profiles ranging from highly polar to hydrophobic. They also found more hexosylceramides, which are found in sphingolipids, in one of the donors compared with the other healthy donors, which increased their interest in studying dysregulated sphingolipid metabolism as a potential target in retinal degeneration.

DOI: 10.1016/j.jlr.2023.100343

A better way to process LC mass spec

Combining liquid chromatography with mass spectrometry, or LC-MS/MS, provides a powerful tool for profiling cellular proteomic data. This technique has been used to identify posttranslational modifications, or PTMs, across sample conditions, but analyzing the resulting data can be challenging. Standard statistical tests such as analysis of variance may not distinguish between the shifting abundances of a particular modification versus proteins in general, for instance. In a recent **Molecular & Cellular Proteomics** paper, Devon Kohler of Northeastern University and a U.S.-based team present a software package to address these issues.

They write that their analysis framework, MSstatsPTM, exposes



New stroke drug doesn't impair memory

Learning and memory require synaptic plasticity; neural connections must be able to form and re-form to establish patterns of signal transduction. Scientists have long known that the Ca^{2+}/calmodulin-dependent protein kinase II, or CaMKII, plays an important role in forming memories. The neuroprotective peptide drug tatCN19o, an inhibitor of CaMKII, is a promising treatment for cerebral ischemia, or stroke. Studies have shown that sustained genetic inhibition of CaMKII can impair memory; however, researchers were not yet sure whether short-term CaMKII inhibition with tatCN19o could also have this negative effect.

Nicole Rumian, Nicole Brown and colleagues at the University of Colorado Anschutz Medical Campus have now described in an article in the **Journal of Biological Chemistry** their findings that acute CaMKII inhibition using the neuroprotective peptide tatCN19o did not affect pre-formed memories and only mildly and transiently interfered with learning. The authors used a concentration of tatCN19o 500 times that required for neuroprotection and found that mice injected with the drug displayed no impairment in fear-conditioning memory tests. Furthermore, they showed that in rat cortical cell cultures and live pigs this drug retained its neuroprotective functions at very low doses, even when administered 30 to 60 minutes after ischemia.

These findings support tatCN19o as a promising candidate to treat stroke and show that two of the biggest fears of its short-term use, that it could induce retrograde amnesia or have a long-term impact on learning, were not detected and thus do not pose a counter-indication.

DOI: 10.1016/j.jbc.2023.104693

— Ken Farabaugh

statistical differences between individual posttranslational modifications and global protein abundances. This can provide information about processes that occur on a short timescale, such as signaling events. The software, available on Bioconductor as an open-source R package, models complex experimental designs by accounting for more sources of variability and efficiently using the given data.

The researchers tested MSstatsPTM against the common analysis tools ANOVA and Limma. They evaluated its performance on two computer-simulated datasets, one benchmark-controlled mixture and three biologically based experiments. Across all testing, they found MSstatsPTM to be more accurate and better able to parse out statistical differences than the standard workhorse packages. These experiments were done on data-dependent acquisitions of LC-MS/MS, but the authors noted that this program can also work on data-independent acquisitions, another mark of its versatility.

DOI: 10.1016/j.mcpro.2022.100477

A new platform for detecting microRNAs

The small noncoding RNAs known as microRNAs, or miRNAs, can regulate gene expression or, in the case of numerous diseases such as cancers, dysregulate it. Traditional methods of detecting miRNAs include Northern blotting, DNA microarrays and real-time polymerase chain reaction, or RT-PCR, which can be slow and difficult to validate and require a large amount of starting material. More recent isothermal amplification techniques such as rolling circle, strand displacement and loop-mediated isothermal

amplification have other issues such as limited sensitivity, complicated design and numerous false positives.

In a recent paper in the **Journal of Biological Chemistry**, Xiuen Cao and colleagues at Central South University in Hunan, China, describe how they developed a new application to detect miRNAs using a platform that combines nonlinear branched hybridization chain reaction, or bHCR, which uses single-stranded DNA as an initiator to trigger assembly of a network of branched DNA hairpin structures, and DNAzymes, which are synthetic DNA sequences with catalytic function, to detect miRNAs. This method used DNAzymes that cleave the bow structures in bHCR to generate new branch-generating trigger sequences, thus exponentially speeding up amplification. The researchers showed that they were able to detect miR-21, a miRNA commonly expressed in cancer, in human liver samples in an assay that was simple, efficient, low cost and, importantly, protein enzyme-free.

This novel method for detecting miR-21 could be adapted to detect other miRNAs with the same accuracy as RT-PCR but with greater reproducibility. With further validation and testing, the bHCR-DNAzyme detection method could have potential for cancer diagnosis in the clinic.

DOI: 10.1016/j.jbc.2023.104751

Single-cell lipidomics shows how cells differ

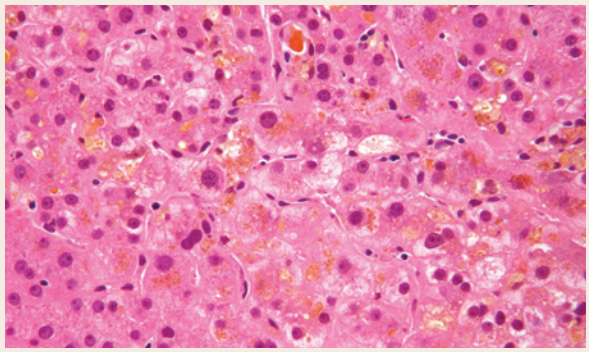
Multicellular organisms arise from a single cell, and cell-to-cell differences are the basis for varying levels

A combined therapy for bile duct disease

Bile acids, molecules that both attract and repel water, play a regulatory role in cholesterol metabolism and lipid absorption. The extent to which bile acids repel water depends on the number and position of hydroxyl groups in their structures. Accumulation of hydrophobic bile acids and their increased serum level are the prime cause of many gastrointestinal diseases including cholestasis, the slowing of bile flow from the liver to the duodenum.

Hepatic cytochromes P450 play a pivotal role in synthesizing bile acid metabolites, and CYP 2 subfamily c polypeptide 70 catalyzes the formation of rodent-specific muricholic acids, or MCAs, from chenodeoxycholic acid, or CDCA. CYP2C70 causes differences between humans and mice in hepatic synthesis of MCA.

In a recently published **Journal of Lipid Research** article, Mohammad Nazmul Hasan and a team at the University of Oklahoma Health Sciences Center describe how a combined therapy of an apical sodium-dependent bile acid transporter inhibitor and fibroblast growth factor-15, or FGF15, overexpression was more effective for cholestasis than common bile acid-based monotherapies. Using male and female mice that were genetically altered to lack the CYP2C70 gene, they compared how effectively the combined treatment reversed portal inflammation, ductular reaction and fibrosis compared with either agent alone.



NEPHRON/WIKIMEDIA COMMONS

This high-magnification micrograph shows liver cholestasis.

The researchers found that the effects of the combined treatment were similar to those of an engineered nontumorigenic FGF19 analog that was used in a recent clinical trial for effectiveness in treating nonalcoholic steatohepatitis (FGF19, an endocrine hormone, is the human ortholog of mouse FGF15). In mice that had severe cholangiopathy and portal fibrosis, the combined therapy was more effective in females than in males and overall more effective in reducing the amount of bile acids that cause the disease than either agent alone. The team detected about 30% enrichment of hydrophilic tauroursodeoxycholic acid in the gallbladder bile acid pool of the female mice.

The authors are considering a more in-depth analysis of the sex-dependent reduction of the hydrophobic bile acid pool to find any limits of this combined therapy and determine whether it can be used to treat humans.

DOI: 10.1016/j.jlr.2023.100340

— Swarnali Roy

of cellular expression and complex signaling networks. Single-cell analysis allows researchers to understand subtle cellular differences; however, characterizing the lipidome of a single cell is challenging; the structure is complex and the amount of lipid is limited.

In a recent **Journal of Lipid Research** article, Sarah E. Hancock of the Victor Chang Cardiac Research Institute and a group of researchers in Australia describe how they developed a fluorescence-assisted cell sorting, or FACS, technique and coupled it with automated chip-based nanoelectrospray ionization and shotgun lipidomics (a mass spectrometry-based tool for quantitative analysis of complex lipid networks) to study lipidome variability in a single cell. Using FACS, they were able to identify and quantify 56 distinct phosphatidylcholine and sphingomyelin species from C2C12 and HepG2 single cells.

To make the work more clinically relevant, the team used the same method to study single-cell lipidomics profiles in four prostate cancer cell lines with discrete PC composition. They identified subtle variations in lipidome within individual cancer cell lines. The authors hope to use this tool in combination with technologies such as a liquid biopsy to study differences in lipids among cancer patients to help guide treatment.
DOI: 10.1016/j.jlr.2023.100341

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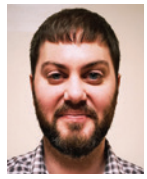

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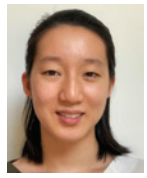

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Meet Enrique De La Cruz

The JBC associate editor tracks the actin cytoskeleton and gets lost in punk rock

By Paula Amann

ENRIQUE DE LA CRUZ

Enrique De La Cruz balances biochemical research with academic leadership at Yale University, where he chairs the molecular biophysics and biochemistry department and heads Branford College. He has served in a host of professional roles over his two decades at Yale, from committee member and chair to grant reviewer and mentor.

Before coming to Yale in 2001, De La Cruz had a postdoctoral fellowship at the University of Pennsylvania School of Medicine. He earned a doctorate in cell biology at Johns Hopkins University School of Medicine and a bachelor's degree in biology and chemistry at Rutgers University in Newark.

Newark is this scientist's hometown. He largely grew up in Kearny, New Jersey, where much of the television drama "The Sopranos" was filmed.

De La Cruz has authored 92 research publications in peer-reviewed journals. His most recent studies explore the dance-like movement of actin filaments and bundles in the cell. He was a member of the American Society for Biochemistry and Molecular Biology's inaugural class of fellows in 2021. He was elected as a fellow of the American Association for the Advancement of Science in 2022 and of the Connecticut Academy of Science in 2021.

De La Cruz spoke with Paula Amann, ASBMB Today's science writer, about his career and his work as an associate editor for the Journal of Biological Chemistry. The interview has been edited for clarity and length.

Q: When did your fascination with science begin?

My parents got married in Cuba in the early 1960s, shortly after the revolution when the politics were shifting. They left everything behind to come to the U.S., including family. Dad was a welder in a factory; Mom worked in a hospital. Education was impressed on all three of their children as one of the few things that could not be taken away from someone.

On a good day, I represent what can happen when good people step up for those younger and more vulnerable. I was fortunate to have many caring people pointing me in the right direction and helping create opportunities for me to grow and thrive. At 16, I started working in a lab at Hoffmann–La Roche in Nutley, New Jersey. I was fortunate to be the one person from my high school selected to participate in this inaugural work-study program. The bus commute from Kearny to Nutley was 40 to 45 minutes, on two buses.

It was a challenge, but that experience really got me excited about science and made me want to learn more.

I applied to one college: Rutgers University. At the Rutgers campus in

"At Rutgers Newark, I had stellar professors and advisors who were excellent at teaching and mentoring. They were honest and tough but supportive. Their teacher-to-student message was: You should think about being a scientist. It was my experiences at Newark that made me want to be a scientist and a teacher."

Newark, I took part in the Minority Biomedical Research Support Program, a National Institute of General Medical Sciences–sponsored program designed to expose underrepresented students to laboratory research and careers. I did that for four years, and it was transformative. The fact that I had a job that was advancing my career and I was getting paid was absolutely essential for my subsequent career path and trajectory.

At Rutgers Newark, I had stellar professors and advisors who were excellent at teaching and mentoring. They were honest and tough but supportive. Their teacher-to-student message was: You should think about being a scientist. It was my experiences at Newark that made me want to be a scientist and a teacher.

Q: Mentors were clearly important to you. What makes a good mentor?

Someone who has the capacity to see somebody for who they can and want to be and help them get there. One thing I know for sure: All of my mentors genuinely cared for me. Of this I am certain. When you have mentors like that, you have the courage to take chances, even if you lack confidence.

Q: What got you interested in studying actin?

I took Ed Bonder's undergraduate cell biology course at Rutgers. He taught me about actin, and I thought it was the coolest thing I'd heard of in my life. I fell in love with a molecule, and you never forget your first love.

I asked him, where was the best lab studying actin, and he said without a pause: Tom Pollard at Johns Hopkins. The next day I wrote Pollard a letter asking about graduate school opportunities.

He replied with a handwritten letter to an undergraduate student from Newark, explaining the opportunities, inviting me to apply to the various programs, and welcoming me to join his group if accepted. I hadn't even applied to graduate school yet, but I knew then that Pollard was the kind of person I wanted to be around.

Q: What's involved in running Branford College?

At Yale, we are proud of the residential college system, which is modeled on the United Kingdom's system, Oxford and Cambridge in particular. It's a community within a community; it has its own gym, intramural sports teams, dining hall and, in some cases, a printing press, pottery studio or theater. Each college has its own colors, its own mascot, and its own crest or shield. It's a wonderful way to establish community and support.

Being head of the residential college is one of the most fulfilling professional roles I've ever had. It's also one of the most demanding. You lead the college: You serve as its chief executive officer and spiritual leader. Heads deal with everything from community-building activities, finances and budget and space management to disciplinary matters.

Q: How do you juggle that role with running your department and your lab?

You have to believe in what you're doing, and you have to have the right people around you. In all these roles, you need to see yourself as part of a bigger team. I have amazing people in the lab, in the department and in

the college.

The challenge is in the multiplicity: I have three assistants for three different things. The hardest part is switching roles. All of them — the lab, the college, the department — are about teaching, pedagogy, identity and community, so there is a shared mission, but the roles are quite different.

Q: How did you get connected to the ASBMB and the JBC?

I was always a fan of the ASBMB, in large part because of the JBC. I've argued that you cannot write a good paper without citing the JBC. The journal was my first connection to ASBMB.

The ASBMB annual meeting is one of the most valuable national conferences you can attend. I tell people: If you can go to only one meeting this year, this is the one to go to, because of the breadth and excellence of the science.

Q: As an associate editor, how do you sort the good from the great studies streaming in?

There's a lot of good work that should be published but not necessarily by JBC. As an editor, I look for quality and rigor as well as the defining feature of our journal, which is biological mechanisms.

I don't view editors as gatekeepers. We are the ambassadors and mediators for the field. Our goal is to disseminate data to the community and to help community members to disseminate data to others.

Q: What do you do to unwind after a long week at Yale?

There are several things that I find therapeutic, and being beaten by my kids in sports is one of them. I like sitting with my wife when we have downtime — she always has something interesting to say that I did not know or did but didn't think about.

ASBMB

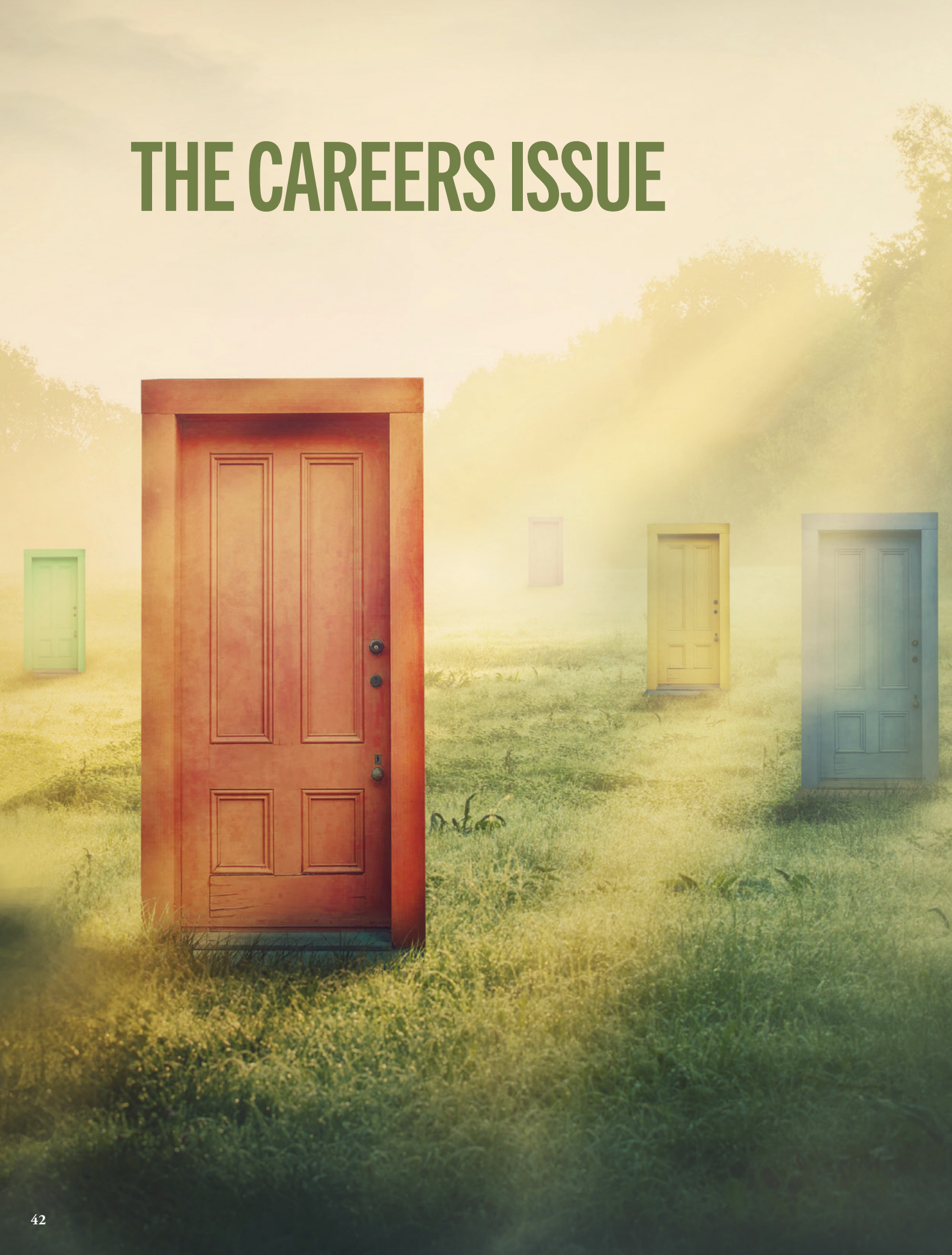
Enrique De La Cruz socializes with other scientists at an ASBMB annual meeting which he describes as "one of the most valuable national conferences you can attend."

I love going to vinyl record stores. I have been doing this since I was 12 years old and have accumulated an extensive record collection. I have five turntable systems set up, including four at home and one in my office. My heart belongs to punk rock, especially The Clash, Stiff Little Fingers and The Jam, but I also love soul, power pop, mod and glam, and in recent years I've started appreciating jazz.

Like science, there's always something new to learn about and appreciate in music, even if it's not a new release.

Paula Amann (pamann@asbmb.org) is the ASBMB's science writer.

THE CAREERS ISSUE



The silent toll of unpromotable work

By Courtney Chandler

When she was in her first faculty position at Ball State University in Indiana, Karlett Parra started volunteering with the Science Olympiad, a national K–12 team competition focused on science education and outreach. Over the years, her role grew; for three years she was the registration coordinator for the East Central Indiana Science Fair. Although Parra was also mentoring several students, maintaining her research program, writing grants and serving on several committees, she kept dedicating more time to the Olympiad.

"It was a beautiful experience that helped science development and helped kids get inspired and motivated by science," Parra said. "But, it was something I really didn't need to do."

KARLETT PARRA

Extra commitments like this one are everywhere in academia — from sitting on qualification committees to volunteering with outreach programs and beyond — and can take significant time and effort. These efforts may be of great value to students, the department or the institution, but they do not advance the faculty member's career. Yet, this work often is not acknowledged or recognized during annual reviews. Instead, researchers are evaluated on their performance in what are known as "core" areas such as research, teaching, mentoring and school service.

Geoffrey Kapler, a professor and former chair of the molecular and cellular medicine department at Texas A&M University, said there's a name for this phenomenon that highlights its professional downside.

"This type of extra work can become what has been termed 'un-promotable work' when it isn't recognized by department heads or review committees during annual reviews or the promotion process," Kapler said.

GEOFFREY KAPLER

Parra has been doing this kind of work throughout her career, partly because she wanted to learn and fit into this country's scientific community. She moved to the U.S. from Venezuela after earning her undergraduate degree, and while she wasn't planning to stay in academia, in grad school she fell in love with research and teaching. She is now a professor and chair of the biochemistry and molecular biology department at the University of New Mexico.

Women bear the brunt

In her experience, Parra said, specific groups seem to do more of this nonpromotable work.

"I've seen a trend where women tend to take on more, especially a lot of foreign women," she said. "Not that men and others don't do this work, but this group seems to go above and beyond."

Karen Allen, professor and chair of the chemistry department at Boston University, sees the same trend.

"There have historically been fewer women available to take on responsibilities internally for the university or externally to professional societies," Allen said. "In an attempt to balance the composition, women are being asked more frequently to do this work, and my understanding is that those from underrepresented populations would be even more in demand."

This phenomenon has been researched as well — the Women and Public Policy Program at Harvard University found that when an undesirable task is presented and no one immediately volunteers, women will take it on twice as often as men. As a case in point, at one large university, a WPPP study found, only 3.7% of the faculty volunteered to serve on a faculty senate committee — a nonpromotable task. And women were 2.7

times more likely than men to volunteer.

Kapler affirmed that women take on more of the nonpromotable work burden. As department chairs, Parra, Kapler and Allen, who are all members of the American Society for Biochemistry and Molecular Biology's Women in BMB Committee, said they try not to overload those faculty members who are willing to take on extra tasks.

"When someone does a good job, there is a tendency to ask them for more," Parra said. "I try to compensate them for their time by adding incentives to salaries or other ways, but I also try to make sure work is equitably distributed."

Allen agreed and said that, on a departmental level, she is constantly fighting to make sure people who do a good job aren't continuously overburdened. Even so, as faculty members take on more nonpromotable work, they will have to adjust their priorities. This can lead to less time for research, grant-writing or their personal life, creating an imbalance that can be hard to sustain.

When to say no

In recognition of the unequal burden on women, some faculty members are pushing back. Four women in the social sciences and economics fields at Carnegie Mellon University and the University of Pittsburgh wrote "The No Club," a book that explores how work is distributed in academia. In it, they use their research findings — which also found that women are 44% more likely to be asked to do nonpromotable work — to build a framework for women to balance their priorities and say no to tasks that don't serve them.

To be a good science citizen and give back to the community, Parra, Kapler and Allen think it's important for faculty members to stay engaged in nonpromotable work that they find individually meaningful. But these department chairs also caution against researchers overloading their plates. When Kapler has felt overburdened by extra work in the past, he said it bled over into his professional and personal life.

"I would drive to work, and I could feel my mood changing by the mile," he said. "I would get there and be incapacitated — promotable or unpromotable, no quality work is going to happen on a day like that."

Kapler advises any faculty member who feels like they're drowning to ask for help. Start with the department chair, who is usually an ally for their department members, he said, or a more senior faculty member or mentor.

When a faculty member comes to him with this kind of issue, Kapler said he starts by asking which activities they can step away from. He first has them identify commitments that must continue and then asks about tasks that are the most personally or professionally meaningful. Talking to a doctor or therapist can also help researchers make sure their mental health doesn't suffer.

KAREN ALLEN

Allen said her top tip when asked to take on extra work is the "pause rule."

"You don't need to say yes to a new commitment right away," she said. "Take the time to stop and make sure you know what the commitment is and think about how it will impact your current responsibilities. If you put this on your plate, ask yourself what will fall off and if that is worth it."

For anyone who has a hard time saying no to new commitments, even after taking a pause, Parra's advice is to further delay answering.

"Say you need to ask your department chair, to delay that feeling of obligation to say yes immediately, then think about if you can really take on another task," she said. "You can also talk with your department chair about what tasks you need to take off your plate before saying yes to something."

Parra, Kapler and Allen encourage faculty members to engage in meaningful unpromotable work, but with limits. Individual faculty members need to evaluate whether they are overburdened, but department chairs and other senior faculty can also help.

They can start by recognizing that women and members of historically underrepresented groups take on more of this unpaid and unpromotable work, as Parra, Kapler and Allen have. By addressing this trend, departments can move toward creating a more equitable distribution of work.

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.

6 tips for writing an effective recommendation letter

By Lisa Nivison-Smith

Recommendation letters can have a significant impact on an individual's chances of securing research grants, academic positions or awards. However, researchers and academics receive almost no training in how to write them. As both a recipient and writer of six successful recommendations for awards in academic leadership, public communication and engagement and research excellence, I share here my top tips on writing an effective recommendation letter and some examples to help you get started.

1. Confirm eligibility

Before you even consider writing a letter, ensure that the applicant meets the eligibility criteria for the scheme or position. If they do, specify this in writing in the recommendation. This demonstrates that you have done your due diligence checking the requirements, which builds trust in your recommendation. It also ensures you do not accidentally waste your time endorsing an ineligible applicant.

2. Confirm your appropriateness

Before agreeing to write a recommendation letter, be sure you have a good relationship with the applicant and you're comfortable commenting on their work. For example, if you're a clinical supervisor, you might only feel comfortable commenting on the applicant's clinical work. It's important to communicate this upfront. According to a linguistic analysis of recommendation letters published in the Journal of Surgical Education, having a direct relationship with the applicant is more effective than having a high academic rank. Tell the applicant clearly what areas you feel qualified to assess so they can approach someone else if they need a more comprehensive letter.

3. Define your relationship

In your letter, specify the type and length of your relationship with the applicant. This shows that you have the authority to make recommendations and can speak

TABLE 1: EXAMPLES OF HOW TO WRITE A MORE EFFECTIVE RECOMMENDATION LETTER

Confirm eligibility	✖ Person X is a suitable candidate.	✔ I confirm Person X meets the criteria of having a Ph.D. and being a U.S. citizen.
Define your relationship	✖ I work with person X.	✔ I've known person X for five years: as their Ph.D. supervisor from 2018 to 2020 and then as a mentor from 2020 to now.
Quote assessment criteria	✖ Person X led the innovative project.	✔ Person X led the project, exemplifying the award criteria of "strong commitment to innovation."
Give specific examples	✖ Person X excels at teamwork.	✔ Person X quickly made online channels so the team could communicate effectively while working from home.
Quantify their abilities	✖ Person X is an enthusiastic teacher.	✔ Person X increased student responses by 23% in only four weeks, the greatest increase by any education staff member since 2018.

to the applicant's qualities and achievements. This is particularly important if your relationship has evolved (from a supervisor to a mentor, for instance) or you are co-writing a recommendation with others.

4. Quote the assessment criteria

Most readers use recommendation letters to evaluate whether an applicant is suitable for the scheme/position they are applying for. Make this easy for the reader by directly quoting the relevant assessment criteria and then providing the evidence. This eases the workload for the reader and ensures they do not miss any evidence showing why the applicant is suitable.

5. Give specific examples

Rather than simply listing generic strengths and characteristics (such as dedicated, collaborative and innovative), provide specific examples of how the applicant has applied those strengths in relevant situations. This validates the abilities of the applicant by providing concrete evidence and gives your recommendation letter greater authenticity as it features personalized information on the applicant. The latter is especially valuable considering the rise in popularity of artificial intelligence tools for writing.

6. Quantify the applicant's abilities

Where possible, provide metrics or quantified evidence to support your recommendation of the applicant. Objective, quantified descriptions of the applicant's abilities, particularly when described in relation to their field of work, can be more impactful than subjective descriptions of the applicant's character or abilities. Metrics can help avoid the use of biased language that is commonly associated with recommendations letters written for women and members of historically underrepresented groups.

Finally, it is important to consider any unconscious biases you have that may influence your letter. In particular, several studies have shown that women receive shorter and less favorable recommendation letters than men based on letter length, tone of language and specific adjectives used to describe the applicant. Running your recommendation letter through a gender bias calculator can help you identify any gender-associated words that you may have unconsciously included. Other linguistic biases also exist, such as race; therefore, each letter should be reviewed carefully if the applicant is part of a minority or disadvantaged group. Other considerations during review including checking for grammatical errors and adherence to formatting guidelines should not be discounted; as while a well-written recommendation letter may not guarantee the applicant's success, a poorly written letter will very likely result in them being unsuccessful.

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Beyond the science:

What else should a PI teach a rotating graduate student?

By Bill Sullivan

At most universities, graduate students rotate through multiple laboratories before deciding which is best suited for their studies. During these rotations, which span an average of eight weeks, students learn the fundamentals central to the laboratory's research, receive training in associated experimental techniques and get a sense of the laboratory's culture.

Over the past 20 years, I've fielded many questions from rotating students who are curious about aspects of the scientific enterprise that usually are not taught in the classroom. These questions remind me of how little I understood about research funding, effective science communication and career options when I started graduate school. It occurred to me that a rotation period is a great opportunity to introduce students to these practical topics. Setting aside 30 minutes a week to review these subjects with your student helps round out the rotation experience.

Here are the topics I address in my weekly "Beyond the Science" meetings with rotation students.

Week 1. What can you do with a Ph.D.?

Many students enroll in a Ph.D. program with plans to stay in academia, but I make a point of telling them about other career options they could consider. While most students are knowledgeable about the biotech and pharmaceutical industries, they are less aware of positions in government, law, nonprofit research groups, technical writing, or science communication and outreach.

While obtaining a Ph.D., a successful student develops a set of transferable skills that are attractive to a wide variety of employers in other occupations, including those outside of scientific research. These skills include critical thinking, project management, communication, organization, and the ability to work either independently or as a member of a team. This discussion can show

the student the many different doors a Ph.D. allows them to open.

Week 2. How to stay on top of the literature.

Many students know that the search for published research papers begins with PubMed, but they are less familiar with the various ways the search engine can be interrogated by combining keywords or searching for author(s). Lesser-known sites such as Google Scholar and ResearchGate are also good sources for finding published research articles or following authors of interest. In addition to these sources of peer-reviewed research, it is important to teach students about preprint repositories such as bioRxiv and medRxiv.

Staying informed is key to success in science, so I teach students how to set up alert services through PubMed or a third-party platform like PubCrawler. Some investigators still rely on emailed tables of contents from their favorite journals, which are set up easily through the journal websites. Finally, social media, especially Twitter, is a useful way to stay informed about the latest research or publications (more on this in Week 5).

Week 3. Who funds scientific research?

This lesson covers the variety of internal (institutional) and external funding available for scientific research, how to identify an appropriate funding agency and mechanism, and how to apply (grant writing is reviewed during Week 6). In addition to highlighting the dominant federal sources of funding for basic research such as the National Institutes of Health and the National Science Foundation, I tell students that other government agencies offer research grants, such as the U.S. Department of Agriculture and the Department of Defense.

Outside of government agencies, I point out the many nonprofit organizations and foundations that offer research grant opportunities, such as the American Heart Association, the PhRMA Foundation, or the Bill & Melinda Gates Foundation. The list of opportunities will differ depending on the type of research conducted by the laboratory. Because federal funding is so competitive, researchers need to know about these additional options.

More germane to a graduate student, I also review training grants and travel grants for which they may be eligible. I encourage students to sign up for email notifications from relevant agencies so they can keep a finger on the pulse of research trends and stay vigilant for predoctoral fellowship opportunities.

Week 4. The importance of scientific conferences.

In this lesson, I educate students about the types of scientific meetings they can attend and why it is important to do so. Many students never have been to a conference, so I like to start with the basics, including a discussion on the sizes and scopes of various scientific meetings, their links to scientific societies (if applicable), and how attendees often can present a talk or poster. I emphasize that conferences are critical for staying apprised of recent developments in the field, networking with colleagues and gaining valuable presentation skills.

To help students learn how to prepare compelling abstracts for conferences, I refer them to "How to write a killer abstract in 10 sentences."

Week 5. Science and social media.

Most students already are engaged with social media, but they may not be using it as a research or career development tool. I show them that Twitter is used by journals, funding agencies, science news sites and their fellow scientists. Twitter can help students make connections, establish research collaborations, follow conference proceedings or seek help with experiments from the scientific hivemind. It is also useful to establish a profile on more career-oriented social media sites such as LinkedIn.

Social media provide students with a way to build their scientist brand, which can help plug them into a network of like-minded researchers and catalyze their career development.

Week 6. Planning and writing grants and papers.

It is never too early to contemplate how a research project might look in grant or paper form. While science remains unpredictable, it is useful to pose a single, focused question at the outset and design studies to address the hypothesis. I advocate that graduate students avoid thesis projects that are too exploratory and risky in favor of more defined projects that will yield a publishable result regardless of the outcome.

My strategy for grant and paper planning resembles the storyboarding approach that filmmakers use. But instead of putting scenes in order to make up a movie, I put the paper's envisioned figures in order. With

graduate students, I also review the different types of journals, what impact factors mean, how peer review works and the concept behind preprints.

To further guide the discussion on grant writing, I refer to my article, "Grant-writing tips for beginners."

Week 7. Preparing a scientific talk.

I've developed a method of presenting science modeled after a mystery dinner theater. Almost any scientific question can be framed as an intriguing mystery (the appetizer), which is addressed by gathering clues generated during experiments (the main course). Finally, the dessert course should be a satisfying conclusion that reveals how the clues helped solve the mystery.

In addition to sharing this method, I encourage students to attend as many research seminars as they can, not only to expand their research horizons but also to study different speaker and presentation styles. I encourage students to take notice of what makes a seminar lousy or exceptional so they can improve their own presentations.

Week 8. Evaluation of student rotation presentation.

Students end their rotation in our laboratory by giving a short (15-20 minute) synopsis of their project. This presentation follows the model they learned in Week 7, in which students describe the nature and significance of the research question, what experiments were attempted to address the question, what the findings revealed and how the project should move forward.

The final lesson is dedicated to critiquing this presentation, reviewing the strengths as well as the areas that could use improvement.

If you run a lab, I hope the ideas in this article inspire you to enrich your students' rotation experience. And if you're a graduate student, I hope you seek lessons like these from the researchers you meet and work with. There is so much to teach and learn besides experimental design and troubleshooting.

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A textbook for nonscience majors

By Patricia Melloy

Are you committed to sharing scientific knowledge? Consider writing about it for a general audience. It's one of the most important things a scientist can do — after conducting experiments and analysis. Given the current climate of mistrust of experts, delivering your message without coming off as preachy or pedantic can be a challenge. I practiced this balancing act while writing "Viruses and Society," a textbook for nonscience majors.

I chose to start, as many of us do when planning our courses, with learning outcomes. What do citizens need to know about viruses to make everyday decisions for themselves, their families and their community? Of course, a textbook cannot cover every virus, but which ones are the most historically or culturally relevant to college students? What are the most important points every young voter should know when evaluating a new public health policy?

I put a priority on practical knowledge. If students saw a topic as relevant to their lives, my textbook might engage them, even if they had signed up for the course merely to check the box on their science requirement. I also hoped the book would contribute to information literacy, so I included many scientific sources on viruses and related topics with each chapter.

Then, I moved on to issues of clarity and accessibility. What level did I want to use for the scientific vocabulary and explanations? My reference point was a nonscience majors' textbook that I had used in my own classroom for several years, "Biology Today: An Issues Approach" by Eli Minkoff and Pamela Baker. Where possible, I presented viruses as a story with characters and actions, so the reader could envision some of the real people behind the science. (In "Writing Science in Plain English," author Anne E. Greene recommends this practice.)

The layout of the figures also mattered, as well as how they complemented the explanations in the text. When creating discussion questions at the end of each chapter, I included links to videos or web pages to give students with different attention spans and learning styles other options for reviewing the material.

After producing a draft, I asked a couple of colleagues to review the vocabulary and concept explanations to see if the level was right for a nonscience major in college. I plan to gather additional feedback for any future editions.

It also seemed worthwhile to focus on my own "aha" moments — such as when I first grasped the concept of herd immunity and how it builds a wall of protection for those in the community who cannot be vaccinated due to their age or medical status. I highlighted common misconceptions among students, such as the mistaken idea that an antibiotic works against a virus.

Writing the textbook also involved reflection on how to address controversial topics, such as vaccine hesitancy, without appearing to judge certain parties in the controversy. I tried out some of the content in a current topics course the first summer I was working on the textbook. This real-world testing helped me narrow discussion and comparison points to those that drew the most response and discussion from the students.

Finally, I decided it was important to talk about the process of making scientific discoveries. For example, I covered how long it took to discover the pathogen behind the 1918 influenza A pandemic. I explored how the path of the poliovirus through the body was hotly debated, not to mention the road to the polio vaccine itself. I wanted to present the inherent messiness of science.

I sought to show that scientific inquiry involves conducting detective work without all the facts or the technology to interpret the facts that are known. Researchers cannot predict how a biological system will change over time. Scientific understanding is always a work in progress, and as new technologies emerge, what we know about viruses is revised. There is nothing wrong with that. From the early days of the COVID-19 pandemic, we have been updating our knowledge of SARS-CoV-2. This process would continue long after the textbook was published.

I found it so rewarding to see the textbook completed. From beginning to end, my editors let me make the project my own. I look forward to using "Viruses and Society" in the classroom and revising, based on feedback from its users — students and colleagues in the field.

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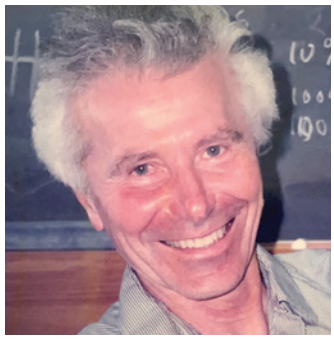
A tale of two postdocs

By Reinhart Reithmeier

A postdoctoral fellowship is a crucial transitional step on the road to an independent research position, especially a faculty appointment. A key element to consider is the lab culture. Is it one where you can develop your own project, or are you part of a well-oiled research machine? It turned out that I benefitted from both experiences.

After I graduated with my Ph.D. in biochemistry from the University of British Columbia in 1978, I was lucky enough to win a two-year Medical Research Council of Canada postdoctoral fellowship to join the laboratory of Guido Guidotti at Harvard University, where the focus was on studies of membrane proteins.

Guidotti was a unique scientist. He expected everyone in his lab to develop their own projects, and he didn't put his name on papers unless he did some of the bench work himself. I decided to work on the oligomeric structure of the Band 3 anion transport protein of human red blood cells, which resulted in a single-author paper in the Journal of Biological Chemistry. Guidotti also encouraged collaboration within his large group, and I benefited from joint projects with Lewis Cantley, now a professor of cell biology at the Dana Farber Cancer Institutes, and Anjana Rao, a professor at the La Jolla Institute for Immunology. We combined our complementary expertise to publish three more papers on Band 3.



Guido Guidotti expected everyone in his lab to develop their own projects.

The opportunity to develop a new project from concept to publication was certainly challenging, but with the support of a mentor like Guidotti, I developed the very skills I needed to start an independent research program. I also learned the power of teamwork and collaboration, a theme I continued to use throughout my career.

COURTESY OF REINHART REITHMEIER

The MacLennan lab at the University of Toronto circa 1979 included (back row from left) Vijay Khanna, Kaz Kurzydlowski, Marek Michalak, Elzbieta Zubrzycka-Gaarn, Denis LeBel, Stella DeLeon and Varda Shoshan; (front row from left) Kevin Campbell, David MacLennan and author Reinhart Reithmeier.

I decided to return to Canada to build my network and find a research position. I turned down a job in a government lab and chose to do a second postdoc with David MacLennan, a leading expert in proteins of the sarcoplasmic reticulum, at the University of Toronto. MacLennan had a carefully laid-out plan for his research and had assembled a team of outstanding postdocs to work on various projects. He made it very clear that all projects would remain under his direction.We decided I would work on the biosynthesis of SR proteins, which introduced me to emerging techniques like cell-free translation. MacLennan gave me the opportunity to supervise a couple of terrific technicians, which provided me with lab management skills.

After two years, MacLennan encouraged me to seek an independent faculty position. With his support, I landed a job in the biochemistry department at the University of Alberta, home to the Medical Research Council Group in Protein Structure and Function. I knew I couldn't compete with the MacLennan lab, so I proposed that we continue to collaborate, which we did for many years. For my independent project, I went back to Band 3 and received an MRC research grant on the subject of my first postdoc. I had experience with the system and papers to demonstrate my success in the field. The MRC Group proved the expertise and resources I needed to work on the structure of the Band 3 protein in my own lab.

When I work with postdocs, I encourage them to develop their own lines of inquiry so they can take their projects with them, especially if they decide to pursue an academic career path. I act more as a mentor than a supervisor and am open to helping trainees explore various career options.

If you are looking for a faculty position, make sure that you find a postdoc where you can demonstrate independence and develop not only your technical skills but your people skills, including teamwork. Before you decide on a postdoc position, research the lab projects and expertise, read the papers, interview the supervisor and reach out to current and former members of the lab to get a sense of the lab culture and if it is a good fit for you.

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Academia and industry: Demystifying the gap

By Tian Yu

As chief scientific officer of Truckee Applied Genomics, I was honored to give a talk at the Experimental Biology conference in the spring of 2022. While there, I attended several other events, including those hosted by the American Society for Biochemistry and Molecular Biology.

The conference had great attendance, but few industry participants. This disparity made me stand out and sparked interesting conversations with early career academics about the differences between industry and academia. Popular questions included "How do I make the switch?" and "Is the grass really greener on the other side?"

Many Ph.D. graduates in molecular biology and biochemistry are now considering work in industry, drawn to better working conditions and higher salaries than in academia. Also driving this trend is the fact that there are far more doctoral graduates than available academic positions. As a result, many such graduates won't receive any tenure-track or full-time offers. This was not something I acknowledged while pursuing my own doctorate. I assumed the only viable career option was conducting academic research, and it felt wrong to even discuss other options. Yet, most Ph.D.s ultimately end up working in industry, statistics show. It's important to acknowledge this reality, and I'm happy to see more young scientists are exploring these career paths.

As a professional in molecular biology or biochemistry, you may have observed a gap between academia and industry. This gap is starting to close as collaborations and joint programs become more common. Nevertheless, the two sectors do not always connect or understand each other, resulting in fewer opportunities and resources for aspiring professionals.

Debunking common myths about academia and industry may increase understanding and encourage professionals in science, technology, engineering and medicine to explore a wider range of career options.

Myths debunked: The truth about industry and academia

1. Publication and conferences. Many people think that industry scientists don't attend conferences or publish their work. In fact, many companies — big and small — encourage their scientists to keep current with the latest knowledge by doing just that. It's worth noting that in industry it's important to create materials well in advance, as legal staff must review studies before they go public. So, polish your project management skills and plan accordingly.

2. The point of no return. For a long time, I believed the myth that you can't go back to academia once you leave it for industry. However, many professionals are successfully transitioning back to academia after gaining experience in industry — or working in both areas simultaneously. The academic community increasingly embraces this movement, as it brings fresh ideas and perspectives to the field.

3. Meaningful work. Some believe that industry jobs lack meaning compared with academia and are solely focused on making money. However, this is not accurate. Certain industry jobs may seem dull and lacking direction, but people have a wide range of roles and responsibilities. With the potential for immediate impact, industry work can be just as fulfilling and purposeful as academic research. I derive more satisfaction from the work I do in industry, because I share a sense of accomplishment with my team in achieving our goals, instead of constantly working independently on projects.

4. Work environment. Many people think that industry jobs come with a less flexible work environment compared with academia. This is no longer true either. In recent years, the work environment in many industries has become more flexible and accommodating to employee needs. There is a greater emphasis on collaboration and team-building, as well as more opportunities for career growth and development.

4. Postdoctoral requirement. Many think transitioning to industry requires completing a postdoctoral position. Yet, companies often highly value doctoral graduates as scientists who can apply their knowledge immediately, even without a postdoc. In fact, some senior positions are available for people with doctorates and zero years of professional experience.

5. Job security and lab work. In the past, academia offered stability and job security through tenure. Yet, these days, it is actually easier to find job security in industry, which offers an abundance of job opportunities and greater flexibility to switch between jobs. Although tenured principal investigators may have some stability, they still have the responsibility of supporting their lab staff. This can become stressful, especially when funding is running low.

It's a misconception that in industry, you may be limited to laboratory benchwork or forced into fields like sales. Actually, industry provides numerous career opportunities beyond the lab, such as regulatory affairs, technical writing and project management.

6. Work visa options. STEM professionals who require a work visa to work in the United States often think they can only take lower-paying, postdoctoral jobs until they obtain permanent residency, which would allow them to work without a company-sponsored visa. However, the health care and biotech industries also provide opportunities for STEM professionals with work visas. These industries are growing rapidly and need skilled workers, making them more open to sponsoring visas for foreign workers. Many pharmaceutical and biotech companies in coastal biotech hubs such as San Francisco and Boston offer visa sponsorship programs for qualified candidates.

Although it may seem difficult, it is possible to find an industrial job that offers visa sponsorship. Keep in mind that the demand for workers in STEM fields changes over time, so hiring practices and policies may also change. STEM professionals looking for a work visa should consider all options and be willing to explore different industries.

Industry and academia may seem distinct, but they actually have several features in common. Both sectors place importance on strong communication skills that enable cooperation among colleagues, partners and other stakeholders. Both rely heavily on problem-solving skills and the ability to analyze data quickly and accurately. They also require professionals to think critically and understand the latest technologies or methods in their field. I believe the divide between academia and industry is not as wide as some may think. Bridging the gap simply requires an understanding of the unique needs and strengths of each.

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Space to ponder the next step

By Anna Crysler

Senior year of college is a time to begin wrapping up one adventure and start planning for the next. But what if that plan doesn't come together?

Last year, I was a senior at Albion College, finalizing a list of Ph.D. programs I might apply to and imagining the year ahead, living in a new city and starting my next academic chapter. Like many students at small, liberal arts colleges, I bustled around campus, hopping from one lab, rehearsal or club meeting to another, with barely a moment to rest. I loved the busyness of it all, especially because I knew once graduation rolled around, many of these experiences would come to an end.

As the semester progressed, I realized I couldn't narrow down what I wanted to be doing in a year, or even in five years. I felt like I had so much purpose on my campus, but I couldn't figure out what type of research I was most passionate about and wanted to study for the next six years. Everything seemed interesting — from chemical biology to bioengineering, I felt like I needed to try it all before I could find my place in the scientific world.

This need to keep every scientific door open became overwhelming. How could I choose a graduate program, let alone a lab and a principal investigator, if everyone's science was so inspiring?

The move into industry

While I was preparing my application materials for grad school and becoming increasingly overwhelmed, I learned about an industry opportunity at Adimab, LLC, specifically designed for recent bachelor's graduates interested in getting a Ph.D. Through a connection from my undergrad adviser, I was encouraged to apply to this program as a way to gain industry experience before returning to school. This two-year predoctoral research associate position at a biotech company includes working to discover and optimize antibodies for future therapeutics while also receiving career mentorship from Ph.D. scientists within the company.

I was interested in being a predoc at Adimab. I knew I needed time to decompress after my busy college life and before starting an even more demanding schedule in

grad school. The paper application was quite simple; the bulk of the process was interviews, including several hours onsite. While this was daunting, the company culture of Adimab felt overwhelmingly positive and supportive, so I left any interview feeling excited about what was next.

Once I received an offer, I started making plans to move from Michigan to New Hampshire, where I now work onsite doing lots of bench work and data analysis. This is a salaried position with competitive earnings and great benefits. A reimbursement for many of my moving expenses helped me make a smooth transition.

What does a predoc do?

My typical day at Adimab follows an 8 a.m. to 4 p.m. schedule. I'm in a discovery group where our goal is to discover antibodies from mouse, human or llama immune repertoires. Often I work on a couple of research projects simultaneously along with one main discovery effort. While my research projects are focused on antibody discovery in animals, we constantly collaborate with other teams within the company. This is a great way to learn more about cloning, sequencing, antibody purification and many other aspects of developing an antibody with favorable profiles to a given target.

My job also involves attending meetings and seminars, ranging from companywide to predoc–specific. The predoc program accepts three to five people per year, so our meetings are small and mainly discussion based. Topics include how to choose a PI, grant-writing tips and tricks, potential Ph.D. careers and panels for general grad school advice.

When I was an undergrad, I had resources to address many of these topics, but I was consumed by other responsibilities that pushed grad school preparation to the back burner. At Adimab, I've gained valuable lab experience while also having the time and space to think about what's next for me.

Taking time

During my senior year, I was unable to prioritize activities such as reaching out to grad school labs to gain insight into their research and group dynamics, exploring a wide range of careers through informational interviews with scientists outside academia and, most importantly, determining why I wanted to earn a Ph.D. Working for a couple of years in industry is allowing me to take time to consider all these things before making my next big academic decision. The mentorship I received in undergrad plus the guidance from Adimab's predoc program makes me confident that pursuing a Ph.D. is truly what I want to do next, especially since I now have a better understanding of careers that require and don't require a doctoral degree.

I needed to take extra time to consider what I value in my career and my life to feel confident about what my scientific future holds. Leaving undergrad, I felt prepared for graduate school in terms of my lab experience and coursework, but I needed time to consider more career pathways before heading into Ph.D. training. Looking back, I am glad I took the time in undergrad to focus on becoming a well-rounded student and adult.

Now I have time in my schedule to think about what's next and make connections with scientists working in careers I didn't even know existed. Networking beyond academia has opened doors in all scientific directions and has helped me imagine what lifestyles I can expect with certain careers. For example, jobs revolving around clinical health often have less flexibility in terms of working hours but can be found anywhere in the country. Alternatively, jobs in biotech might be more flexible and offer more benefits but tend to be geographically limited.

Understanding the timeline to become a tenured professor at a large university opened my eyes to the commitment someone must have to remain in academia after earning a Ph.D. This contrasts with jobs in industry that are available to scientists immediately after completing their degree. A scientist in academia has more ownership and freedom in their research, but a scientist in industry isn't required to complete a lengthy postdoc fellowship and apply for grants. Learning all the pros and cons of each career direction paints a better picture of what my life might look like after grad school.

After working in this position for almost a year, I've begun to focus my scientific interests. I'm considering Ph.D. programs in immunology or bioengineering, and I feel ready for my next academic endeavor. While I'm still narrowing down the exact programs I'm interested in, I have a real sense of where my scientific passions will lead me and what careers will fit into the lifestyle I plan to have.

Taking time in industry between undergrad and grad school can be an excellent way to ensure your priorities align with what you value both as a scientist and as a person moving into the next stage of life.

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Making the leap from academia to industry

By Teisha J. Rowland

After many years in academia, in 2021 I became a principal scientist at a small biotech startup, Umoja Biopharma. Since then, multiple postdocs and even professors have asked me: How did you make it happen?

While everyone's journey is different, I found certain strategies to be useful for making the leap — and later discovered approaches I wish I'd known about sooner. Here, I share some of these.

Why make the leap?

Primarily, I wanted to help produce a clinical product that would have a positive, meaningful impact on patients' lives. Because my mother-in-law died from breast cancer in 2014, I was particularly interested in cancer therapeutics.

Like many academics, I also felt underpaid. And industry does typically pay more: according to a life sciences salary survey in The Scientist, industry scientists make about 30% more than their academic peers. (And if this motivates you, don't feel ashamed; you're not alone. A LinkedIn hiring survey found compensation to be the most common important factor for accepting a job.)

Identifying these two reasons through honest self-reflection helped me stay motivated during the job hunt, fueled me with a genuine interest in different companies' research (what they call "pipelines"), and enabled me to give sincere, passionate, meaningful answers to job interview questions.

From CV to résumé

Like most scientists who have spent years in academia, I had become attached to my CV and did not relish reducing it to a one- or even two-page résumé, but I recognized this was necessary for leaping. It was more challenging than I thought it would be and took weeks of revisions. I reviewed examples and resources online. I was also grateful that some industry friends kindly

looked over my initial (cringe-worthy) drafts and did not hold back in their detailed feedback.

There are many ways to create a résumé; section by section, I found the following to be helpful:

- **Objective:** Self-reflection helped me create a short summary of my key skills/experience and my current position, and a sentence describing what type of position I sought, at the top of my résumé. Example: "Seeking leadership position developing innovative therapeutic products." Tip: You don't need to know where you want to be in five to 10 years; just the next step is good enough for now.

- **Experience:** I broke the wall of text for each paid professional position in my CV (including postdocs) into bullet points focusing on my most relevant skills/experiences, including quantifiable achievements. Example of one point from a position: "Developed and delivered nine iPSC culture workshops; 61 trainees, 4 in industry."

- **Education** (yup, no longer at the top!): For any research projects (in graduate student and postdoc positions), I included a brief descriptive summary.

- **Leadership Skills** (optional): Because I was looking for a managerial position, I included mentoring, project management, communication skills/presentations, collaborations managed, and team building or leadership workshops.
- **Technical Skills:** I also applied for lab positions, so I listed general and specialized techniques such as Western blot and RNA-Seq.
- **Selected Publications** (optional): I summarized my citation information and listed a few of the most relevant (or impressive) publications with a Google Scholar link to the rest.

While it's easy to reuse one résumé for every job, I found it's worth the five to 10 minutes to customize it for each. I'd reread the job posting and usually tweak my Objective, Experience and Technical Skills sections to ensure they were as relevant as possible I also included any keywords a busy hiring manager might quickly search for.

Industry wants good team players — teamwork is crucial — so I worked to highlight experiences where I'd worked in a team. Examples: led collaborations, managed/mentored others, developed communication skills. Demonstrating I have a growth mindset — I'm willing to learn, adapt and try new things — was helpful too. When preparing for an interview, I kept all this in mind as part of my story.

Embracing LinkedIn (and other networking tips)

From the few industry contacts I had at the time, I learned that industry folks heavily use LinkedIn for networking, tracking competitors and contacting candidates. I thoroughly updated my profile, using parts of my new résumé and industry profiles as models, and then worked on expanding my network. In addition to connecting with family, friends, classmates and co-authors/co-workers, I easily expanded my industry network by connecting with:

- Presenters from seminars or conferences.
- Employees of any companies I'd worked with (even just a sales rep).
- People in mutual professional organizations.
- Employees of companies I was interested in. (Tip: It's useful to follow the companies too.)
- Hiring managers for job postings.

Connections can be anywhere. (Tip: Sending a free message when you connect on LinkedIn can help.) I met my best industry biotech contact because our kids were in the same daycare classroom; we became friends, and he kindly tore apart my early résumé drafts.

Using my network was crucial for the next step in my journey.

Finding and applying for jobs

A scientist from Umoja Biopharma attended a training workshop I led, and she must have liked it; she recruited me to join Umoja in a position that was not yet posted. This is not unusual; a LinkedIn job hunting survey reported about 85% of all jobs are filled through networking, and many are never advertised. This seems particularly true in quickly expanding startups, which is why working a network (trying to get referred to the hiring manager) and even cold calling can be effective.

As with finding any job, automated searches are useful too. I set up searches and email notifications on sites such as LinkedIn, HigherEd Jobs and BioSpace, an industry-focused jobs website. I manually searched relevant job boards (including the ASBMB's) and the careers section of company websites. I later learned about statewide communities such as the Colorado Bioscience Association that post local positions; it's worth hunting for these, as they sometimes have local networking events.

I wish I'd better understood titles and leveling when I started applying for industry positions. Reading job duties and requirements helped me figure out if the position were a good match, but the differences between an associate scientist, scientist and principal scientist were enigmatic until I did some Googling. Similarly, taking time to look up unfamiliar terms (CDMO, GMP, IND, Series B funding) helped me get up to speed and more quickly speak the language.

I learned that, once I found a job I was interested in, I needed to apply right away. Many companies, especially startups, interview candidates within a few days of receiving their applications. Fortunately, applying was relatively quick; instead of the teaching philosophy, research statement and three letters of reference I was accustomed to providing in academia, it was usually only a matter of customizing my résumé and, if needed, a cover letter.

Once I'd written a few cover letters (and had experienced friends review them), they were easy to quickly customize. I again tried to differentiate myself and make it clear that I'd both be a good fit for the position and

further the company's mission (I could usually find this in the job posting or company website). Usually, submitting a résumé was the end of the story; I only landed a few interviews. But I kept trying.

Interviewing

The interview process can vary, depending on the company and its stage. Smaller, newer startups may not have a formal interview process — this happened to me, and it felt more like a meet-and-greet with team members. Established companies can feel like academia, with multiple interview rounds with different people or teams, and even a formal presentation.

I researched job interview strategies (including negotiation tips); luckily, there are many good resources out there. I found it particularly useful to read up on a company's research and recent news, so I could accurately and enthusiastically explain how my experiences would help me — and the company — succeed. I reviewed my résumé and cover letter and even made a cheat sheet of my top relevant experiences and achievements to work into the conversation. I rehearsed my story — think elevator pitch but longer — a five- to 10-minute professional background summary, including key experiences and selling points.

As with any job interview, I made a list of questions about anything I wanted clarified, such as expectations and duties, work–life balance and reporting structure. I wish I had better understood funding situations — startups may talk about enigmatic Series B funding and the like, but, to put it in concrete terms, I later found it helps to ask about what they call "funding runways," or how long they expect current funds to last.

And finally, buckle up. Startup positions go hand-in-hand with being mobile and flexible.

Teisha J. Rowland (Teisha.Rowland@colorado.edu) is a principal scientist at Umoja Biopharma and former director of the Stem Cell Research and Technology Resource Center at the University of Colorado Boulder. She is passionate about science education; Women in Science and Education, or WiSE, efforts; helping scientists become better communicators and being a good scientist mother.

From pipette to pen

Breaking into science communication as an immigrant scientist

By Arti Dumbrepatil

"What are you doing?" my mother asked me. "So, you are not a scientist anymore?" she wailed as I explained to her that I was switching careers — moving from being a bench scientist to a science writer and communicator.

This reminded me of the time I decided to do graduate studies in South Korea. I grew up in a small town in India; my immediate family's idea of higher education was training to be either an engineer or a doctor. It was a daunting task to explain to my mother that I wanted to do a Ph.D. in biochemistry.

"Scientists are these weird people who work in labs — I am not sure what they do. Do they even earn a decent living? This field is for the rich. We do not know of any scientists!" Her exact words still ringing loud in my ears after all these years.

When I considered breaking into science writing and communication as an immigrant scientist, I contemplated common hurdles such as how and where to start my new career. Little did I know that these would be the least of my concerns.

My mother had suffered a bad marriage and was harassed by her family because she did not have much money. So, she did not like the idea of me leaving the stable income of an academic job to chase my new passion. First and foremost, I had to convince my immediate family that being a science communicator is a real career. My experience might not be universal, but for many immigrants from Asia, family opinions weigh heavily in career decisions, and these families prefer careers with financial security.

I had a hard enough time explaining to them what I did in the lab. Explaining what I wanted to do as a science writer was even more arduous. The best way was to dive in headfirst, seek opportunities to communicate science, and then have my family read and/or watch what I had created.

My first science communication activity, for the University of Michigan Museum of Natural History, was to teach middle school students how enzymes work. My mother had fun viewing the recording. I think it was the first time she understood how enzymes work. Watching the science communication video, she understood that science writing and communication was just not a temporary phase but was going to be a new career.

COURTESY OF ARTI DUMBREPATIL

The author presents her first science communication activity for the University of Michigan Museum of Natural History.

Soon, my mother was not only on board with my career goals, but she also pointed out that science writing should not be just in English. Most people in the world speak other languages, she noted, and science articles do not translate well.

Visa challenges

As a scientist on a visa who was trying to break into science communication, I also had to deal with complex U.S. immigration laws. Most international students and postdoctoral researchers like me are on J1 and/or H1B visas. The rules are complex, and, as foreign citizens, we have limited options for fellowships and internships. These limited opportunities often define our early career choices. Switching careers while navigating visa rules is often risky, expensive and emotionally taxing.

Most newsrooms and media outlets, although they state a commitment to diversity in their workforces, shy away from hiring foreign workers, wary of taking on tedious visa

sponsorship paperwork. As an immigrant science writer and communicator, my chances of getting my dream job seemed largely determined by whether a potential employer was willing to sponsor a visa.

As an international postdoctoral researcher on an H1B visa at the University of Michigan, visa-based employment restrictions did not permit me to apply for science writing internships and fellowships. I was fortunate to have a supportive postdoctoral advisor who encouraged me, and the department allowed me and a few graduate students to form a science writing club. I was the only postdoc in this club.

I built a niche and network that allowed me to explore many facets of science writing. Through the writing club, I got connected to the science communication cell at the University of Michigan Museum of Natural History. I had to complete a ton of paperwork from the international office to be able to complete the museum's science communication course. And then I needed another mountain of paperwork to be able to work with school children for my first science communication project, "Enzymes in Action."

Leaping from challenge to challenge, including visa issues and limited opportunities as an international postdoc, I realized that I could learn from every available opportunity. Each science communication activity and article helped me build strong relationships with mentors and editors and gave me the confidence to grow as a science writer and communicator.

I was thrilled to land my first full-time job as a science writer, but an employer with a discriminatory attitude towards immigrants upended my hope of continuing with that job. Although the experience was harrowing, I was lucky that my work visa was not sponsored by the employer but supported by my husband's J1 visa. So, even though I had to quit the job, I was able to continue to work as a science writer in the U.S.

This experience was a setback, but it had a silver lining. The clients that I worked with at my previous positions were happy with my work and started to reach out to me directly for assignments through social media. I shared my work on LinkedIn, and many more potential clients contacted me after reading these posts. I was in uncharted waters again, figuring out how to work as a freelancer and continue to develop as a writer and communicator.

I took the plunge and started accepting freelance science writing and content development projects. It took time and persistence to develop a client base and find answers to questions such as how much to charge for a project, where and when to start planning content development meetings and how to pay my taxes. Establishing myself as a freelancer was like a roller coaster ride — filled with fun but scary.

COURTESY OF ARTI DUMBREPATIL

The author organized a science communication activity for the Association for Women in Science at the University of Michigan.

Embracing awkwardness

During my early job interviews, hiring managers almost always asked me, "As a non-native speaker, how eloquent is your English?"

However, uncomfortable this question made me, I answered it to the best of my ability, explaining that I had published peer-reviewed papers in high-impact journals, written grant applications and presented at international conferences. As an immigrant scientist turned science communicator, I initially felt like an outsider in the field, but identifying, acknowledging, and distinguishing nuances across cultural and scientific identities made me a better science translator for the community. Because I have lived these identities, my stories can reach and engage more readers.

Another common question was "As a scientist turned science writer will you be able to write science communication articles for the general public?"

I was lost as to how to answer this question. I hoped my portfolio would be enough to show my competency as a science communicator. Hiring managers may think my scientific training makes me less able to break down scientific jargon, but it is extremely advantageous because I am trained to learn and dissect scientific facts. Not only that but working at the bench trained me to do accurate research for my news articles and helped me build and explain activities to promote general scientific awareness.

Learning curve

If I were asked these two questions today, my answer would be along these lines: "As a science writer and communicator, I know communities are not homogeneous; they are filled with diverse, real faces with unique personalities and cultural backgrounds. Science stories should reflect this fact along with the cool science. At the core of all science writing and communication is the fact that science is for the people, of the people and by the people."

Immigrant science writers and communicators are more apt to tell stories that represent overlooked topics and voices and share the work of researchers from around the world. As a member of the mixed scientific cultural pot, I have the advantage of being a community liaison, which often helps me get unique insights from researchers across borders on how their cultural journey shaped their research and life. I hope that many more immigrant science writers highlight the achievements and stories of underrepresented groups in science, which will inspire the next generation to pursue science careers.

An immigrant science writer's cultural and scientific identity is not a burden — it is an inspiration. It defuses hesitation among scientists and non-scientists and helps to eliminate pseudoscience.

I like to think that every science story I write will help readers discover the relevance of science to their lives and inspire them to say, "Science has a place in my world."

Arti Dumbrepatil (artidumbre@gmail.com) is a freelance science writer and communicator. With her academic training plus expertise in science communication, she transforms complex, jargon-filled science into enjoyable and comprehensible content. Follow her on Twitter: @rtisciwrites.

Exploring careers in microscopy

By Laura McCormick

The first time I looked at cells under a fluorescent microscope, all I could say was, "Wow."

I had just graduated from college and started working as a research technician in a cell biology lab. My background was in biochemistry and biophysics. I'd never worked with living cells before.

As I watched endocytic vesicles zip around inside the cell in real time, I could hardly believe I was seeing life in motion.

I'm now a Ph.D. candidate at the University of North Carolina at Chapel Hill. My scientific interests have continued to shift and expand; however, a unifying theme — whether my model system is biochemical reconstitutions or developing neurons — has been microscopy.

Early this year, the neuroscience microscopy core, or NMC, on campus was getting a new Zeiss confocal microscope, and the core director, Michelle Itano, worked with Zeiss to craft a short internship centered on the microscope's installation. I use the NMC frequently, and Itano invited me to participate. The goal was to learn about two career paths: working at a core facility and working at a microscopy company such as Zeiss.

Behind the scenes at the core

Itano operates the NMC with two staff members, Tessa-Jonne Ropp and Christina Moore. In 2022, the core hosted 202 users from 72 labs on six microscopes. Usage this year is expected to increase with the acquisition of two new microscopes.

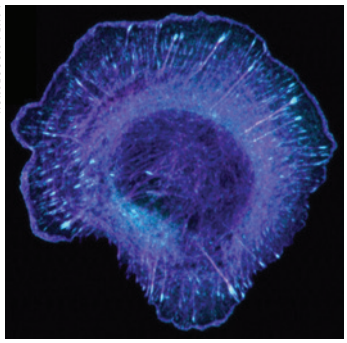
We began our internship by learning how microscopes are acquired. The NMC staff works to stay in touch with the needs of core users and determine what instruments will advance research at UNC. Typically, the core arranges microscope demonstrations by a variety of vendors to evaluate which equipment is the best fit. These demos also help the core stay up to date on new technology.

The NMC staff chose the Zeiss 980 laser scanning confocal microscope, or LSM980, to provide an updated option to an older Zeiss confocal. This latest

MICHELLE ITANO

The UNC Chapel Hill Neuroscience Microscopy Core and Zeiss teams.

LAURA MCCORMICK



The actin cytoskeleton of a mouse fibroblast cell, imaged on the Zeiss LSM980.

model has Airyscan 2 super-resolution imaging, allowing researchers to image with greater detail at faster speeds.

We also learned about the core facility's finances. The NMC is supported by the National Institutes of Health, the Chan Zuckerberg Initiative and UNC. Hourly fees paid by labs that use core microscopes help pay for maintenance contracts, salaries and supplies.

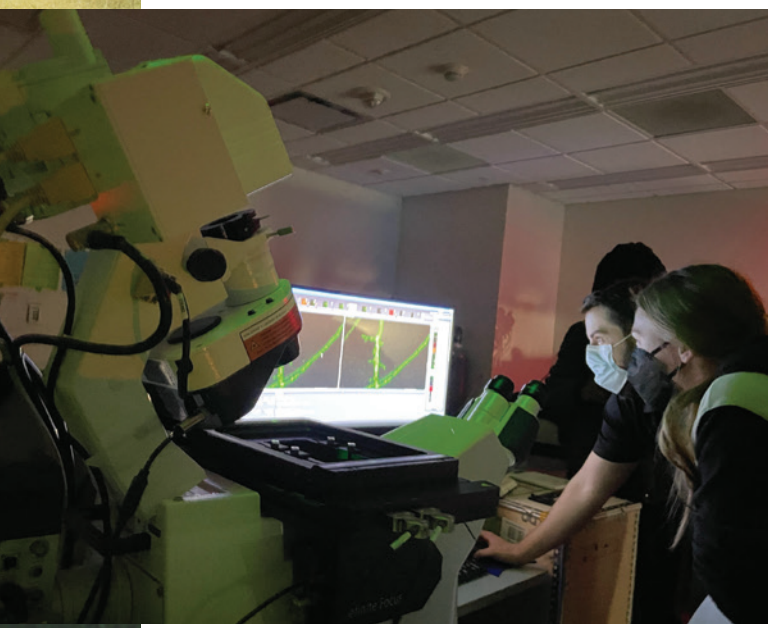
To help purchase the LSM980, Itano won a $600,000 S10 Biomedical Research Support Shared Instrumentation Grant from the National Institutes of Health. She took us through each component of her grant — emphasizing the need for this specific microscope and the research projects it will help advance.

There is no such thing as a typical day in a busy core facility, but Itano, Ropp and Moore told us they perform weekly maintenance on instruments, train new users on microscopes and image analysis software, provide advice on trouble-shooting and best practices and manage billing.

Itano also co-directs a semester-long microscopy course for UNC graduate students, which includes hands-on labs with a variety of instruments, including those in the NMC.

The NMC also engages with the larger microscopy community. As part of a multi-institutional team, Itano was the corresponding author of a 2021 paper on how to publish imaging methods to improve reproducibility in science. She is editor-in-chief of the journal BioTechniques and teaches at the Marine Biological Laboratory in Woods Hole, Massachusetts. Itano and Ropp — along with other UNC faculty and core directors — were instructors at the recent Partnering to Advance Imaging Research for Underrepresented Minority Scientists Program, or PAIR-UP, Advanced Live Cell Imaging Workshop for Black Imaging Scientists.

MICHELLE ITANO



Optimizing the imaging of cultured neurons during the LSM980 training.

Pushing science forward

While we were learning about the NMC, we also worked with the Zeiss staff to understand their role in the microscopy community.

Michael P. Nymick, the Mid-Atlantic/South regional sales manager, and Kimberly Toops, the director of sales, life sciences at Zeiss, provided a brief history of the company and an overview of its structure. They also told us about their career journeys; Nymick came to Zeiss with a business background, and Toops previously ran a microscopy core facility.

We also met our Zeiss team in North Carolina: Garrick Koermer (account manager), James Shaw (product application sales specialist) and Charles Christensen (field service engineer).

Koermer and Shaw are both in sales and customer support. While Koermer primarily focuses on widefield microscopes, Shaw's work centers on confocal microscopes. Their job responsibilities include product demos, user training and troubleshooting customer issues.

On the day the LSM980 was delivered, I shadowed Koermer and Shaw. After helping to unpack the instrument components, the pair checked in on other UNC Zeiss clients. They installed a widefield microscope in a neuroscience lab and then headed over to a microscopy core in the biology department to discuss delivery of another confocal microscope and demonstration of a lattice light-sheet microscope.

Koermer and Shaw both joined the company within the last few years. Both had extensive microscopy experience during graduate school and had worked in scientific sales at other companies. Although sales experience is not a requirement, they said Zeiss expects

them to be able to work well with others and provide excellent customer service.

Christensen works closely with customers, but his role is more mechanically focused. As a field service engineer, he was in charge of installing the confocal microscope. He also does maintenance. Need a laser line replaced? He's the person to call.

One of my favorite moments of the installation was when Christensen opened up the microscope's scan head to show us its inner workings. The scan head contains the components needed to form an image — including the pinhole, filters and mirrors. I'm familiar with illustrations of these pathways, but it was amazing to see all the tiny parts and gears that can transform light into pictures.

Focusing on the big picture

Throughout my mini-internship, I noticed working at a core facility and a microscopy company had several common aspects.

First, it was clear that you should enjoy working with people. Employees at both the NMC and Zeiss stressed that they enjoy problem-solving and feel fulfilled helping other researchers do the best imaging science possible.

Second, both career paths offer a fast-paced and ever-changing schedule. When you're constantly working with new people and addressing new questions, each day looks different.

Careers in microscopy bring exposure to a broad range of science. Each lab and each researcher is investigating a unique scientific question in a unique way. By helping others optimize their imaging, you naturally learn more about their projects.

Finally, both careers require a team mentality. The NMC often partners with other microscopy core facilities at UNC (and neighboring universities) to share resources and provide troubleshooting advice. Likewise, I saw the dynamic within our local Zeiss team as they worked together to install the LSM980. And of course, the NMC and Zeiss cooperate to ensure the microscopes at the core are used to their highest potential.

Interested in learning more about careers at Zeiss? The company offers a formal, paid summer internship for graduate students. Check the careers section of zeiss.com.

Laura McCormick (lemccorm@email.unc.edu) is a graduate student in cell biology and physiology at the University of North Carolina at Chapel Hill. Follow her on Twitter: @le_mccorm.

What's a scientist outside academia?

By Elizabeth Stivison

Any career move can be emotionally fraught, and getting your first job outside of a university is no different. In fact, academia's structure puts departing on the extreme end of the "requires soul searching" spectrum.

The academic science pipeline often seems to operate on the premise that people work in labs in order to become professors. Most of us are considered trainees well into our 30s, for years after we've completed a Ph.D. To get into a graduate program, to get a postdoc position, to get fellowships — whenever we're asked the question "What are your career goals?" it feels like our answer must be an emphatic "To be a professor." But, there are many other uses for Ph.D.s.

So, who are you if you leave academia? Are you still a scientist?

If you leave the bench, will you feel like you're leaving the cutting edge of research?

Does your training go to waste? Will you be letting your mentors and teachers down? What about the funding agencies that invested in you — or the taxpayers?

Will people think you just couldn't make it in academia?

I cannot answer these questions myself. I am a postdoc in an academic lab. But, as a careers columnist for ASBMB Today, I've spoken to a lot of people in a lot of jobs. And I read a lot of tweets about this topic, which we all know makes me an official expert.

So, are you still a scientist if you leave academia?

I found four ways to answer this question:

1. Yes. Scientist positions exist outside of academia.

You can be a bench scientist in industry or government or at a nonprofit. They have plenty of jobs with the title of "scientist." Although, if you're thinking about leaving academia, you might be thinking about giving up bench work — and wondering how your identity holds up in that case.

2. Yes. You can hold whatever identity is important to you.

Society allows us to keep whatever identity we've created in our lives. Think of people in other fields. Sally Ride, for example, only flew into space twice, for a few days total. She worked in STEM education for most of her life but was considered an astronaut until she died. Your past will always inform your future self.

3. Yes. Science is more than working at the bench.

Now that the two simpler answers are out of the way, let's talk about how being a scientist informs your way of operating in and seeing the world. Being a scientist is more than pipetting.

Late last year, I asked folks on Twitter, "How (if at all) do you think about your 'scientist' identity outside academia?" I got very thoughtful answers, some of which I'm including here.

One thing that came up over and over again is that, on a skills level, your science training stays with you. You don't forget all the things you learned in labs when you walk out the door. And taking those skills with you keeps you broadly defined as a scientist.

Shoba Subramanian, a former faculty member who now works at a company, wrote on Twitter: "Scientist identity is a broad one with many transferable skills: Problem solver. Data Analyzer. Communicator. Fast Learner. Critical Thinker." She also points out that being driven by curiosity and moving on from failure are skills scientists have and can keep with them.

Aviv Sharon, a STEM education researcher, wrote that he considers science to be three things: a process (the scientific method or ways of reasoning); a product (the data or body of knowledge); and an institution (including but not limited to academia). You can think about how you are still participating in any of these aspects.

Dave Tang, a design researcher, wrote: "Being a scientist includes several skills that transfer outside (academia), but for me identifying as a scientist is about using those skills to generate new knowledge and communicate it to others

for the benefit of society. Still try to do that, so I still identify as a scientist."

Holly Prescott has a humanities Ph.D. and is a careers adviser. In a March 2021 article on PostGradual: The PhD Careers Blog, she points out that people "can feel dissatisfied and underused if we're not able to bring this rigorous, 'intellectually curious' approach to our post-Ph.D. work. … however there are many roles to which we can apply this approach that are by no means exclusive to academic research and teaching in our subject area."

Other people approached the question by thinking about what they wanted to keep with them from academia. Hadas Kotek, a linguist, tweeted that how she was identified was not an issue, but she wanted to stay connected with "the relevant communities." She worked this out by staying active in her field's professional society. (This is why the American Society for Biochemistry and Molecular Biology offers affiliate memberships.)

Twitter user Life After My PhD, a medical writer, tweeted, "If the work I do helps scientific advancement (in my case, drugs) then I still see myself as a scientist."

Thinking about these responses, we can say that once we get past all those years of being a trainee in academia, we can become even more of a scientist than before, finally applying all the things we've spent so long learning — just not always in the context we might have expected.

4. It doesn't matter. Identity is not just your work.

Life is multifaceted. To prevent work-related identity crises, build an identity in which work is only one aspect.

Ben, an astrophysicist and software engineer, wrote on Twitter: "I like the idea of expanding one's identity beyond that of being a scientist. We all usually have passions and interests in multiple things. Some of these interests we make a career out of, and sometimes our career changes into one that is based on another interest."

Data analyst Tobias Brevik agreed: "I try to keep my identity having to do with work to a minimum. But I'm still doing science outside of academia, and I'm doing the bits I enjoy most (coding and doing stats) much more often."

Vikki Burns, who hosts the PhD Life Coach podcast, wrote that "having a life outside of academia during your career can make things more fun AND make it easier if you want to transition away at any stage. So important that 'academic' isn't your only identity/source of validation."

Maybe you still identify as a scientist because you continue to work at the bench or because you use problem-solving skills you developed during your time as a bench scientist. Or maybe you want to leave the scientist identity behind. Either way, you're still you — with all your skills and knowledge, and life experiences to help and guide you in your career journey.

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

Ten years in the making

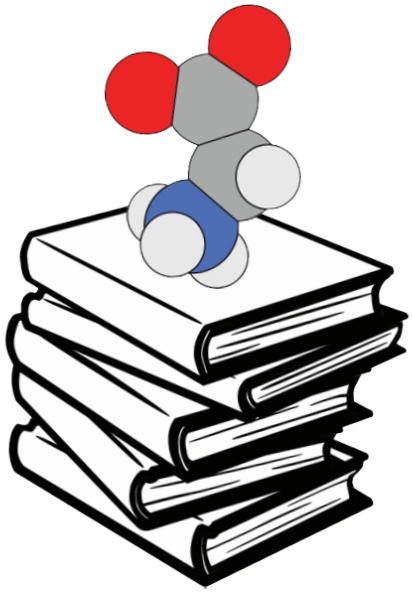
How a community of teachers developed a visual literacy repository

By Kristen "KP" Procko & Pamela S. Mertz

In life science classrooms such as biochemistry, instructors show figures of cells, organelles and macromolecules in various ways; for example, the outline of a protein's surface may be used to illustrate its binding to another molecule, then the representation of that same protein changed to a cartoon to highlight its secondary structure. However, instructors don't always tell students how to interpret an image or explain why a scientist might choose to represent a biological structure one way over another. Whether a student sees what their instructor expects them to see in an image depends on the student's visual literacy — their ability to extract meaning from details that are both explicitly and implicitly displayed.

At the 2013 American Society for Biochemistry and Molecular Biology Education Meeting in Seattle, a group of BMB educators began discussing the challenges students face when interpreting these biological images. The group agreed that visual literacy requires more deliberate instruction than we often provide, and they recognized that this ability is so foundational in the molecular life sciences that a learner can't effectively progress in the field without developing it; it is what Jenny Loertscher and the other authors of a 2017 paper in CBE—Life Sciences Education termed a "threshold concept."

That meeting is where BioMolViz originated.



After that beginning, Paul Craig of the Rochester Institute of Technology started hosting online meetings to continue these conversations, long before Zoom was a mainstay in our lives. The team, scattered across the U.S., worked to create tools that would help other instructors address visual literacy in their own classrooms.

In 2017, Craig and others published a scaffold of learning objectives, the BioMolViz Framework. Then, the group sought funding to host workshops that would teach educators how to use the framework to write questions to evaluate students' visual literacy. We intended to make the assessment questions broadly available for any interested BMB instructor to use in their classroom, and we wanted a central place to house these assessments. Importantly, an educator new to teaching and evaluating visual literacy should be able to easily identify learning objectives that fit their instruction and search for associated questions.

A decade after that first meeting, BioMolViz launched our library of instructor tools. To mark that accomplishment, we offer our individual perspectives — and some reflections from other members of the community.

KP Procko: A reluctant director

I joined BioMolViz at an exciting time. Dan Dries of Juniata College had taken over from Craig and secured the team's first round of funding in 2017. With one year to prove ourselves, BioMolViz planned to hold workshops where faculty could write and revise assessments to evaluate students' visual literacy skills. We figured that eventually we'd have so many ideas, we'd need to organize them in a searchable repository.

In 2018, I reluctantly agreed to take over the directorship of BioMolViz. As a non–tenure-track faculty member, I was at an uncertain time in my career. Plus, a big part of the role would be overseeing the construction of our repository. How would 10 educators with almost no experience in database design build this thing?

According to our most tech-savvy member, Alberto Roca of DiverseScholar, we needed project management software and a database

structure; the repository should be a place to accept, review, revise and publish assessments. However, we reached the end of our first round of funding with an architecture of Google Drive folders and subfolders containing great assessment questions, each classified by a specific labeling system, but with no repository to house them.

This is when I became director.

Our meetings were filled with discussions about how we should — and should not — move the repository forward. It seemed we needed to make some dramatic changes to our process, but deliberations about that process had stopped us in our tracks. It occurred to me that perhaps this team wasn't comfortable jumping into new project management software when we were just figuring out how to craft assessments. Heck, it had taken months to convince everyone to make the switch from massive email chains to streamlined communication in Slack.

At that moment, I decided to do something … anything. We don't know which software to use, so let's start without it. How could we comfortably make progress? Our temporary solution was a giant, inelegant Excel spreadsheet linking to Google folders — it wasn't pretty, but it let us move forward.

Early in 2020, we secured a four-year grant and found an external evaluator, Shelly Engelman of Custom EduEval LLC, who helped us develop a plan to ensure the assessments were high quality. Separate teams of faculty would write and revise assessments in workshops. An expert panel that was removed from the project would then review the questions, and finally, they'd be tested by students in classrooms. Data from each step of the process would be used to improve or rethink the assessment. Riding high on the promise of interactive, in-person meetings, we began to seek workshop hosts. And then the pandemic hit.

We were already versed in online meetings, so online workshops were a straightforward pivot. With a surplus of travel funds lying around, we invited participants to work with us remotely after the workshops for additional stipends.

This was the secret sauce. A one-time workshop was a great start, but weekly working groups really put the wheels in motion. The assessments moved forward at a pace we'd never experienced. The workflow was haphazard, but no one seemed to mind. The weekly groups gave us time to develop our process, create detailed documentation and, maybe most importantly, build a community to discuss teaching, commiserate about the challenges we were experiencing and become friends.

That's how the first group of BioMolViz Fellows emerged — a team of educators working together to build this repository.

Pamela Mertz: From sabbatical workshop to leadership

I attended the first BioMolViz brainstorming meeting in Seattle — an informal circle of engaged educators talking excitedly about how to teach biomolecular visualization. I was always interested, and I checked out their workshops at ASBMB meetings, but I couldn't commit to more involvement.

That changed in December 2020 when I participated in an online workshop. I was on sabbatical and — as many things pandemic related — my sabbatical was not what I had anticipated; travel and social interactions were limited, and my son did school at home for much of the year.

I felt isolated, and I found a community in BioMolViz through a regular working group. Led by BioMolViz Steering Committee member Margaret Franzen, our team included Roderico Acevedo of Westfield State University, Charmita Burch of Georgia Gwinnett College and me. Franzen was a whiz at manipulating a giant spreadsheet of assessments with the constant goal of better organization while we added more items. We met almost weekly and worked on revising and writing new assessments. We had fun and we valued the project. As a bonus, the leaders of BioMolViz recognized our dedication by naming us fellows.

After I joined the steering committee in 2022, I got a bird's eye view of the project. People talked about platforms I'd never heard of. Only then did I realize what the group was trying to do — build this searchable, organized public database to house all of these assessments we had been working on.

My husband, Johnathan Steere, is an application architect with database design experience. During a BioMolViz steering committee meeting, I thought to myself, could he help?

I connected KP Procko and Josh Beckman of the University of Texas at Austin, project PI, with Johnathan in May 2022. He suggested we could save money on the development process by creating mock-ups for the application. Soon after that, KP was reporting on progress with developers.

At a steering committee meeting in Austin this past January, we actually worked in the repository, sending and receiving feedback from the developer as he made updates.

About a month later, KP sent out a simple newsletter to the community, announcing the launch of the BioMolViz Library. It included the

logo our working group had created the week before, and it said so much: The repository was open for business.

A keystone for community and professional development

We asked others involved in BioMolViz to tell us what the work has meant to them. Members of the working group that began in early 2021 said they shared a commitment to the project and a need for community, and these motivations continued as more people came on board.

"The friends that I made during the workshop (pandemic-times) helped me improve my pedagogy and keep my spirits high," Acevedo said. "Having friends to bounce ideas and strategies made teaching easier and more enjoyable."

Kristin Fox of Union College commented, "I have been using molecular visualization in my classes for years and was excited to have other people to talk with and to be able to spend more time thinking about the best way to teach and assess molecular visualization."

Shane Austin of the University of the West Indies said, "It was the first time I felt part of a community of persons interested in visualization and visualization education."

These individuals and most participants in our workshops are faculty, but others have become engaged in our project. Harry T. Rahn 5th, a graduate student at the University of Michigan–Dearborn, was inspired by his love for the intersection of science, art and learning. "I appreciated the valuable feedback I may be able to provide to give a student perspective," he said.

Many members of the group also noted that working on the library improved their teaching. "I learned better ways to assess student understanding beyond rote memorization," Burch said. "Helping develop the repository has given me more confidence in writing my own exams."

Acevedo noted, "My exam questions that have images now include a CPK color key, more concise questions that apply directly to the image, and are images that are color-blind friendly. All of these things I learned from BioMolViz."

Working group members also commented on the value of a public assessment repository. Austin said, "Resources for teaching visualization are available, and instructors can easily get illustrations and videos from textbooks for lectures. What remained missing to me was really good and accurate assessments that used visualization or tested students' skills in visualization. Contributing to this repository seems like it could make a big change in that way."

Burch said, "The ability to search for a variety of questions beyond what is provided with textbooks is invaluable."

Fox noted, "While molecular visualization is essential to modern biochemistry, it is not emphasized in current biochemistry textbooks. Since most people who teach biochemistry don't have enough experience with it to generate their own assessments, it is crucial to have high quality assessments available if we are going to be able to guide students."

When given a preview of the library just before it went public, Paul Craig said it exceeded the expectations he had after that Seattle meeting a decade ago.

The importance of building and maintaining the community — in addition to the library — comes through in our current working groups. We take time at the beginning of each meeting to catch up; we discuss teaching and share our triumphs and struggles.

Once our network was established, even a daunting task like building a repository became enjoyable. As Acevedo said, "I have not worked a day at BioMolViz — I have fun making the assessments with my friends every week."

Kristen "KP" Procko (kristen.procko@austin.utexas.edu) is an associate professor of instruction at the University of Texas at Austin.

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‘Don’t just stop at what you’re assigned to do’

By Martina G. Efeyini

Isaac Bell works in clinical assay development at the Jackson Laboratory, an independent, nonprofit research institute with five locations in the U.S. and Asia. Bell has worked at the Farmington, Connecticut, location for the past three years. He talked to ASBMB Today about his career path and current position. This interview has been condensed and edited.

1 Why did you go into industry right after undergrad?

I looked very briefly into grad schools, but I didn’t have the grades. I decided to go into industry, and it worked out. Now I have probably a better job than I could have gotten if I had continued on. The Jackson Labs is a research institute, so it’s about as close as you can come to an academic lab — but we have more funding.

2 How did you get started there?

I was at IsoPlexis, but they had to cut back during COVID–19. The day I got laid off, I got a message on LinkedIn from a recruiter looking for people for the COVID–19 testing lab at the Jackson Laboratory. I started as a genomics technologist just running COVID–19 tests every day for 2½ months before I got promoted into clinical assay development. The pandemic both made me lose my job and helped me find a much better one.

3 What does a day in your life look like?

I work under the associate scientific director at the Jackson Laboratory for Genomic Medicine. My team makes sure all assays have smooth pipelines for both experimental workflow and data analysis.

I work mainly on the computational side. I do a lot of the data analysis.

Whenever we have a new sequencing pipeline, or anything like that, I make sure we have all the correct controls and that the experimental assay conditions are correct.

We also develop PCR-based approaches.

Isaac Bell

CURRENT POSITION
Bioinformatics analyst I, Clinical Laboratory Improvement Amendments Program, Research and Development, the Jackson Laboratory

EDUCATION
Bachelor’s in chemistry from the University of San Diego

FIRST JOB OUTSIDE OF ACADEMIA
Lab technician at IsoPlexis

FAVORITE MOLECULE OR PROTEIN
“Calcineurin homologous protein B isoform-2. That’s because that’s the paper I first got published on as a first author from work that I did in undergrad.”

4 What skills do you need at work that you didn’t learn in college?

It is very important to have lab and research experience. I think that’s the main reason I got promoted. I was up against candidates who had Ph.D.s and master’s degrees. But because of my experience in the COVID–19 lab, they knew that I had strong problem-solving skills and was able to work through complex protocols very efficiently.

I was a chemistry major — not even a biochemistry major. I learned all of the genomics in my current role. Now I would consider myself an expert on it.

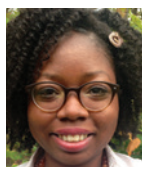
There’s a lot of opportunities to learn while you’re in industry. You don’t necessarily need to go in with every single skill.

5 What advice do you have for students interested in pursuing a similar career?

Take as many lab courses and get as much time in a physical lab, like internships, as possible.

Also, when I was a genomics tech, I built good relationships with managers to learn the next steps in the process. So don’t just stop at what you're assigned to do, but have curiosity toward the next steps and the entire pipeline. That definitely helps show employers that you’re committed and helps with career advancement.

Martina G. Efeyini (mefeyini@gmail.com) is a science communicator and STEM education advocate, and a careers columnist for ASBMB Today. Follow her on Twitter: @mefeyini.



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