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ASBMB TODAY

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










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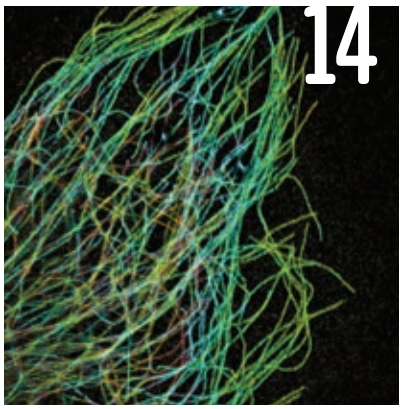

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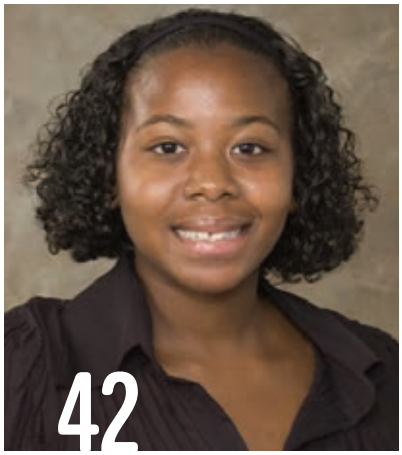

PERSPECTIVES

ON THE COVER: PICTURED ARE ASBMB MEMBERS SUSAN WALLACE, DANIEL BASTARDO BLANCO, SUSAN BARSERGA, BERONDA MONTGOMERY, HOSSEIN BAHARVAND, GUSTAVO SILVA, KELLY CHACON, JORGE TORRES, SUZANNE BARBOUR, CRAIG CAMERON, MICHAEL ROSEN, STELLA MA AND IVET BAHAR.

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We've got a new way of meeting

By Comfort Dorn

I have what might be called an armchair interest in logistics; I don't want to have to plan anything huge or intricate, but I'd like to know how it's done. That's why, when I first got to the American Society for Biochemistry and Molecular Biology back in May 2017, I was curious about the annual meeting. Everyone in the office was still buzzing about that year's meeting in Chicago, and I wanted to know how all the pieces came together for the society's big event.

My boss humored me and let me interview Joan Geiling, who at that point had been the society's meetings manager for 14 years, for a behind-the-scenes article about how the annual meeting came together and how it sometimes almost didn't. Geiling — along with the meetings committee, members of the ASBMB staff and at least one indispensable events company employee — handled challenges that ranged from a volcano eruption canceling air travel to a comic book character wandering into a banquet.

Fast forward three years, and the world has changed a bit. In 2020, no one with an ounce of concern for public health would schedule an enormous meeting in a convention center. And the ASBMB just happens to have a new meetings manager who knows how to juggle everything in a new way — virtually. Roya Jaseb was weighing the benefits of online events long before a new coronavirus was transmitted to a human being last winter in a Hunan marketplace. Roya's forethought and preparation are paying off now as the society plans for its first online annual meeting and schedules multiple smaller meetings, all using a new virtual platform.

ASBMB Today staff writer John Arnst interviewed Roya and others to explain the society's new way of hosting meetings. Read all about it here on page 26 and find out how you can participate. Just imagine: If you want to plan or attend a meeting now, you don't need to book a flight or pack a bag. You can just log onto your laptop and be part of sharing all the best science the ASBMB community has to offer.

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

Munson named co-investigator of ASCB MOSAIC program

Mary Munson, professor of biochemistry and molecular pharmacology at the University of Massachusetts Medical School, is a co-investigator of the American Society for Cell Biology's Maximizing Opportunities for Scientific and Academic Independent Careers program, which will deliver skills-development workshops, training for mentors, and other initiatives to enhance diversity in the academic biomedical workforce.

MUNSON

The ASCB MOSAIC program is supported by a $1.3 million, five-year grant from the National Institute for General Medical Science. The program will be led by two co-PIs at ASCB: CEO Erika Shugart, and Ashanti Edwards, director of professional development. Michael Boyce of Duke University School of Medicine will be a co-investigator with Munson.

Munson is chair of the ASCB Women in Cell Biology Committee and an editorial board member for the American Society for Biochemistry and Molecular Biology's Journal of Biological Chemistry.

ASCB is one of three organizations selected by the NIGMS to run MOSAIC programming. The other two organizations are the Association of American Medical Colleges and the ASBMB.

Beuning, Stubbe named ACS Fellows

The American Chemical Society has announced its 2020 class of fellows. ACS fellows are recognized for outstanding achievements and contributions in science and for their service to the scientific community. This year's inductees include two ASBMB members.

Penny J. Beuning, a professor at Northeastern University and recently named chair of that university's department of chemistry and chemical biology, studies the structure–function relationships and catalytic mechanisms of enzymes involved in DNA metabolism and cells' tolerance for DNA damage. Her lab is particularly interested in a family of E. coli DNA polymerases that can synthesize new DNA strands even if there is damage in the template DNA, called the Y family. They also work on prediction of protein functions, and protein engineering, in a longtime collaboration with Northeastern colleague Mary Jo Ondrechen. Beuning is highly involved in undergraduate and graduate education and faculty professional development, and serves on the ACS Committee on Economic and Professional Affairs.

BEUNING

STUBBE

JoAnne Stubbe, Novartis professor of chemistry and biology, emerita, at the Massachusetts Institute of Technology, studies enzymatic reaction mechanisms including ribonucleotide reductases that catalyze the conversion of RNA building blocks to DNA building blocks in all organisms. Her studies have established the importance of controlled radical reactions in biology. Stubbe and her many collaborators uncovered how gemcitabine, a clinically used cancer therapeutic, stoichiometrically inhibits these enzymes and how the natural-product therapeutic bleomycin cleaves DNA via radical mediated mechanisms. Among her many honors, Stubbe was awarded the National Medal of Science in 2009, and earlier this year she received the Priestly Medal, the highest honor that the ACS awards.

Okáľová receives UGA scholarship

Jennifer Okáľová, an undergraduate at the University of Georgia, was recently awarded the UGA College of Pharmacy's Richard A. Bryan Scholarship for High Academic Achievement and Excellence in Research.

OKÁĽOVÁ

Okáľová, who is set to graduate in spring 2021 with a degree in pharmaceutical sciences, has worked for more than two years in Neil Grimsey's lab alongside a graduate student, Jeremy Burton, to develop a fluorescence biosensor platform to assess the spatiotemporal activation of atypical p38 signaling in living cells.

The $1,000 Bryan Scholarship is awarded annually to an undergraduate researcher in the pharmaceutical sciences program. Okáľová also received UGA's Center for Undergraduate Research Opportunites, or CURO,

Summer Research Fellowship. She won an Experimental Biology 2020 Travel Award to travel to San Diego, but the in-person conference was canceled due to the COVID-19 outbreak.

"Research is my passion," Okáľová said. "Being both a student and research assistant has shown me that science is more than a career path, it is a lifestyle. I am excited to be applying to graduate programs to start a Ph.D. program in fall 2021 so I can continue my journey."

Glycobiology society honors Costello, Moremen and Varki

The Society for Glycobiology has announced the winners of its 2020 awards. Among them are American Society for Biochemistry and Molecular Biology members Catherine Costello, Kelley Moremen and Ajit Varki. All honorees will accept their awards during the society's virtual annual meeting in November.

COSTELLO

Catherine Costello, a distinguished professor at the Boston University School of Medicine, will deliver the Molecular and Cellular Proteomics lecture. Costello, a mass spectrometry expert, pioneered the use of tandem mass spectrometry to characterize carbohydrate structures, allowing researchers to determine the size, sequence and branching structures of glycoconjugate molecules. She has used the approach to address many important questions in biology and medicine. She is a fellow of the American Association for the Advancement of Science and the American Chemical Society and a past president of the American Society for Mass Spectrometry, the International Mass Spectrometry Foundation and the Human Proteome Organization.

Kelley Moremen, a distinguished research professor at the University of Georgia's Complex Carbohydrate Research Center, receives the Karl Meyer Lectureship Award. Moremen studies mammalian glycoprotein synthesis, glycosidase and glycosyltransferase activities, along with the activity of endoplasmic reticulum and Golgi quality control pathways for complex carbohydrates. He was one of an international team of 24 scientists who collaborated to establish unique identifiers for each individual glycan structure to reduce duplication of effort in the field, and operates a glycoenzyme expression library that provides plasmids, baculovirus and other expression tools to fellow researchers.

MOREMEN

Ajit Varki, a physician–scientist and distinguished professor at the University of California, San Diego, receives the Rosalind Kornfeld Award for Lifetime Achievement in Glycobiology. Varki, who trained in Stuart Kornfeld's lab in the 1970s, recalls advice and mentoring that Rosalind offered from her own lab next door as crucial to his later success. He studies biological roles of sialic acids in evolution, health and disease, with an emphasis on human origins. He is the editor of the textbook Essentials of Glycobiology, served as editor-in-chief of the Journal of Clinical Investigation and as president of the American Society of Clinical Investigation and the Society for Glycobiology, and is a member of the National Academy of Medicine and the American Academy of Arts and Sciences.

VARKI

National Academy of Inventors inducts Batzer

Mark Batzer, a distinguished professor in the department of biological sciences at Louisiana State University in Baton Rouge, has been named a senior member of the National Academy of Inventors.

Batzer's work has focused on the role of mobile DNA elements in the genome, such as the retrotransposons Alu elements and short interspersed nuclear elements, or SINEs. Recently he has focused on using these elements to conduct population genetics and phylogenic analyses in various primates, including humans, baboons, monkeys and marmosets.

BATZER

Batzer holds six patents for polymerase chain reaction techniques for forensic analysis, most based on inference from repeating genome elements, to determine the species, gender and geographic origin of DNA samples.

The National Academy of Inventors, founded in 2010, is a nonprofit modeled on (but not affiliated with) the National Academies of Sciences, Engineering and Medicine. Senior members are selected by nomination from member universities for consideration by the NAI advisory council.

Aebersold receives Swiss prize

Ruedi Aebersold, professor emeritus of molecular systems biology at ETH Zurich and the University of Zurich, is this year's recipient of the

Garcia, Rodland win HUPO awards

Benjamin Garcia, a professor at the University of Pennsylvania Perelman School of Medicine, and **Karin Rodland**, a chief scientist at the U.S. Department of Energy's Pacific Northwest National Laboratory, have been named recipients of 2020 awards from the Human Proteome Organization.

Garcia received HUPO's Discovery in Proteomic Sciences award recognizing researchers for a single discovery in the field. He is presidential professor of biochemistry and biophysics, director of quantitative proteomics and John McCrea Dickson M.D. presidential professor in the Epigenetics Institute at U Penn. The award honors Garcia's work developing MS-based experimental and computational platforms for characterization of histone PTMs, including improved quantification and high-throughput analyses of histone PTMs, new methods for high-throughput quantitative tracking of thousands of combinatorial histone codes in a single experiment, and novel approaches to monitor the progression and dynamics of distinct histone modifications during their cellular lifespan and in response to external perturbation.

GARCIA

Rodland received HUPO's Distinguished Achievement in Proteomic Sciences Award. She studies mechanisms of signal transduction in normal cells and how these mechanisms are altered in cancer cells. She provides biological focus to the proteomics group at PNNL, insuring that the technologies are applied to the most significant biomedical problems and that issues of experimental design and data analysis reflect the needs of the biomedical community. She was among the first to demonstrate that variations in extracellular calcium concentration could be sensed by a variety of epithelial and mesenchymal cells through activation of the G-protein coupled calcium-sensing receptor, resulting in activation of the Ras-Raf-MEK-ERK signaling cascade. She was named a fellow of the American Association for the Advancement of Science in 2011.

RODLAND

Garcia shares his HUPO award with Ben Collins of Queen's University Belfast, School of Biological Sciences, Ireland. Rodland shares the award with Fuchu He, a member of the group that founded HUPO in 2001 and founder of the organization's Chinese arm. The awards were presented online at HUPO Connect 2020 in October.

Swiss Science Prize Marcel Benoist.

A pioneer in the field of quantitative proteomics, Aebersold is a systems biologist who developed an early isotopic labeling technique to allow researchers to determine quantitatively the concentration of proteins in two or more samples. He led some of the first studies to integrate proteomics and transcriptomics, giving scientists a fuller picture of the gaps between RNA and protein level and opening the way for studies of how these discrepancies arise. More recently, his lab has developed targeted proteomics methods such as selected reaction monitoring and data-independent acquisition, combining techniques into new types of multiomics, and using clinical samples for proteomic diagnoses.

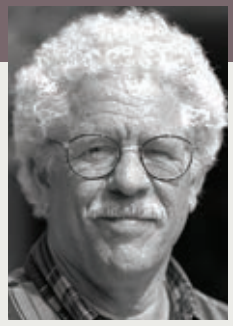
AEBERSOLD

Aebersold obtained his doctorate in cell biology in Basel in 1983. He held faculty positions at the University of British Columbia and at the University of Washington for years, co-founding Seattle's Institute for Systems Biology in 2000 with Leroy Hood and Alan Aderem, before returning to Switzerland in 2004 as a professor at ETH Zurich and the University of Zurich. He was an early editor of the journal Molecular & Cellular Proteomics. His honors include prizes from the Human Proteome Organization, the European Proteomics Association, the Swiss Chemical Society and the ASBMB.

The Marcel Benoist award, now in its centennial year, was named for a French lawyer and philanthropist who bequeathed the prize for a scholar in Switzerland studying "sciences … of particular relevance to human life." The laureate is selected by the Swiss National Science Foundation from peer nominations and receives a cash prize of 250,000 Swiss francs, or about $273,500.

IN MEMORIAM

Robert Dario Simoni



Stanford professor emeritus of biology Robert Dario Simoni died at his home in Palo Alto on September 18. He was 81.

Throughout his career, Simoni focused on the biogenesis, structure and function of cellular membranes. He retired from Stanford in 2013 after 42 years of service as a faculty member, department chair, chair of the faculty senate and acting provost in 2012. An editorial board member and associate editor at the Journal of Biological Chemistry, Simoni helped guide the JBC's transition to become the first science journal to appear online.

Simoni was born in San Jose, California in 1939. He attended San Jose State University as an undergraduate, where he majored in biology, then pursued a doctorate in biochemistry at the University of California, Davis, which he completed in 1966. He then served as a postdoctoral fellow and research associate at Johns Hopkins University, where he worked on cell membrane structure and function, before joining the faculty at Stanford in 1971.

Simoni made national news in 1994; as he assumed the position of Faculty Senate chair, he was among faculty advocating for a review of grading policies following reports that suggested grade inflation was rampant on college campuses nationwide.

In 1998, Simoni was awarded the William C. Rose Award of the American Society for Biochemistry and Molecular Biology for excellence in research and dedication to the teaching and training of scientists. He also was a recipient of a Fulbright Fellowship and a Research Career Development Award from the National Institutes of Health.

A committed teacher and mentor, Simoni was known campus-wide for his signature shock of curly white hair, and continued to teach the introductory Biology 41 class until 2019. In a Stanford Historical Society interview in 2014, he estimated that he had taught some 16,000 Stanford students over his career. He also applied his expertise in biochemistry to his interest in winemaking, an avocation inherited from his Italian family.

Simoni is survived by his wife of 59 years, Diane Simoni; children, Susan Simoni Burk, Steven Simoni and David Simoni; and five grandchildren.

Robert Wayne Wheat

Retired Duke University biochemist and microbiologist Robert "Bob" Wayne Wheat died February 19 at Peake–Brookshire Nursing Facility in Hillsborough, North Carolina. He was 93.

Wheat was born Nov. 10, 1926, in Springfield, Missouri, where he was raised. After serving for two years in the Navy, he graduated with honors from Missouri State University. In 1948, he married Johnnie Maxine Simmons, with whom he had attended high school. Wheat then earned a master's degree in chemistry from the University of New Mexico, followed by a Ph.D. in biochemistry and microbiology from Washington University in St. Louis in 1955. After completing his doctoral research at Walter Reed Research Center in Washington, D.C., Wheat became one of the first postdoctoral researchers studying metabolic diseases at the National Institutes of Health.

In 1956, Wheat took a faculty position at the department of biochemistry at Duke University, where he remained for the duration of his career. Over the next four decades, during which he explored the relationship between antibiotics and bacterial cells walls, Wheat served on the editorial staff for the Journal of Bacteriology and as a study section consultant for NIH and the National Science Foundation.

After retiring from Duke in 1992, Wheat took up painting. He also played clarinet and piano, and he sang tenor in the choir at the Pilgrim United Church of Christ, where he was a member for over 50 years. Although Wheat gradually lost his vision to macular degeneration in the last decade of his life, he was able to continue his love of reading using books on tape provided by the services of the North Carolina Library for the Blind.

Wheat was preceded in death by his wife of 69 years, his parents, and three brothers. He is survived by three children, eight grandchildren, three great-grandchildren, and one sister.

Mixing mitochondrial biology, mentoring—and doughnuts

Breann Brown works to be honest about the Black experience in academia without scaring talented students away from science

By Leia Dwyer

COURTESY OF BREANN BROWN

As Breann Brown launches her lab during a period of international momentum for the Black Lives Matter movement, she considers the career implications of her identity as a Black woman.

The phrase "the mitochondria is the powerhouse of the cell" has a jokey reputation in American education as a hallmark of middle school memorization-based learning. Breann Brown researches the structural biology of protein complexes regulating mitochondrial physiology, and she harks back to that well-worn phrase when she describes herself as, like the mitochondria, "small but mighty."

Now an assistant professor in the biochemistry department at Vanderbilt University, Brown states with calm self-assurance, "I've always known a career in academia was for me."

She does not remember a time when she wavered from her goal. She credits both a stubborn streak and the exceptional support of her family and academic mentors along her journey to a career she describes as "vocational."

Encouraged by her parents, Brown attended an engineering program in high school, which helped kick-start her interest in science. She gained research lab experience during an internship before college, and she says now that such academic experiences and a commitment by colleges and universities to giving back to their local communities through educational opportunities are important because they expose school-age children, especially girls, to careers they might want to explore.

Before landing in Nashville, Brown steadily traveled the East Coast in her academic trajectory. Born and raised in the Washington, D.C., metro area, she attended Duke University as an undergraduate in chemistry and then earned her Ph.D. in molecular pharmacology and physiology in Rebecca Page's lab at Brown University. Continuing north, she did her postdoctoral training in biology at the Massachusetts Institute of Technology with Tania Baker. Though she's excited about her new

lab at Vanderbilt, Brown said she misses one thing about the East Coast: the sports culture.

Building a research lab

For Brown, athletics and team dynamics translate from the field and court to her vision for building her research lab. She grew up playing team sports, including volleyball and softball, and she takes the same approach to learning skills in sports and research. "Mentorship is coaching," she said. "I'll show you how to do it, you'll practice, you'll get better and do it on your own."

Brown arrived at Vanderbilt in 2019, so her lab is still young and growing, as is her role in mentoring her students. She took on her first graduate student in spring 2019 and a research assistant shortly thereafter. "I'm … a first-base coach right now," she said. "I'll be more like a third-base coach as my students start getting nearer to graduating."

Brown describes the theme of her research in structural biology as "proper macromolecular protein complex assembly is critical for maintaining human health" through a variety of cellular processes. Her current focus is on mitochondrial biology and metabolism, an area so complex that "there are lots of avenues to pursue and a lot that we don't know."

Brown sees applications of her current work in mitochondrial encephalopathy, lactic acidosis and strokelike episodes, or MELAS, syndrome, a rare genetic disorder caused by mutations in the mitochondrial DNA. Her lab resides in the division of basic sciences, and she notes that Vanderbilt supports mechanistic and basic science–driven research with the understanding that strong fundamentals must precede developments in downstream applications. Her lab website states that other areas of interest include "assembly mechanisms responsible for regulation of heme biosynthesis, which is altered in several blood diseases, and maintenance of mitochondrial DNA copy number, which has direct implication in proper neuronal development."

About the Research Spotlight

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

COURTESY OF BREANN BROWN

Student Jessica Taylor and research assistant Nicolle Serrano celebrate the lab's first grant in August.

COURTESY OF BREANN BROWN

The Brown lab celebrated with a picnic when student Jessica Taylor passed her qualifying exam.

'A Black woman first'

As Brown launches her lab during a period of international momentum for the Black Lives Matter movement, she actively considers the implications of her identity in her career. "I identify as a Black woman first and foremost," she said, "and everything else comes after that."

As many institutions in the U.S. prioritize creating a space for talking about race, Brown believes it is crucial to bring diverse perspectives to these conversations in academia and to move forward with the aim of making concrete changes. She wants to communicate her experience as best she can, she said, and she has reached a point in her career where she is comfortable speaking her mind. She feels a responsibility to represent herself as a Black woman to the next generation of scientists because, she said, "Being a Black woman in science is not easy."

Brown works to stay true to herself as she develops her voice at Vanderbilt. Her aim is to balance mentoring students, teaching classes, building a lab, representing herself as a Black woman and all the other challenges of academic life in a way that doesn't turn people off science. "I never walk into lab in a power suit," she said. "I joke around, and I don't want to lose that."

Doing hands-on lab work and troubleshooting is part of what originally drew her to science, and today she goes into the lab as often as she can. She likes the freedom and flexibility she has as an academic to structure her schedule and follow her own path.

Another passion for Brown is finding ways to satisfy her sweet tooth, and she fuels her lab with Nashville's finest local bakery fare. She searches the city for new bakeries and coffee shops and flexes her chemistry muscles in the kitchen, experimenting with her own pies and cakes. In the race to satisfy her craving, she said, one sweet is leading at the bench: "Our lab is a doughnut lab."

Leia Dwyer (leia.dwyer@gmail.com) is a biotech and pharmaceutical industry professional.

Cannabis: A secret weapon against superbugs

By Arti Dumbrepatil

Although the novel coronavirus has grabbed most headlines in recent months, antimicrobial resistance remains a critical challenges for public health agencies around the world, notably the rapid spread of methicillin-resistant Staphylococcus aureus, known as MRSA. In the fight against this superbug, Eric Brown employs an unconventional research approach, developing novel drug molecules from natural products, specifically from Cannabis sativa.

"Natural products have the potential to solve the issue of drug resistance in pathogenic bacteria," Brown said. "This is a great resource that we haven't fully investigated. Researchers in academia have the tools and ability to pursue outlandish ideas, which can be steered to the development of new therapeutic agents."

As the Canada research chair in microbial chemical biology and a professor of biochemistry and biomedical sciences at McMaster University, Brown leads an interdisciplinary research team that has detected a cannabinoid called cannabigerol or CBG.

"Cannabis plants are known to produce compounds to block the invading pathogens," Brown said. "We decided to take benefit of the regulatory environment in Canada and use cannabis to tackle the emerging threat of drug resistance."

Since the 2018 legalization of marijuana in Canada, Brown's lab has been studying the antibiotic potential of cannabis. This research has some stigma associated with it, Brown said, but there is circumstantial evidence for medicinal use of the plant. The team established the antibacterial properties of CBG and found that it was highly effective at controlling MRSA in mice. Controlling MRSA is challenging as it is resistant to all known beta-lactam antibiotics. Further, the lab's study, published in the journal American Chemical Society Infectious Diseases, found that CBG targeted the cell membrane of bacteria and prevented formation of biofilms, bacterial communities that adhere to each other and surfaces, and also destroyed existing biofilms.

The team also demonstrated the potential of CBG in combination with antibiotic therapy to combat increasing instances of drug resistance in bacteria. CBG with polymyxin B inhibited the growth of Gram-negative pathogens that are resistant to multiple drugs, such as Acinetobacter baumannii, Escherichia coli, Klebsiella pneumonia and Pseudomonas aeruginosa, revealing the broad-spectrum therapeutic potential for cannabinoids. But the compound is not without drawbacks.

COURTESY OF THE BROWN LAB

From left, postdoctoral fellow Omar El-Halfawy, Eric Brown, and research associate Maya Farha are authors of the lab's study of CBG.

"CBG is great at attacking pathogenic bacteria; however, it is toxic to host cells," Brown said. "Further research and development are needed to ultimately have a safe drug for therapeutic purposes."

Although the lab has developed creative chemical-biology approaches to characterize novel antimicrobial compounds from natural products, they face additional challenges. "A major hurdle in natural product drug discovery is the chemical synthesis of these molecules," Brown said.

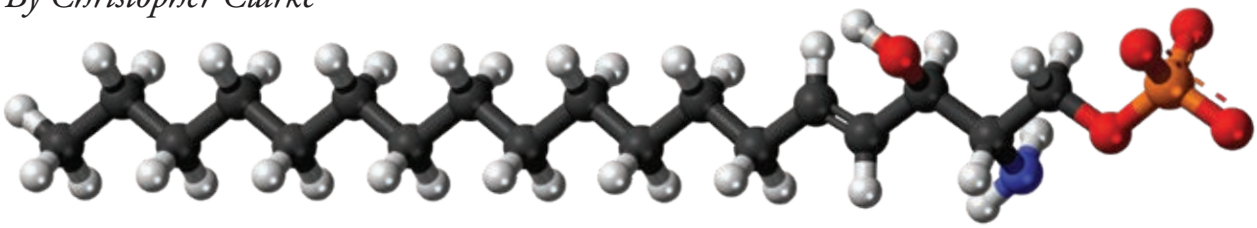
For this, they collaborated with Jakob Magolan, a McMaster associate professor of biochemistry and biomedical sciences whose research focuses on using organic synthetic chemistry in drug development. "When you take an unusual research project," Brown said, "it is great to have a team with complementary expertise, as it helps to advance the field (by) rapidly overcoming hurdles."

Brown hopes to pursue the commercialization of CBG in collaboration with partners in the pharma industry.

Arti Dumbrepatil (artidumbre@gmail.com) is a science writer covering topics ranging from nanorobots to virology. She has a Ph.D. in biochemistry and writes for Microbiome Digest and Bio Voice News. Follow her on Twitter @rtisciwrites.

Targeting sphingolipid metabolism to treat cancer

By Christopher Clarke



JYNTO/WIKIMEDIA COMMONS

In this ball-and-stick model of the sphingosine-1-phosphate molecule showing the anionic (negatively charged) form, carbon is black, hydrogen is white, oxygen is red, nitrogen is blue and phosphorus is orange.

Bioactive sphingolipids, or SLs, such as ceramide and sphingosine-1-phosphate, long have been implicated in cell death, cell survival and cell growth. This took on greater significance when researchers discovered that SL metabolism is dysregulated in many cancers, leading to the hypothesis that an altered SL balance helps drive the uncontrolled growth and evasion of cell death that are hallmarks of cancer. It also suggested the tantalizing possibility that restoring the balance of SLs could be an effective therapeutic. However, despite considerable effort, the promise of targeting SL metabolism for cancer treatment has yet to be realized fully.

To date, development of SL-based therapeutics has been pursued in two main ways: using exogenous ceramide, or Cer — the archetypal anti-growth, pro-death SL — and targeting of SL enzymes with increased expression in cancer. While there is considerable evidence that exogenous Cer effectively kills cancer cells in the laboratory, it also affects noncancerous cells. This has been circumvented in part by incorporating Cer into coated nanoliposomes, which have shown promise in preclinical models and are in early clinical trials for safety. However, exogenous Cer also upregulates its own catabolic pathways that can promote a resistance phenotype. As these pathways also can be increased in aggressive cancers, the broader utility of Cer treatments across cancers is unclear.

The best example of the SL enzyme–targeting approach involves the sphingosine kinases 1 and 2, or SK 1 and 2, which are overexpressed in many cancers and whose product, sphingosine-1-phosphate, has been implicated in many pro-tumor biologies, prompting efforts to develop potent and isoform-specific SK inhibitors. However, treatment of many cancer cells with PF-543 — a nanomolar potency SK1 inhibitor — had no effect on cancer cell viability, and studies with other SK inhibitors suggested their anti-cancer efficacy could be due to off-target effects. Thus, researchers are reexamining efforts to develop SK as a general anticancer target.

As our understanding of SL signaling increases, we need to use this knowledge to refine our approach to SL-based therapeutics. For example, there is growing evidence that the same lipid can have different functions depending on where it is generated in the cell — for example, in the endoplasmic reticulum versus the plasma membrane — or the particular species that is produced, such as C16-Cer versus C18-Cer. Thus, more targeted alterations in SL levels may be necessary to achieve the desired anti-cancer response.

Similarly, we need to look beyond a magic-bullet SL therapeutic and consider that different SL targets may be relevant for specific cancers and cancer subtypes — indeed, recent evidence suggests that this might be the case for SKs. Finally, the interconnected nature of the SL metabolism makes it difficult to separate primary driver events from bystander effects. Thus, we need to look beyond enzyme expression to define tumor-specific vulnerabilities in the SL network.

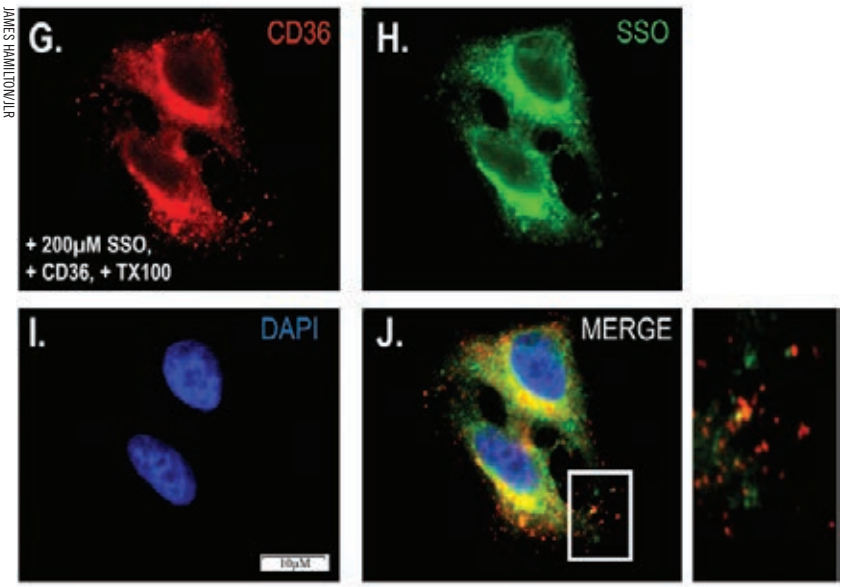
Overall, the potential for cancer therapeutics targeting SL metabolism remains high, particularly as most metabolic outputs are driven enzymatically and are thus highly druggable. We have made strides along the path to translation. We still have a long way to go, but as we gain greater appreciation of the biological roles and regulation of SL, I am confident that ultimately we will succeed.

Christopher Clarke (Christopher.Clarke@stonybrookmedicine.edu) is an assistant professor in the department of medicine and cancer center at Stony Brook University. His research focuses on how deregulation of sphingolipids promotes tumorigenesis. Follow him on Twitter @tallcat78.

Plasma membrane is no barrier to free fatty acid

By Nathalie Gerassimov

JAMES HAMILTON/JLR



These images show immunofluorescence staining of amino acids modified with the fatty acid transporter CD36 and the fatty acid transport inhibitor sulfosuccinimidyl oleate. The insert on the right suggest that SSO staining is not exclusive to CD36.

Our understanding of how long-chain fatty acids cross membranes is changing based on recent work by James Hamilton's laboratory at Boston University and others. Their research shows that unlike nutrients such as glucose or amino acids, which require a transporter, fatty acids can diffuse spontaneously through protein-free lipid bilayers and cells' plasma membranes.

A recent paper in the **Journal of Lipid Research** by Anthony Jay and colleagues reveals how molecules previously thought to inhibit fatty acid transport specifically, including sulfosuccinimidyl oleate, or SSO, fit the diffusion model.

Control of fatty acid entry into cells is difficult to visualize. Researchers often have used fatty acid metabolites that become trapped in the cell to infer transport by plasma membrane proteins. The Hamilton lab has focused on distinguishing transmembrane movement from metabolism.

The lab made a seminal discovery that transport of fatty acids across a bilayer can be followed by pH changes. They combined a fluorescent fatty acid reporter with phospholipid vesicles enclosing a pH-probe to measure absorption in real time. They showed that natural fatty acids can acquire a proton near the outer leaflet, leading to equilibrium between neutral and ionized forms. The net neutral fatty acid spontaneously diffuses across the bilayer and then releases the proton near the inner leaflet, reducing the internal pH. This energy-free diffusion has been termed the "flip-flop" mechanism.

"Our studies also showed that all fatty acids studied … exhibit rapid flip-flop, and that this mechanism is reversible," Hamilton said.

The researchers were excited by this finding but acknowledge that it does not exclude a role for proteins. Jay said, "If fatty acids can simply diffuse into cells, how could there be inhibitors of this transmembrane movement?"

The recent paper tests several proposed transport inhibitors, including the gold standard, SSO. Scientists had described SSO as a specific inhibitor of fatty acid entry into cells that acts on the fatty acid transporter CD36 without penetrating membranes. However, Hamilton's team showed that SSO crosses membranes. Immunofluorescence using novel antibodies that bind SSO-linked fatty acids suggested that SSO modifies numerous proteins on the cell surface and interior, refuting the assumption of CD36 specificity.

The research informs nutritional considerations, Hamilton said. "Metabolism, and not the plasma membrane, controls the retention of fatty acids in cells, by trapping the fatty acids. Although membrane proteins may bind fatty acids or participate in metabolism, they cannot block diffusion in the surrounding bilayer."

In fact, cells with and without CD36 exhibited the same diffusion, but CD36 increased the content of intercellular lipids.

For nutrition, Hamilton empha-

sized, "Healthy fatty acids such as omega 3 fatty acids need to enter cells readily, whereas unhealthy fatty acids, such as trans fatty acids, cannot be excluded from cells and need to be reduced in the diet."

Hamilton's lab is moving on to clinical trials using a high concentration of beneficial fatty acids to improve stroke and heart attack outcomes. Meanwhile, he recommends taking omega-3 supplements and eating more nuts.

DOI: 10.1194/jlr.RA120000648

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Another interpretation

According to Maastricht University researchers Jan Glatz and Joost Luiken, the Hamilton lab's results also could be interpreted as a step toward integration of the argument that fatty acids diffuse across the cell membrane and the view that the protein CD36 is required for fatty acid uptake. In a Letter to the Editors of the JLR, Glatz and Luiken lay out their view that CD36 may be helpful but not necessary for lipid uptake.

When Taxol met tubulin

By John Arnst

When the drug Taxol was approved by the U.S. Food and Drug Administration in 1993, it was a game changer for cancer patients. The compound, which arrests cell division by preventing the disassembly of tubulin microfibers, has been used over the past three decades to treat millions of cases of breast, lung and ovarian cancer as well as Kaposi's sarcoma.

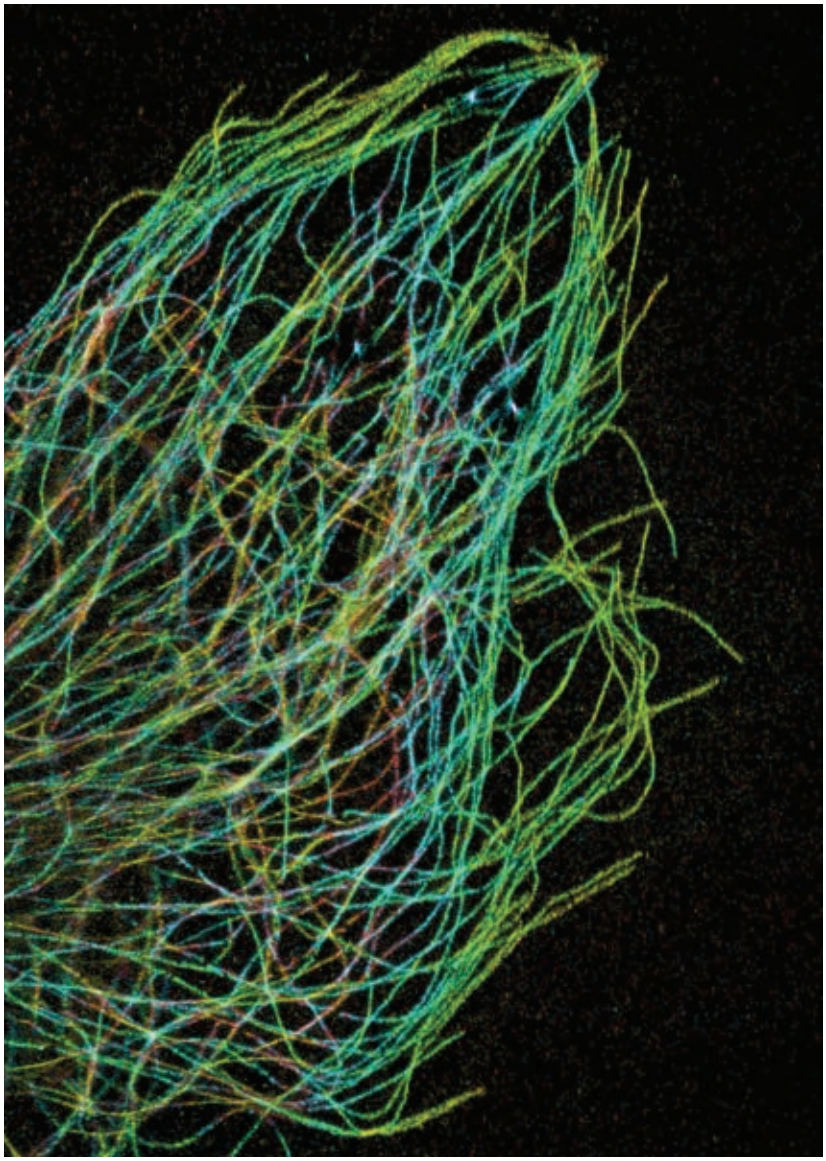
Tubulin was discovered in the late 1960s, but it was unclear at the time how the soluble protein dimer polymerized to form the long, complex structures of the cytoskeleton. As Taxol was entering clinical trials in the late 1970s, it became clear that it was a useful tool for cytoskeletal research.

"Back then, people were just discovering the most basic functions of tubulin and how it polymerized, and then they found a drug that affected this," said Velia Fowler, a cell biologist at the University of Delaware and former associate editor at the **Journal of Biological Chemistry**.

The drug and its cytoskeletal activity intersected in the 1981 JBC paper "Taxol-induced polymerization of purified tubulin," which recently was designated as a JBC Classic. In the single-author paper, Nirbhay Kumar, then a postdoctoral fellow at the National Institutes of Health, reported that Taxol could promote tubulin assembly in the absence of the microtubule-associated proteins that typically attach to the dimer and make the process possible.

"The mid- and late '70s were really exciting times to work on tubulin biochemistry and microtubule formation," Kumar said.

Previous studies had shown that adding tubulin to a mixture of various cellular proteins, plus Taxol, would cause an increase in stabilized microtubule formation. "But, that really did not address the question of how and what aspect of microtubule assembly was actually being influenced by Taxol," Kumar said. "I thought, 'Well, let's try Taxol with purified tubulin without any other proteins.'"



PAKORN KANCHANAWONG & CLARE WATERMAN/NATIONAL UNIVERSITY OF SINGAPORE & NHLBI

Microtubules, strands of tubulin, a protein in the cytoskeleton, photographed using a high-resolution microscopy technique.

Kumar said he was surprised that adding Taxol to the tubulin dimers in an equal molar concentration produced a "beautiful assembly of purified tubulin dimers into microtubule structures."

He continued: "That was the first time it was known that, without any accessory proteins or proteins that

actually help in the microtubule formation, Taxol could do it directly through some mechanistic action."

From bark to bedside

Taxol's path to cytoskeletal insight and drug development began in 1955 when the National Cancer Institute created the Cancer Chemotherapy National Service Center to screen known compounds, and later collect novel ones, for anticancer activity. At the time, cancer treatments largely were limited to surgery and radiotherapy.

Working at the behest of the NCI and the U.S. Department of Agriculture in 1962, botanist Arthur S. Barclay collected some 200 bark samples from trees in the Pacific Northwest. Among them was a sample from the Pacific yew, and within it, scientists later learned, was Taxol. Over the next 20 years, scientists in the program tested more than 114,000 compounds extracted from 35,000 plants for anticancer activity.

In 1964, Pacific yew samples made their way into the hands of the chemists Monroe E. Wall and Mansukh C. Wani at the Research Triangle Institute, now RTI International, after a scientist working for CCNSC found that the material displayed cytotoxic activity. In 1966, the duo isolated the active ingredient, naming it Taxol after the tree's scientific name, Taxus breviofolia. The pair presented their results at the 1967 American Chemical Society meeting, ultimately publishing their findings in 1971.

The NCI then began exploring the compound's anti-tumor activity in earnest and began a partnership with Susan Horwitz at the Albert Einstein College of Medicine in 1977. That year, she and graduate student Peter Shiff found that Taxol could exhibit anti-tumor activity by inhibiting cell mitosis. In 1979, they published their landmark paper showing that Taxol promotes the assembly of microtubules, which prevents shrinkage and segregation of the chromosomes, arresting cell growth.

Blocking the depolymerization of microtubules, however, is a mechanism that causes mild to severe nerve pain in nearly everyone who takes Taxol, noted Robert S. Fischer at the National Heart, Lung and Blood Institute. In 2015, he and Fowler co-edited a thematic minireview series in JBC titled "The State of the Cytoskeleton."

"(The) microtubules in your neurons need to be dynamic, otherwise you have massive neuropathy," Fischer said. "It's really messing up your neurons, and it's depleting your gut of all their dividing cells. It's a sledgehammer."

According to Kumar, subsequent research in 1985 did indicate that the drug might cause neuropathy: "There were some hints in a second study that I did in malaria parasites where we found that Taxol actually causes bundling or clumping of microtubules," he said. "So, when you think of the bundling aspect, and when you think of microtubule dynamic disassembly being disrupted, it should not be surprising that when used as a drug for treatment it will have some neuropathic effects."

In 1990, Bristol–Myers Squibb applied to trademark the name Taxol, which was approved in 1992, changing the drug's generic name to paclitaxel. In the years since Taxol and paclitaxel received U.S. Food and Drug Administration approval — in 1993 for ovarian cancer, 1994 for breast cancer and 2006 for non–small cell lung cancer — dozens of new chemotherapeutics, including Gleevac, have become available for cancer patients.

"We knew a lot about the dynamics of tubulin, but we didn't know anything about the molecules that controlled it," Fowler said. "I see this Taxol paper as one of the earlier forays into really understanding the biochemistry and biophysics of tubulin polymerization."

After completing his postdoctoral work at the NIH, Kumar joined the faculty of the School of Public Health at Johns Hopkins University. There, he applied his training in cell biology, immunology and vaccinology toward the development of a malaria vaccine, work he continues today at the Milken Institute School of Public Health at George Washington University.

"We knew a lot about the dynamics of tubulin, but we didn't know anything about the molecules that controlled it," Fowler said. "I see this Taxol paper as one of the earlier forays into really understanding the biochemistry and biophysics of tubulin polymerization."

This article originally appeared in the Journal of Biological Chemistry. It has been modified for ASBMB Today.

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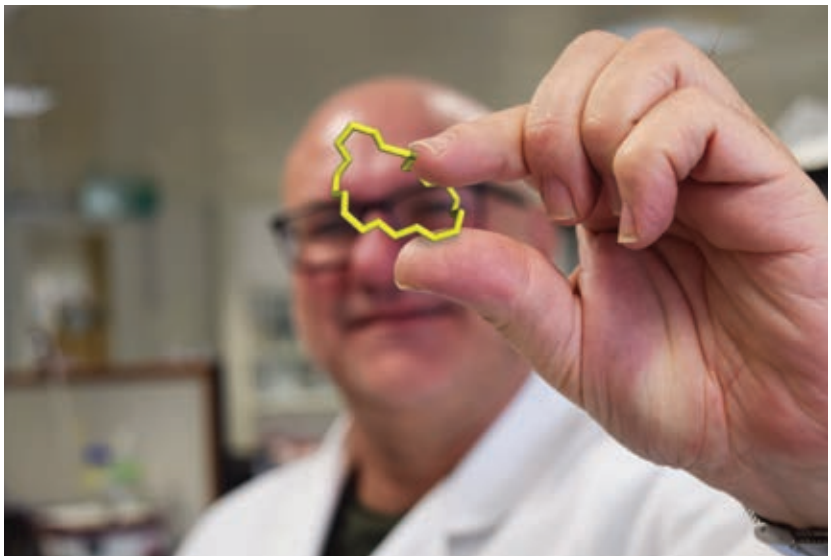
How researchers rediscovered the first known plant cyclic peptide

By Laurel Oldach

COURTESY OF JOSH MYLNE



Mark Fisher poses for a photo illustration with the structure of evolidine.

Last June, a botanist cut a handful of dark, shiny leaves from a slender understory tree in the rainforest of northeastern Australia. Some 2,700 miles away, on another coast of the continent, a team of molecular biologists had uncovered a forgotten history of the tree's biochemistry, and they wanted to learn more from its leaves. Their findings recently were published in the **Journal of Biological Chemistry**.

The find

Mark Fisher, a graduate student at the University of Western Australia in Perth, studies the synthesis of cyclic peptides, which are cut from longer proteins and joined end-to-end to make a ring structure. While writing his dissertation, Fisher came across an obscure paper from the 1950s that described a cyclic peptide before cyclic peptides were known to have been discovered in plants.

TOURISM TROPICAL NORTH QUEENSLAND

Yellow evodia grows in rainforests of northern Australia, such as this area along Cooper Creek.

The 1955 article in the Australian Journal of Chemistry described a chemical isolated from a native tree called Melicope xanthoxyloides, or yellow evodia, and its chemistry only made sense if it was a peptide with no N or C terminus. In the spare style of their time, the authors didn't discuss what the compound's existence might mean or how it might be made. Still, they demonstrated that it was cyclic — a first for plants back when scientists were first working out the rules of protein and peptide synthesis — and dubbed it evolidine.

The journal was small, new and relatively unknown. Over time, researchers remembered the molecule, vaguely, but its place in history was forgotten. Intrigued, Fisher traced a chain of modern references. "Papers stated with more and more certainty over the years that cyclolinopeptide A (from flax) was the first such peptide discovered," he said.

Fisher's advisor, Joshua Mylne, has studied cyclic peptide biosynthesis for over a decade, lately as a sideline to more applied research on herbicides. He recalls a slide set Fisher put together for a talk tracing the slow distortion.

"(As) he clicked his way through the papers … there was no maliciousness, no, 'Screw those Aussie guys, we're gonna start calling this the first one,'" Mylne said. Still, the effect was the same: Evolidine's early discovery was forgotten.

With a certain national pride, Mylne set out to reestablish evolidine's reputation as the first of the plant cyclic peptides. Fisher stayed on as a postdoc because he was intrigued.

The sample

Evodia doesn't grow in Perth, so Mylne recruited researchers at the

Australian Tropical Herbarium in Cairns, Queensland, to obtain it.

When it's not in flower, yellow evodia is hard to distinguish from closely related trees. The first time botanist Fanie Venter returned to the herbarium from a collecting expedition, it became clear that the leaves he had brought back were from another species.

"It probably contained some kind of evolidine, but we wanted the (yellow evodia) evolidine," Mylne said.

Once they had the right samples in hand, Mylne and Fisher generated a leaf transcriptome and ran protein extracts through a mass spectrometer, searching for the cyclic peptide described decades before as a seven–amino-acid compound. They found it, along with six newly described peptides that are similar in sequence.

The team studies cyclic peptide synthesis to understand protein evolution. To learn which gene product makes evolidine, they needed to determine the sequence of the longer protein it was cut from, so they searched the leaf transcriptome for mRNAs that might match the collection of seven–amino-acid sequences.

"It is very hard to search a transcriptome for such a short sequence, as you usually get many matches," Fisher said. "This case was no exception." He found the relevant transcripts eventually by searching for homology to a citrus cyclic peptide precursor.

KERRY COLEMAN / INATURALIST AUSTRALIA

Yellow evodia, or melicope xanthoxyloides, is differentiated from related species most easily when it's in flower.

TOURISM TROPICAL NORTH QUEENSLAND

The plant that synthesizes evolidine is native to tropical rainforests of northern Australia (shown), Papua New Guinea and nearby islands.

Most known cyclic peptides are made by enzymes called transpeptidases, which behave like a slightly confused protease. Ordinarily, proteases break the bond between two amino acids — one vertebra in the backbone of a protein — by bringing in a water molecule that acts as a nucleophile, shouldering its way into a bond with a backbone carbon in a process called peptide hydrolysis. If the amino terminus of the substrate's protein backbone is close enough to slip into the protein's active site, then instead of breaking the peptide bond with water, a transpeptidase may break the peptide bond using an amino-terminal nitrogen instead — yielding one truncated protein and one small cyclic peptide.

Like many enzymes, transpeptidases are picky about their substrates, each enzyme preferring a known substrate-recognition sequence. The team found that, oddly, the precursor proteins for evolidine and its relatives don't have any of those recognition sites. That suggests the evolidine family might be made by a yet-undiscovered transpeptidase or by another undescribed molecular mechanism.

It is unclear what knowing about evolidine might mean for future researchers. Often, scientists look to natural products in search of antimicrobial activity; although previous researchers had reported that evolidine could kill some bacteria, the team was unable to reproduce that result, and they suspect that the earlier researchers' peptide preparation may have had some impurities. It may be, Mylne said, that evolidine is the evolutionary equivalent of a human tailbone, a vestige that neither harms the plant nor does it much good. However, it is likely to shed light both on the tree's history and on the curious evolution of the scientific literature.

DOI 10.1074/jbc.RA120.014781

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The metabolic trigger that activates sperm

By John Arnst

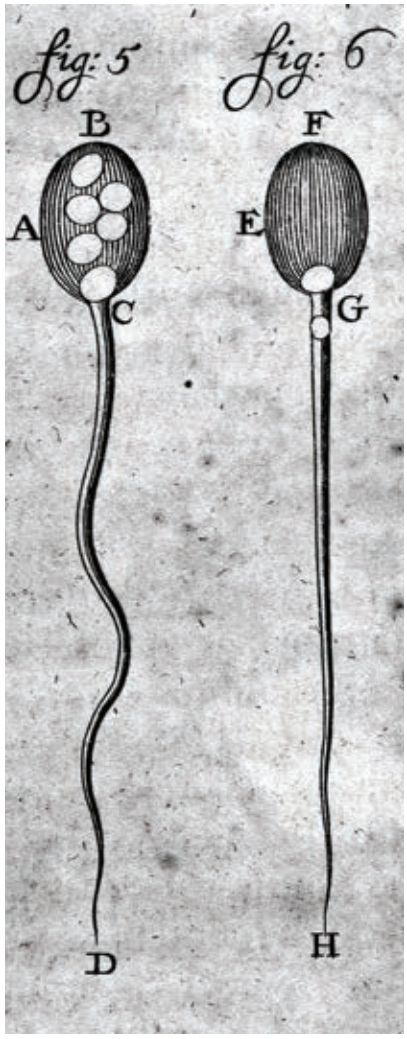
When viewed under a microscope, sperm cells typically look like eager swimmers with a singular purpose. But despite the haste that their flagella and behavior imply, sperm are hardly ready to go at a moment's notice.

After ejaculation, they need up to an hour to undergo a process of posttranslational modifications called capacitation, which alters their heads so they can merge with an egg and changes the movement patterns of their tails to a frenzied state of hyperactivity before they are able to fertilize that egg. While in this state, sperm shut off their typical metabolic pathway, oxidative phosphorylation, and instead begin to rely on glycolysis for their final push. One of the biochemical changes that makes capacitation possible is the covalent addition of sialic acid to the terminal end of glycoproteins, or sialyation, a process that only affects a handful of proteins on sperm but is essential to fertilization.

To better understand the role that sialyation plays in fertilization, researchers at the University of Newcastle used a tandem mass spectrometry and liquid chromatography approach to examine the glycoproteomic changes in sperm cells that had been made to undergo capacitation through incubation for 90 minutes. They detailed their results in the journal **Molecular & Cellular Proteomics**.

"We wanted to know, if we take sperm before and after capacitation, what would change in terms of the sialic acid proteins," said Mark Baker, a Newcastle scientist who researches the proteomics of sperm and male fertility. "And the answer was extremely little, which was quite surprising. Very, very, very few proteins, 0.4% or something stupidly small."

WELLCOME TRUST COLLECTION



Antonie Van Leeuwenhoek first observed the structure of sperm in 1677, which he detailed here in his 1719 book "Opera omnia."

But the paltry six proteins that Baker and his colleagues found had decreased sialic acid content, which he attributed to either shedding or the activity of a glycosidase, turned out to be glycolic red herrings after they noted a lone protein that had increased sialyation.

That protein's name? Aconitase, or ACO2, an enzyme in the citric acid cycle that catalyzes the isomerization of citrate to isocitrate. Thanks to a computer model built by Vincenzo Carbone, a co-author at the Grasslands Research Centre, the researchers then found that sialyation causes a conformational change in aconitase's alpha helix that distorts its active site and completely shuts it down, along with oxidative phosphorylation as a whole.

"We think that would suggest that when you stop oxidative phosphorylation and shuttle the metabolic pathway through to glycolysis, that's probably a trigger for the hyperactivation, or probably helps it in some way, but we don't know," Baker said.

However, hyperactivity itself is not well understood. According to Baker, researchers currently have multiple competing theories about its role and purpose in fertilization.

"The only thing that we know for sure is that without hyperactivation, you just don't get fertility."

DOI: 10.1074/mcp.RA120.002109

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Images in Lipid Research

A new article format in the Journal of Lipid Research

The editors of the Journal of Lipid Research are pleased to announce the adoption of a new article format: "Images in Lipid Research." Each peer-reviewed, one-page article contains a single horizontal image, a 400-word caption and up to four references.

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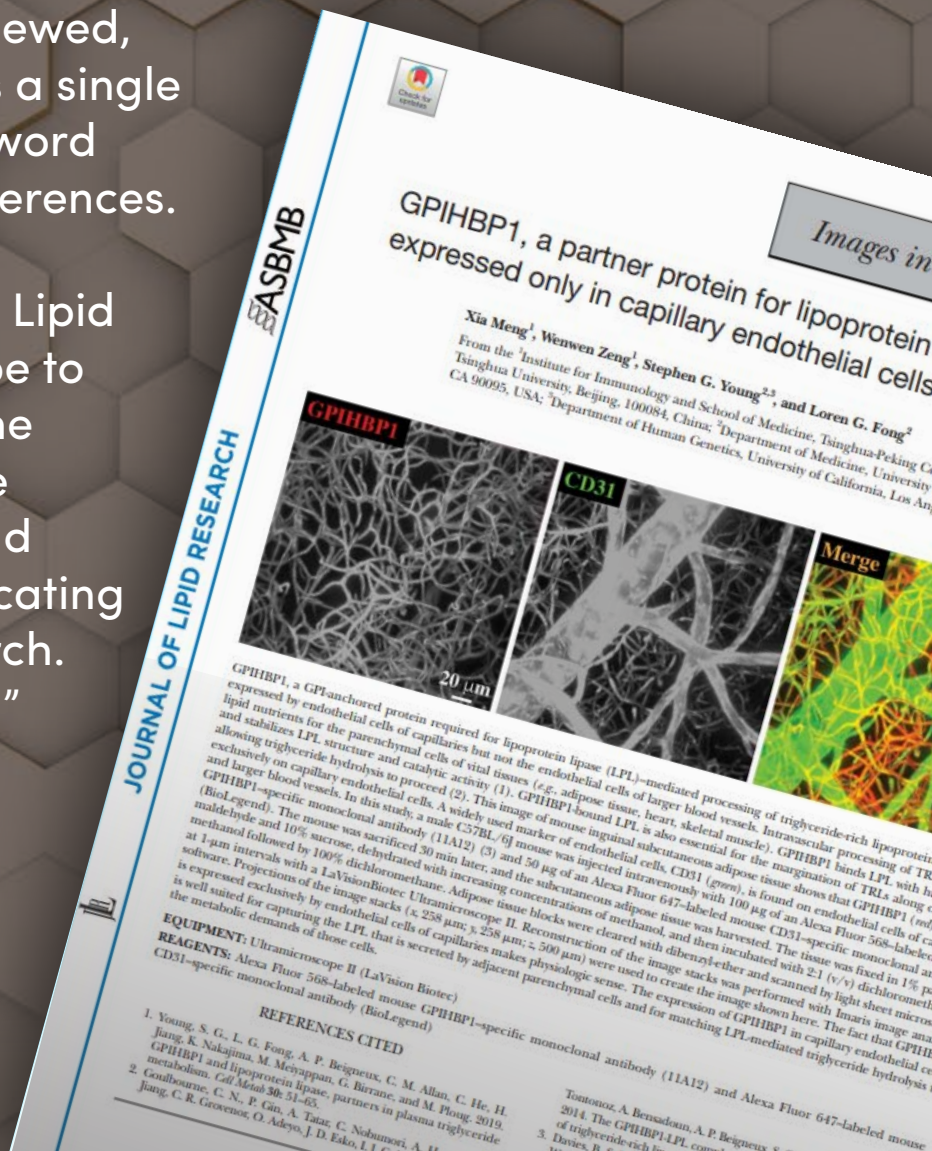


From the journals

By Jaclyn Brennan, Caleigh Findley & Anand Rao

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

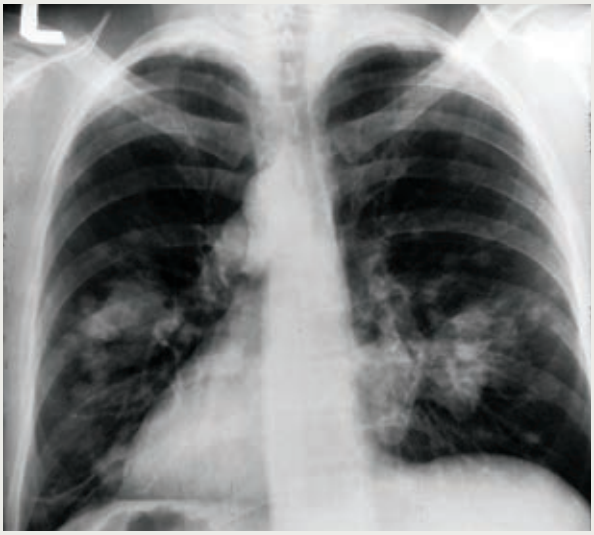
Meat, methyl and the microbiome

The intestinal microbe-mediated metabolic breakdown of carnitine, a molecule found in red meat, produces trimethylamine, or TMA, a chemical linked to the artery-clogging condition atherosclerosis. One produced, TMA enters the bloodstream and lands in the liver, where it can cause deleterious physiological effects.

In a recent paper published in the **Journal of Biological Chemistry**, Duncan Kountz and colleagues at The Ohio State University discovered that the human gut bacterium Eubacterium limosum processes carnitine in a manner that circumvents the production of TMA. The researchers ascribe this desirable feature to the activity of the trimethylamine methyltransferase family protein they designate as MtcB, an enzyme that catalyzes the removal of methyl groups from compounds to help bacterial survival. In the study, the scientists provided E. limosum cultures with a variety of potential compounds, including L-carnitine. The bacteria formed MtcB specifically

Trapping TGF-beta to target tumors

A number of growth factors and cytokines in the tumor microenvironment control tumor metastasis. Transforming growth factor–beta, or TGF-beta, promotes the invasive metastatic properties of cancer cells and tumor angiogenesis. Chimeric proteins composed of the ligand-interacting ectodomains of receptors fused with the fragment crystallizable portion of immunoglobulin often are used by scientists to trap TGF-beta and reduce its oncogenic signaling. However, researchers recently have found evidence indicating that the gold-standard approach of using the TGF-beta receptor 2 domain traps certain subtypes of TGF-beta — such as TGF-beta 1 and TGF-beta 3 — more effectively than TGF-beta 2, whose expression is elevated in multiple forms of cancer.



NATIONAL CANCER INSTITUTE

In this X-ray, the lung shown on the left has a potentially cancerous mass.

In recent work published in the **Journal of Biological Chemistry**, Kazuki Takahashi of Tokyo Medical and Dental University and a team of collaborators in Japan write that they have developed a chimeric TGF-beta receptor that effectively traps all TGF-beta isoforms. The authors found that the receptor, which contained the domains from both TGF-beta receptor 1 and TGF-beta receptor 2, reduced oncogenic TGF-beta signaling in oral cancer cells. Use of this new chimeric protein also halted the cancer cells' epithelial-to-mesenchymal transition, which allowed shed cell–cell adhesions to become migratory and invasive, a property that existing TGF-beta ligand traps do not demonstrate. Furthermore, the researchers found that their chimeric receptor suppressed tumor growth and angiogenesis more effectively than alternative methods in a cancer model where tumor cells are transplanted in the abdominal walls of immunodeficient nude mice.

Taken together, the researchers' data suggest that this strategy, which effectively inhibits oncogenic TGF-beta signaling, tumor growth and angiogenesis, may be a promising tool for suppressing oncogenic tumor microenvironment signaling.
DOI: 10.1074/jbc.RA120.012492

in response to L-carnitine to cleave L-carnitine's methyl group. This finding suggested to the authors that MtcB is part of the bacteria's built-in system to consume the substance.

These findings suggest that a healthy gut microbiome containing E. limosum could lessen the occurrence of damaging cardiovascular events associated with red meat consumption.
DOI: 10.1074/jbc.RA120.012934

A cholesterol's role in listeriosis spread

Listeriosis is a foodborne disease resulting from the spread of Listeria monocytogenes. This bacterium moves from one cell to another through plasma membrane protrusions from the host cell. Previous studies have implicated what researchers call accessible cholesterol in the formation of these protrusions and the spread of L. monocytogenes infection. Accessible cholesterol is a part of the plasma membrane, independent of other lipids and proteins, that is involved in cellular signaling and homeostasis.

In a study published in the **Journal of Lipid Research**, Michael E. Abrams and Kristen A. Johnson of the University of Texas Southwestern Medical Center and colleagues used a toxin-based biosensor of accessible cholesterol, or ALOD4, to determine its role in L. monocytogenes cell-to-cell transmission. Results indicated that ALOD4 binds to intestinal epithelial cells infected with L. monocytogenes. Further, they observed increased ALOD4 expression on bacterial membrane protrusions surrounding an L. monocytogenes positioned for transmission. These findings support the theory that accessible cholesterol is involved in the formation of plasma membrane protrusions and put forth a model that may be useful for future research on accessible cholesterol in cellular signaling.
DOI: 10.1194/jlr.ILR120000891

Proteins stay negative to avoid shedding

A group of specialized proteases called sheddases cleave and release the ectodomain of membrane proteins, regulating their function and abundance. While researchers have identified hundreds of sheddase substrates, the mechanisms that control shedding activity are defined incompletely.

Ryo Iwagishi of Ritsumeikan University and collaborators in Japan report that substrates containing negatively charged amino acids in their membrane-proximal juxtadomain are resistant to hydrolysis by some sheddases.

Their findings, published in a recent study in the **Journal of Biological Chemistry**, provide new insights into sheddase activity and may aid in the development of sheddase-directed inhibitors that could have therapeutic applications, such as preventing tumor cell proliferation.
DOI: 10.1074/jbc.RA120.013758

Regulating translation on the ER membrane

Proteins are synthesized by cells through a process known as translation. Studying how proteins are translated by mRNA on the endoplasmic reticulum, ER, is of particular interest to scientists, as new insights can teach us how cells make repairs, create hormones, maintain structures and pass on genetic information. While researchers know that a number of cellular components and regulating mechanisms coordinate mRNA translation on the ER, little is known about the spatial organization of ER-localized translation.

In a paper published in the journal **Molecular & Cellular Proteomics**, Molly Hannigan and colleagues at Duke University write that they found that the membrane of the ER is organized into discrete protein interaction domains. Using a BioID proximity-labeling approach, the researchers identified distinct labeling patterns of four selected ribosome-interacting proteins, or interactomes. In doing so, they found a previously unappreciated role of the protein-coding gene LRRC59 in mRNA translation regulation. They found that this interactome is highly enriched in the SRP pathway, placing LRRC59 in a functional nexus for secretory and membrane protein synthesis. By silencing LRRC59 with siRNA knockdown techniques, the researchers substantially reduced protein synthesis in both the cytosol and the ER. The team has suggested six possible mechanisms for these interactions, which opens doors toward future studies.
DOI: 10.1074/mcp.RA120.002228

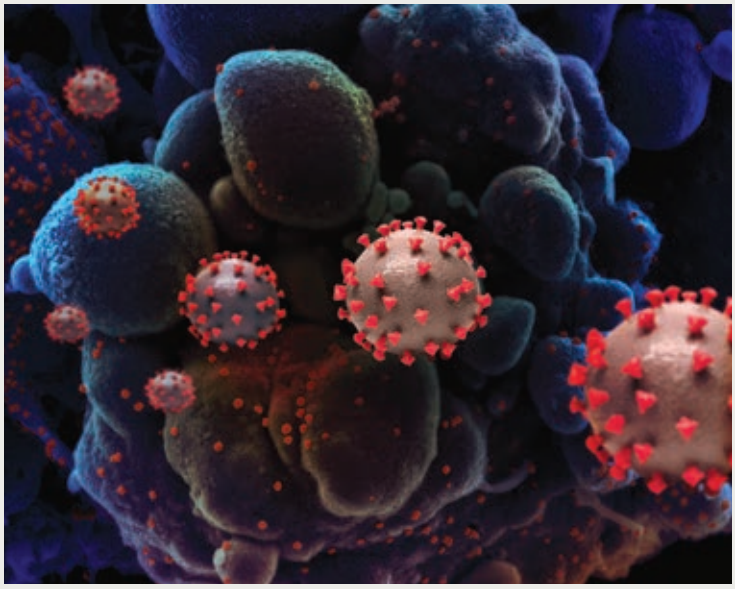
A superior method for studying lipid rafts

On cellular membranes exist lipid microdomains called lipid rafts that are important for cell functions such as membrane fluidity and protein trafficking. Researchers think lipid rafts also are involved directly in activating T cells, an important immune system component. Studying the protein composition of lipid rafts presents many challenges due to methodological limitations in isolating the lipid microdomain without altering its membrane properties.

To address this issue, Cerina Chhuon of the Institut Mondor de Recherche Biomédicale and the Necker Proteomics Platform used a new sample preparation method called suspension-trap (S-Trap). This approach uses suspension-trapping filters to wash out contaminants from lipid isolation and better maintain the raft protein profile. Results published in the **Journal of Lipid Research** report the successful elimination of contaminants from raft samples. For the first time, the new approach allowed researchers to conduct protein analysis

Immune signaling in early-stage COVID-19

The highly contagious and deadly disease COVID-19 caused by the novel coronavirus SARS-CoV-2 has been spreading across the globe for almost a year, threatening millions of human lives. Symptoms of COVID-19 are related closely to those of influenza, including fever, fatigue, dry cough, diarrhea and pneumonia. Flu vaccines have been approved for human use since 1945, but, to date, neither an approved vaccine nor a cure exists for COVID-19.



NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES/NATIONAL INSTITUTES OF HEALTH

Researchers in China have profiled the serum proteome of patients with early-stage COVID-19, the disease caused by the SARS-COV-2 virus, shown here in an artist's rendition.

Many scientists are working to understand better the pathogenesis of this novel disease, and researchers hope that profiling proteins in serum samples from infected patients may lead to the development and design of an effective therapeutic regimen. However, until recently, no one had focused on protein expression changes in serum in the early stages of COVID-19.

Xin Hou and Xiaomei Zhang of Peking Union Medical College and the National Center for Protein Sciences–Beijing, known as the Phoenix Center, and a research team in China have published a new report in the journal **Molecular & Cellular Proteomics** specifically profiling the serum proteome of early-stage COVID-19 and influenza patients. Twenty-eight patients were recruited for this study based on influenzalike symptoms, and 15 tested positive for COVID-19. Using a high-density antibody microarray, the researchers profiled expression levels of over 500 serological proteins and compared differentially expressed proteins between the two groups of patients, those with and those without COVID-19.

After a comprehensive analysis, the researchers determined that activation of viral infection pathways MAPK, ERK1/ERK2, JAK-STAT and PI3K and pro-inflammation occur in early-stage COVID-19 infection. They also identified a number of serological proteins found in COVID-19 patients but not influenza patients, indicating potential biomarkers that could be used in the future diagnosis and treatment of early-stage COVID-19.

As the world continues to grapple with this deadly disease, more such scientific studies are needed to overcome the gaps in knowledge and create therapies to save lives.

DOI: 10.1074/mcp.RP120.002128

on rafts before and after T-cell activation, yielding an established database of 894 T-cell raft proteins. These efforts demonstrate an improved sample preparation procedure for raft protein composition and provide further understanding of their role in T-cell activation.

DOI: 10.1194/jlr.D120000672

How phosphorylation affects GABA receptors

Receptor trafficking is crucial for the regulation and adaptation of cell–cell communication in the brain. Gamma-aminobutyric acid type A receptors, or GABAARs, regulate inhibitory signaling in the central nervous system and are trafficked to functionally diverse synapses. However, the details surrounding GABAAR trafficking are unclear.

In a recent paper published in the **Journal of Biological Chemistry**, Yasuko Nakamura of the University of Bristol and collaborators at the Tufts University School of Medicine

showed that protein kinase A, or PKA, referees GABAAR density at synapses. Using mass spectrometry and biochemical assays, the scientists demonstrated that PKA-mediated phosphorylation on the serine 359 residue of the alpha 2 GABAAR subunit decreases the receptor's binding to scaffolding proteins and reduces its synaptic density.

This indicates that PKA activity influences the accumulation of GABAAR at inhibitory synapses, tuning the strength of synaptic inhibition to ensure normal neural network activity and preventing pathologic hyperexcitability.
DOI: 10.1074/jbc.RA120.014303

Asparagine hydroxylation is reversible

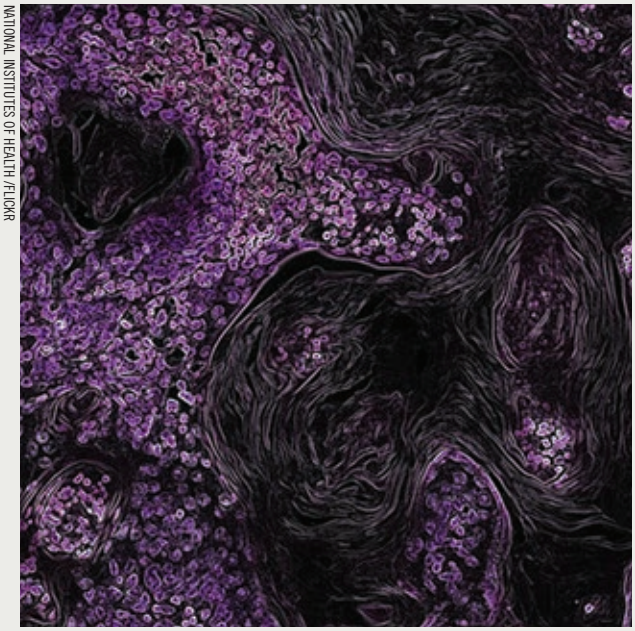
According to current dogma, amino acid hydroxylation is an irreversible post-translational modification, or PTM. PTMs are important chemical alterations of amino acids or proteins, as they allow the proteome to increase its complexity and permit the cell to modify protein functions dynamically. Hydroxylation is a common PTM that makes molecules more water-soluble through the addition of a hydroxyl group, -OH. In recent years, some researchers have postulated the hydroxylation process might be reversible, which could explain the observed rapid cell responses to acute

A new connection in lung cancer research

Non–small cell lung cancer, or NSCLC, is the most common subtype of lung cancer. Over 30% of lung cancers have mutations of Kras and elevated expression of Myc, proto-oncogenes important for the cell cycle and cell growth. Previous studies indicated a potential link between Myc expression and increased lipid synthesis, another marker of cancer. However, the details of this relationship remained uncertain, especially in the context of lung cancer.

A recent paper in the **Journal of Lipid Research** by Zoe Hall and colleagues at the University of Cambridge and Imperial College London describes their efforts to gain a better understanding of Myc and cholesterol homeostasis. Using a mouse model of lung cancer with reversible activation of Myc, the researchers discovered that activating Myc in lung cells enriched activity in several cellular pathways, including lipid metabolism and transport. Global lipid profiling of tumors then showed an increase in bound cholesterol that was elevated further when Myc was deactivated.

Myc-activated tumors also showed an increase in lipid droplets that store cholesterol, though the authors indicate that this may not result solely from increased lipid storage. The researchers also found that Myc activation generated increased cholesterol influx in tumors, while deactivation of Myc promoted cholesterol efflux. The results showed decreased expression of cholesterol efflux transporters and regulators with Myc activation.



NATIONAL INSTITUTES OF HEALTH /FLICKR

In this image from a genetically engineered mouse model, lung cancer driven by the Kras oncogene shows up in purple. As a key driver in many types of cancer, the Kras gene makes a promising target for new cancer therapies.

The team then looked to human NSCLC data sets to determine the extent to which their findings are observed in human cancer. Data analysis supported the alteration of key cholesterol transport and storage factors that was associated with a significantly lower five-year survival rate for lung cancer patients. Overall, this novel discovery in cancer research points to the dysregulation of cholesterol transport and storage in lung tumors and provides further understanding of the link between cholesterol homeostasis and Myc.
DOI: 10.1194/jlr.RA120000899

hypoxia and reoxygenation, yet no direct evidence of such reversibility has been produced.

Using quantitative mass spectrometry, a group of researchers in Scotland and Australia set out to examine whether hydroxylation could indeed be a reversible process. Javier Rodriguez of the University of Edinburgh and colleagues found evidence in cells that FIH-mediated asparagine hydroxylation is reversible on intact proteins. Though they did not identify the particular enzymes responsible for such a reaction in this study, future work characterizing dehydroxylation enzymes has important implications in the treatment of cancer. The results of this study were published in the journal **Molecular & Cellular Proteomics**.
DOI: 10.1074/mcp.RA120.002189

Managing manganese by way of bile

The composition of bile acids, or BAs, can influence metabolic health. In Type 2 diabetes and insulin resistance, the rate of synthesis of 12-alpha-hydroxylated BAs, or 12HBAs, is increased, but researchers do not understand completely the consequences of 12HBA abundance.

Manganese, an essential element obtained primarily through food and water, is critical for the synthesis and activation of enzymes, metabolism, endocrine regulation, protein synthesis and immune function. Using organoids formed from the small intestines of mice, Tiara Ahmad of Columbia University and colleagues found that BA pools low in 12HBAs promoted the expression of solute carrier family 30 member 10, better known as Slc30a10, a protein critical for maintaining manganese levels. Administration of lithocholic acid or vitamin D also increased Slc30a10 expression in mouse small intestine cells and increased expression-induced excretion of cellular manganese.

These findings, published in a recent study in the **Journal of Biological Chemistry**, show that BA pool induction of Slc30a10 expression occurs through a vitamin D–mediated pathway, uncovering a previously unknown role of BAs in intestinal regulation of manganese levels.
DOI: 10.1074/jbc.RA120.012792

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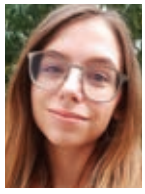

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Upcoming ASBMB events and deadlines

NOV.	1	**American Diabetes Month**
	12	**World Pneumonia Day**
		Virtual Event: Collaboration 101: Developing Partnerships between Academia and Industry
	16, 18, 20	Virtual Event: Navigating career development and building resilience in times of unrest
	25	Renewal deadline for ASBMB Student Chapters
DEC.	1	**World AIDS Day**
JAN.	1	**Cervical Health Awareness Month** ASBMB journals become open access
	7	Abstract deadline for the ASBMB Annual Meeting held in conjunction with Experimental Biology
	11	Abstract deadline for Proteinases and their inhibitors
	24	**International Day of Education**













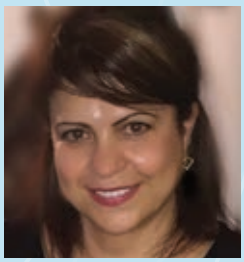
The future of ASBMB meetings is VIRTUAL

With in-person gatherings off-limits, the society has moved its events, both large and small, online — with great success

By John Arnst

Long before the COVID-19 pandemic turned our homes into our offices, Roya Jaseb knew her profession needed to change, and she was ready for it. Director of meetings for the American Society for Biochemistry and Molecular Biology, Jaseb had been preparing for the shift to virtual, more flexible and accessible scientific meetings for years.

"The Trump administration's early 2017 ban on travel to the U.S. by people from predominantly Muslim nations impacted the scientific community dramatically," she said. "I felt like we had to do something to be inclusive and eliminate these barriers that were being thrown up."



ROYA JASEB

Back then, Jaseb was working for the Federation of American Societies for Experimental Biology. It was her job to manage meetings for several client societies. "The more I started looking into virtual meetings, the more I found that the societies that did this significantly expanded their membership and their engagement with their membership," she said.

Like every professional organization that hosts a yearly convention, the ASBMB didn't have the 2020 annual meeting it was hoping for. By the weekend in early April when the society had planned to hold its meeting in San Diego, most of the United States was three weeks into lockdown and physical distancing that has defined American life during the pandemic.

And so, the ASBMB adapted, hosting virtual Spotlight Sessions, poster galleries and poster chats on Twitter from May through July so that the students and researchers who had hoped to present their research at the in-person meeting would still get their moment in the sun. The events were a marked success, boasting more than 11,000 registrants for the virtual Spotlights Sessions.

Over the following months, the meetings committee and the society went on to refine their online-meeting policies for smaller events, including niche seminars, town halls and webinars.

"Our members have been very responsive and adaptable to the pivot to virtual events," said Barbara Gordon, ASBMB's executive director. "We're all looking forward to helping them communicate their science in the best possible way, both now and in the future."

A virtual annual meeting in 2021

The society's 2021 annual meeting will be held entirely online Tuesday, April 27, through Friday, April 30, using a platform full of bells and

"The more I started looking into virtual meetings, the more I found that the societies that did this significantly expanded their membership and their engagement with their membership."

Though the society was forced to cancel its in-person annual meeting earlier this year, it went on to host more than 30 Spotlight Sessions online between May and July.

whistles.

"The virtual meeting experience will be comprehensive, with the ability to learn, network and engage like never before." Jaseb said. That includes award lectures, scientific symposia, Spotlight Sessions, poster presentations and workshops.

Different types of sessions will have different features. For example, the symposia and Spotlight Sessions will have a question-and-answer function that will be moderated. Each poster presenter will be able to display a PDF of their poster, upload an audio recording of their talk, and respond to questions in real time via a chat tool.

"Essentially everyone will get to give a talk," Jaseb said

The engagement tools on the platform are robust, and will also allow attendees to communicate with each other in discussion boards, as well as over video chat in small discussion groups.

The meetings committee is still ironing out how best to execute networking events for special interest groups, such as the beloved welcome reception organized each year by the Minority Affairs Committee and the mixer and talks organized by the Women in Biochemistry and Molecular Biology Committee.

One significant change to the 2021 annual meeting is that the window for submitting abstracts, which opened Oct. 28, will close Jan. 11, more than a month later than in previous years.

Small meetings, big impacts

Throughout its history, the ASBMB has hosted hundreds of specialized meetings in cities, towns and scenic spots in the U.S. and abroad. Those events usually drew between dozens and a few hundred attendees, and their relatively small size helped cultivate tight-knit, niche communities of researchers.

One such meeting, focusing on serine proteases, was founded and has been organized biannually by Toni Antalis of the University of Maryland School of Medicine since 2013. Antalis, who is president of the ASBMB, said, "The small meeting venue was ideal for the building of informal networks particularly among graduate students, postdoctoral fellows and talented junior researchers."

Like the annual meeting, Antalis'

meeting and the other specialized meetings are all going online until it's safe to meet in person again.

"I believe that the virtual meeting in 2021 will attract even more researchers from around the world to engage in new discovery and advance fruitful scientific collaborations," Antalis said.

Virtual seminars

The ASBMB has also started hosting themed virtual seminars, such as the Lipid Research Division Seminar Series. That seminar series was started independently in April by John Burke, a biochemist at the University of Victoria and Mike Airola, a structural biologist at Stony Brook University.

"It was pretty grassroots," Burke said. At the time, Airola and his students had just had back-to-back papers published in *Nature Communications* and *Nature Chemical Biology* and would normally have featured the research in in-person seminars. When those were not an option due to the COVID-19 pandemic shutting down almost every college campus in North America, Burke and Airola began organizing a web series.

"I just had a list of people I knew. We sent it to about 100 different academics and asked them if they could spread it through Twitter. We got like 150 people that first day, and then just started doing it every week," Burke said. "And we ran that for almost four months, averaging about 300 people a session."

During that period, Burke and Airola dedicated several hours each week to inviting and preparing speakers for the seminars. As autumn began to near, the two started the process of handing off organizing responsibilities to the ASBMB's Lipid Research Division, who had caught wind of the series early on. The Lipid Research Division took over the series in September and hosts the seminars on Wednesdays at noon Eastern.

"The ASBMB Meetings staff do all the registration and coordinating, so the workload is now pretty manageable," Burke said, who now hosts talks about every six weeks. "That's just getting there 30 minutes early, running everything during the session and following up with people afterward. It's really manageable; it's two or three hours once every six or seven weeks."

JOHN BURKE

The Lipid Research Division Seminar Series is now one of the many virtual events series hosted by the ASBMB Meetings staff, who welcome members to submit proposals for new events.

"Submitting a proposal is really not as daunting as it seems," Jaseb said. "It's a very short application, and we have a team of people to help organizers through the application and planning process."

In addition to managing the technical aspects of the virtual platform, Jaseb's team can instruct speakers on how best to prepare their slides, their lighting and their camera and coach them through practice runs ahead of their meeting. "We put in a lot of effort in coordinating and marketing the event to make sure the program is successful, taking some of the load off organizers," she said.

With the success of the Lipid Research Division Seminar Series and other virtual events, Jaseb and members of the meetings committee hope they have built a system that can persist after the pandemic has ended.

"Some aspects of the virtual meetings will stay even after everything's back to normal, either because it's just convenient or because there's no other option for some people," she said. "We're hoping to get this program

PLAN YOUR EVENT

The ASBMB invites members to submit proposals for three different types of virtual events.

VIRTUAL CONFERENCES usually take place over one or several days and offer a mixture of seminars and workshops. Participants can use virtual breakout rooms for networking and to foster discussion.

VIRTUAL WORKSHOPS usually last anywhere from a few hours to a couple of days and provide attendees with in-depth how-to guidance. These also feature virtual breakout rooms for discussions.

WEBINARS AND VIRTUAL SEMINARS are typically one to two hours long and usually feature one to five speakers, depending on the length of each speaker's talk. These also include time built in at the end of each talk for a question-and-answer session.

going strong and have people become more aware of this opportunity."

Other virtual special events

When the pandemic made the society's annual Capitol Hill Day and summer advocacy program impossible, the ASBMB public affairs team decided to find another way to talk to the research community about their science policy concerns and needs.

Public Affairs Director Benjamin Corb and Science Policy Manager Sarina Neote put together a series of virtual town hall-style events in September covering the cost of the pandemic, the STEM workforce and immigration, challenges facing women in STEM, and the pandemic's effects on non-COVID research.

"We couldn't physically take scientists to Capitol Hill, and we couldn't have them advocate for increased research funding at a time when Congress was pumping money into COVID-19 research and vaccine development. And we certainly didn't want to encourage them to visit their lawmakers at their home offices during the summer recess as we've done in past years," Corb said. "But it was important to us to still connect with and hear from our members about their experiences and policy priorities. I think we learned a lot — about how the pandemic is affecting them personally and professionally and what messages they want us to take on their behalf to Congress."

BENJAMIN CORB

Also in September, the society's education and professional development team's National Postdoc Appreciation Week activities included a webinar on navigating postdoc life. And in late October, the ASBMB women's committee hosted a weeklong screening of the award-winning documentary "Picture a Scientist" and followed it up with a panel discussion, with director Sharon Shattuck as a special guest, in early November.

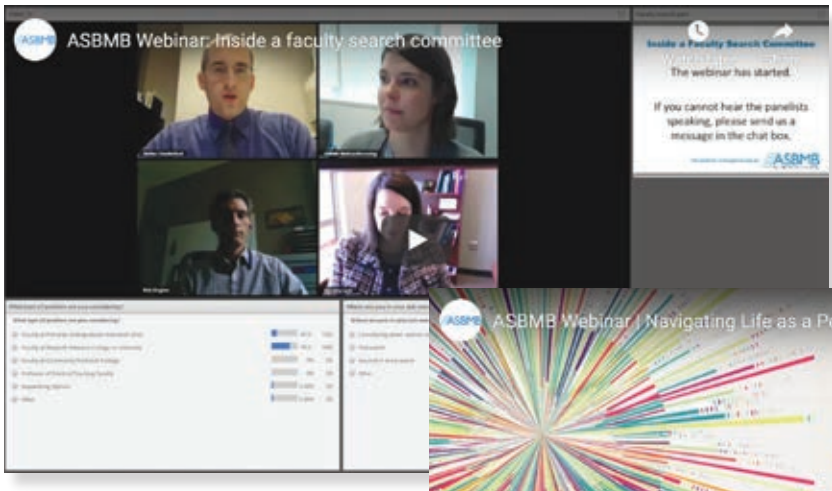
2023 and beyond

While it is too early to tell whether the 2022 annual meeting will also be virtual, a major change will take place in 2023, when the ASBMB will begin to host its annual meeting independently of Experimental Biology and the five other societies that partner with it.

"The ASBMB has been delighted to host our annual meeting alongside EB's for many years," Barbara Gordon, the society's executive director, said. "While it has been a fruitful partnership for all parties, we needed to adapt to the trends of our member base, both from a cost and a size perspective."

According to Jaseb, while concerns about size, cost, and diversity of venues factored into the decision, which was made by the ASBMB council, the strongest push came from the society's members through a survey conducted in March.

"The overwhelming response from the survey was that, while there were benefits to partnering with EB and having a cross-disciplinary meeting with the other societies, most ASBMB members felt like they were lost in



Long before the COVID-19 pandemic required organizations to pivot to virtual events, the ASBMB had been offering webinars to provide scientists and trainees with career advice.

crowds, and that it was difficult to engage with their community in a meaningful way," Jaseb said. "A lot of them felt that having a smaller meeting with science relevant to our community would serve them better, especially the trainees who are networking and meeting investigators."

According to Dan Raben, chair of the meetings committee and organizer of the task force that made the recommendation to split from EB to the ASBMB council, having a stand-alone annual meeting will allow for greater scheduling flexibility.

DAN RABEN

"We were constrained in some cases because we had to be consistent with, or at least do things in concert with, the EB societies' meeting," Raben said. "In some ways, it was great to have a big meeting, because there was the potential for a lot of cross-fertilization that could lead to interesting collaborations. But given the size of the annual meeting, the likelihood of these new collaborations was minimal, and a lot of collaborations were established prior to the meeting. Furthermore, some of the topics covered were not really pertinent to the members of ASBMB. Overall, a survey indicated a majority of our members preferred a smaller meeting with more focus on topics pertinent to our constituents."

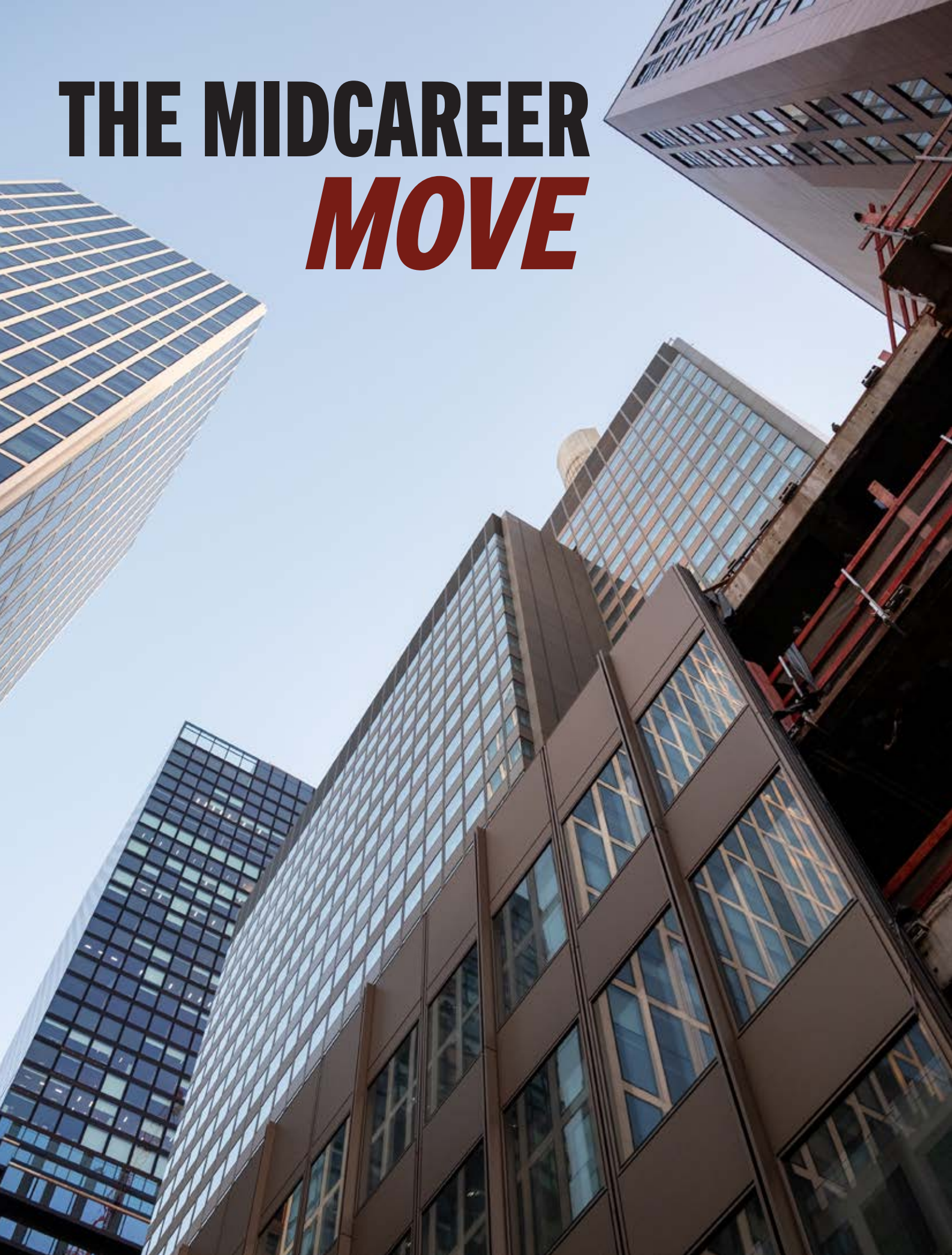
Jaseb said she hopes that focusing the annual meeting on the biochemical and molecular biological research of ASBMB members will ultimately boost turnout.

"Right now, we have about 2,500 to 3,000 annual meeting attendees," she said. "We have more than 10,000 members, and we would like to attract more of them to attend the meeting."

Gordon echoed that sentiment. "Our members are what make ASBMB possible," she said. "We hope that, by holding the meeting on our own, we will be able to draw together as much of our community as possible."

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

THE MIDCAREER *MOVE*



How established professors make the jump to industry

By Laurel Oldach

When Ryan Potts left St. Jude Children's Research Hospital this summer to become a director at the pharmaceutical company Amgen, he joined the small number of former professors who now hold leadership roles in life science companies.

After making it in academia, landing — and holding on to — a job that many people aspire to but never reach, why do Potts and his fellow ex-professors choose to move to a different sector? How do their opportunities arise? And what challenges do they encounter along the way?

ASBMB Today spoke to four former professors to gain some insight into this unusual career path.

Competitive candidates

Carl Cohen, who runs a consultancy teaching leadership skills to scientists, said that career transitions are most common at the junior level, among professors who do not receive tenure or simply decide that academia doesn't suit them.

This was true for Charlotte Jones–Burton, a physician–scientist who now leads global clinical development as a vice president at Otsuka Pharmaceutical Companies. In 2006, as a junior professor, Jones–Burton said, "I began to say, 'Where is this going for me?'"

Despite having landed an assistant professorship at the University of Maryland and a transition-to-independence award from the National Institutes of Health, she calculated that to achieve at the level she aspired to, she would need to put in 80 to 100 hours a week at work, splitting time between research and clinical duties. Jones–Burton's son was very young, and she knew from her years of clinical training how punishing that intense schedule could be.

Still, she said, "I didn't go looking" for a role in the pharmaceutical sciences. Instead, she got a phone call from a recruiter looking to fill a cardiovascular research position at Merck just as she wrapped up another credential, a master's degree in epidemiology and preventative medicine focused in clinical research.

After professors receive tenure, according to executive recruiter Dave Jensen, it becomes more difficult to make a transition. "Once you're pretty far down the (academic) road … employers will look askance and think you've made a decision" to work in a culture very different from business, he said. "It is a move that people make, but it's difficult. And it becomes even more difficult the longer you're there."

The years after receiving tenure also can be a time when professors take stock and experience some career dissatisfaction. Cohen, the leadership trainer, used to be a professor too. His research was going fine, he said. He could have continued to run his lab, bring in grants and pump out papers. But the work "somehow wasn't lighting my fire any more … and I wasn't

The experts:

Howard Jacob was a physician–scientist at the Medical College of Wisconsin who rose to prominence after using exome sequencing to diagnose and treat a young patient with a rare genetic anomaly. He left academia in 2015 for a brief stint leading two biotech startups and then joined pharmaceutical company AbbVie in 2018 as its vice president of genomics.

Charlotte Jones–Burton was an assistant professor at the University of Maryland Medical School before accepting a job in clinical research at Merck in 2007. In 2019, after eight years at Bristol-Myers Squibb, Jones–Burton became the vice president of global clinical development in nephrology at Otsuka Pharmaceutical Companies.

Daniel Ory was a professor at Washington University in St. Louis until 2018, when he moved to Cambridge, Massachusetts, as the senior vice president of translational medicine at a young biotechnology company, Casma Therapeutics. As a physician–scientist, Ory focused on autophagy; now he works on regulating the process to treat disease.

Ryan Potts studied the action of ubiquitin ligase-binding proteins called the MAGE family in a lab he started at the University of Texas Southwestern and moved in 2016 to St. Jude's Children's Research Hospital. This year he took a job as the executive director of a new program to manipulate protein binding as a new drug modality at Amgen.

TOP TO BOTTOM: COURTESY OF ABBVIE. COURTESY OF CHARLOTTE JONES–BURTON. COURTESY OF DANIEL ORY. COURTESY OF RYAN POTTS

Consultant Carl Cohen, who has worked in academia and the biotech industry, leads a management training workshop.

COURTESY OF CARL COHEN

COURTESY OF CARL COHEN

achieving at the level that I really aspire to."

Cohen had grown more interested in science leadership when he became acting chair of his department and took a leadership role in the American Society for Cell Biology. He found that work more compelling than research. So in 1997, he left his role at Tufts University and St. Elizabeth's Medical Center to join a company called Creative Biomolecules. He spent about 15 years in various biotech roles before he began to focus full time on his consulting firm.

Jensen, a recruiter who focuses on finding candidates for biotechnology, pharmaceuticals and agricultural sciences, said that a professor who is senior or well recognized in their field has a leg up. "Someone who's on scientific advisory boards and who becomes known, should they make their desire known to move into a company, they're always given a high degree of credibility."

To stand out before that, Jensen said, a would-be ex-professor needs experience in business or a remarkable reputation within their field.

Some academic institutions in biotechnology hotspots give professors opportunities to develop such reputations earlier. For example, two scientists affiliated with Boston's Broad Institute have transitioned in the last few months to industry leadership: Aviv Regev, who until this summer was a professor at the Broad best known for her work on single-cell sequencing and the ambitious Cell Atlas project, recently moved to Roche's Genentech research and early development as an executive vice president, while Kevin Eggan, who spent years leading psychiatry research at the Broad and a lab at Harvard, just accepted a position at BioMarin.

Bringing a major project to a successful conclusion helps candidates stand out and also can kindle new career aspirations.

That was the case for Daniel Ory, senior vice president of translational medicine at Casma Therapeutics in Cambridge, Massachusetts, who left Washington University in St. Louis in 2018. Ory had helped to bring a candidate treatment for Niemann–Pick disease type C to the clinic through an NIH–industry partnership; he was involved in studying cyclodextrin's effects from preclinical tests in mice a dozen years ago to early-stage clinical tests at the NIH. He also helped recruit a pharmaceutical partner to run final efficacy trials, which recently finished; the Food and Drug Administration is considering the drug.

"I got to help co-lead a team of academic investigators, intramural and extramural NIH investigators, regulatory consultants and also industry," Ory said. "We worked as a project team, similar to what you do in pharma or biotech."

The experience, which helped prepare him for his current job, also motivated him to seek it; developing the drug felt like some of the most important work he had done. "I didn't think it was likely I was going to get another opportunity to do this in my position in academia," he said. "It seemed to me that this time

> "Someone who's on scientific advisory boards and who becomes known, should they make their desire known to move into a company, they're always given a high degree of credibility."
>
> EXECUTIVE RECRUITER DAVE JENSEN

I needed to go out and seek those opportunities directly."

Offers and networking

While still a professor, Ory had met the staff at Third Rock Ventures, a Boston venture capital firm specializing in biotechnology. When he let them know he was looking for a role in biotech, they put him in touch with opportunities at their portfolio companies — including Casma, where he landed.

Casma, which works in manipulating autophagy for therapeutic purposes, needed a doctor with expertise in lysosomal storage diseases. In Ory, they found that expertise combined with clinical development experience and, critically, an interest in moving.

Networking is a key part of Ory's narrative and is central to most successful career-transition stories. "If they are leaving (academia) of their own volition," Carl Cohen said, professors land new jobs by learning to make connections.

"Academia is a rather constrained path," Cohen said. "People don't pay much attention to networking. On the other hand, once you're moving into a different domain, it's all about networking."

Ory put out feelers through professional contacts to find his way to Casma. In Ryan Potts' case, after nine years as a professor, the offer came to him from a contact — although at first he didn't recognize it as such.

When Ray Deshaies, Amgen's senior vice president of global development and himself a former professor at the California Institute of Technology and the Howard Hughes Medical Institute, was working on plans to launch a new program, he sent Potts an email.

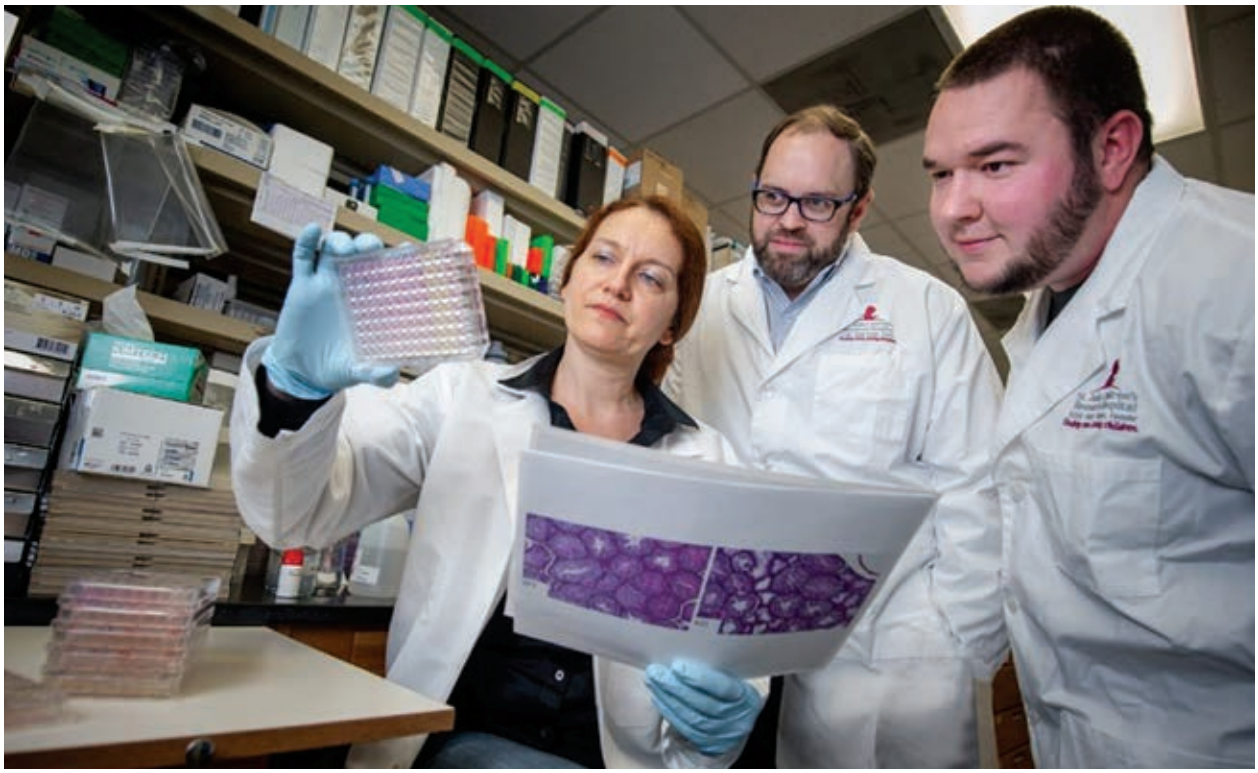
Deshaies is well known for inventing PROTACs, or proteolysis-targeting chimeras, double-headed molecules that bind to both a target protein and a ubiquitin ligase that can tag that target for degradation by the proteasome. As PROTACs gain momentum as drug candidates, researchers are exploring ways to use the same bispecific binding approach for a variety of purposes; for example, chimeras that recruit autophagy factors recently were reported. A new program at Amgen called the induced proximity platform, or IPP, would aim at inducing binding or proximity between proteins to achieve these nonproteolysis effects for therapeutic ends.

COURTESY OF DAVE JENSEN

Dave Jensen is an executive recruiter specializing in the life sciences, agricultural and pharmaceutical industries.

ISTOCKPHOTO.COM

Networking is central to most successful career-transition stories.



COURTESY OF ST. JUDE CHILDREN'S RESEARCH HOSPITAL

In a 2019 photo, Ryan Potts and two of his trainees pose in his lab space at St. Jude Children's Research Hospital.

"Ray sent me an email saying that they've got this IPP program, and they're looking for a leader: 'Know anybody that might be interested?' I wrote back … here are a couple of people I've interacted with that might fit the bill. And he wrote back immediately, 'Well, I was really asking if you wanted to do it.'" The conversation went from there.

"I've known Ray a while," said Potts, who as an academic studied proteins that modulate ubiquitin ligases. "His being a thought leader in this field and his passion … was a lot of the driving force that got me interested."

Without a personal connection or a strong reputation, according to Cohen, that kind of recruitment is uncommon; a typical recruiter, he said, looks first for people already working in industry. After years of leading a lab, he said, "There's little doubt that you're scientifically capable … (but) do you have the management, leadership, organizational and interpersonal skills that will allow you to be successful in a business environment? The fact of the matter is most academics do not."

The culture shift

Recent academia-to-pharma transplants often need time to adjust to the new environment.

Howard Jacob already had left academia to join the HudsonAlpha Institute for Biotechnology, a private research institution, when AbbVie approached him with an opportunity. He learned that the company was seeking a genomics expert like himself to head a project collecting one million genomes and mining them for new discoveries.

"I'm toward the end of my career; I wanted to do one more big thing," Jacob said. "Here was a chance to do the biggest thing … at a scale that I couldn't have imagined in academia."

While he found the move to AbbVie exhilarating, a little reminiscent of starting out as a graduate student, he also faced a learning curve. For one thing, there was no such thing as idle discussion of potential

experiments. "When I got here, I was creating a little bit of turmoil. I'd go and ask people, you know, bounce ideas off of them — and the next thing I knew, they had done it. So I really needed to work with my leadership team to make sure I wasn't just creating chaos by asking questions."

Though his words carry the weight of orders with more people now than when he ran a lab, Jacob said, he also feels a greater sense of accountability to the people who report to him. AbbVie operates by a set of principles called "The Way We Work," and Jacob's evaluation and compensation depend in part on how he treats peers and colleagues who report to him. While the qualitative system of metrics gave him pause at first, he now feels that shared ground rules, explicitly outlined, help keep work moving forward.

"That ability to walk in and say, 'okay, this is going to be a hard conversation … and we all need to be "clear and courageous" so we can solve this problem'— it's fantastic to be able to do that," he said, citing an internal catchphrase.

"Some of the complex relationships at an academic medical center are difficult to navigate," Jacob added delicately. At AbbVie, he has found it easier to resolve conflicts, such as authorship disputes, shared between industry and academia.

An authorship dispute that unfolded while Charlotte Jones-Burton's mother was dying, along with the difficulty she foresaw in disentangling her own research from her adviser's, were major factors in the physician–scientist's decision to take a job at Merck. She said that after arriving at the pharma company, "I didn't miss the fighting for who's going to be first author of the paper … (and) the politics of academic medicine that no one ever talks about."

But the pharmaceutical industry is not without cultural problems common to corporate America, Jones-Burton said. "Thinking about professors and underrepresentation at that level in academia, the same thing happens in the pharmaceutical industry."

In 2015, she launched an organization called Women of Color in Pharma to advocate for greater equity within the pharmaceutical workforce and the patient population it serves.

Professors who make the transition from higher up in the academic hierarchy may experience the culture shift as a loss. "I was an endowed chair professor; I had directorship of different parts of the university," Ory said. "You enjoy, I think, some of the benefits of that status."

As one of 10 employees at a small biotech company with a more egalitarian culture, Ory missed having an office of his own. "It's highly collaborative and collegial," he said. "This is very different from operating as a professor at a university, where maybe you have a laboratory of 20 people and it's run very top-down. … In some ways, you have to subjugate your ego for the greater good."

According to Jensen, prominent

COURTESY OF CHARLOTTE JONES-BURTON

In 2015, Charlotte Jones-Burton launched an organization called Women of Color in Pharma to advocate for greater equity within the pharmaceutical workforce and the patient population it serves.

A lab at Amgen's research facility, Potts' new scientific home.

AMGEN

COURTESY OF ABBVIE

Howard Jacob said that the learning curve when starting his job at AbbVie "was like being a first year graduate student … it was reinvigorating."

When a professor's career trajectory changes, that means a sudden — and often unplanned — change for their trainees and technicians.

professors "have postdocs and scientists and lab managers reporting to them and doing their bidding … so the first thing you have to do is make sure that your candidate (if a professor) has a real-world understanding of the cultural difference."

One important part of fitting into corporate culture is keeping colleagues informed about how projects are coming along.

"If you have your own grants, you have your own lab … there's not a lot of oversight," Jacob said. Now, working in a company, he spends a lot of time figuring out how to update colleagues without inundating their inboxes.

Though it took some getting used to, Ory has come to value Casma's camaraderie. He and others on the company leadership team focus on keeping things egalitarian by sitting intermingled with the rest of the staff in an open-plan office and trusting employees with updates on fundraising and other drivers of the company's future. He has found that such openness about company finance motivates his employees and increases their sense of ownership of the projects they work on.

Money and resources

Ory, Jacob, Jones–Burton and Potts were all successful grant writers — one must be to make it as a professor — but even for people who are good at landing funding, Ory said, "it's not something … that you like doing."

"I don't mind the grants and the papers and whatnot," Potts said, "but the cycle times … seem to have been getting longer and longer from the point that you submitted a grant to actually, if you're lucky, getting the funding."

Resources don't simply appear in for-profit companies, however; Ory, for example, has learned how to describe the work at his small startup to potential investors to attract their interest and dollars.

At a bigger company, Jacob said, internal funding proposals may be one- to three-slide affairs, submitted once a year for approval, in contrast with the intense and competitive grant application process.

Industry labs are comparatively rich in resources, and that money can buy time as well as reagents. Jones–Burton was delighted with how her work time opened up once she could rely on specialist colleagues for tasks such as making slides and running statistics.

"As junior faculty, I'm writing my own papers, I'm doing my own analyses, I'm doing my own coding," she said. At a company where separate departments handle those tasks, she found she could focus on her area of true expertise.

And within that area, work proceeds faster. According to Jensen, "There is a real difference in industry and academia in the pace of the work." While academics can put a primary project on hold to pursue unexpected results or an interesting tangent, "in industry, there are timelines; there are specific goals and objectives that have to be met."

The greater resources available in industry also can open up more ambitious projects. Jacob, Potts and Ory all said their current projects would have been difficult or impossible in their academic positions.

Instead of collecting genomes in an academic lab, Jacob could use the information AbbVie already was collecting about its patients and help the company build systems to keep track of the data — they're aiming for a million patient genomes.

Instead of developing promising molecules in an academic lab and trying to get them through a tech transfer process, Potts can roll the business and scientific considerations together.

"This is an initiative that's been bubbling up for a few years now, where the idea was that you could open up the vast proteome to drug-

ISTOCKPHOTO.COM

Despite the advantages, former professors also find things to miss about academia. Several expressed nostalgia for teaching, for the students they had worked with and the intellectual atmosphere of a university.

gability that has not been accessible before," Potts said, and he was excited to be part of developing those drugs.

Ory said he no longer feels pressure to fit his ideas into the relatively narrow scope of his previous research; he can work on new disease areas. "Going to a startup gives you a lot of flexibility in terms of thinking about the science … there's a lot of innovation and creativity that you can have."

Finally, salaries trend higher in industry. Although compensation for both professors and corporate managers can vary widely depending on institution, precise job title and nonsalary compensation, according to the Bureau of Labor Statistics, the median wage for scientific research and development managers — a role that nearly 20,000 people in the U.S. hold — is $176,660. The median salary for postsecondary biological science teachers, including professors at colleges, universities and professional schools, is $97,560.

Missing students

Despite the advantages, former professors also find things to miss about academia. Several expressed nostalgia for teaching, for the students they had worked with and the intellectual atmosphere of a university. Jones-Burton said she also misses caring for patients in the clinic.

When a professor's career trajectory changes, that means a sudden — and often unplanned — change for their trainees and technicians. The apprenticeship model of science makes trainees highly dependent on professors' expertise, connections and positive references, although they may also receive support from their programs in transitioning to find new mentors. Staff scientists in academia, whose roles are less temporary by design, also may find themselves in a difficult situation when a professor leaves.

According to Potts, although his trainees were his primary concern when considering the job move, the shakeup had turned out reasonably well for them by the time he started at Amgen. Some were moving on to their next career stages. "It spurred everyone to take stock," he said. "After the initial shock wore off for people, it provoked them to look to the next phase of their career."

Sometimes, trainees have an opportunity to follow their advisers into industry. This seems to happen more often when the PI moves into a leadership role at a large company rather than a small biotech. Two scientists

ROBERT BOSTON/WASHINGTON UNIVERSITY IN ST LOUIS

In a 2017 photo, Ory speaks with colleagues including Rohini Sidhu (left), who was a staff scientist in his lab at Washington University who recently took a job at Casma Therapeutics.

who started out as postdocs in Potts' academic lab plan to move to Amgen and join the program.

"It's a real opportunity for them to transition their career paths and start on that in a permanent capacity," Potts said. "It's also great for me, because I get two people who are known entities and can understand how we work and establish the lab there … it works out well for everybody."

When that route is not available — for example, at small companies like Ory's — departing professors may request that colleagues step in to help mentor their trainees. Ory's lab at Washington University overlapped with that of his wife, physician-scientist and American Society for Biochemistry and Molecular Biology award winner Jean Schaffer. Since she was already familiar with the people and projects, Schaffer took over the day-to-day management. "That was really, very helpful," Ory said, adding that most professors do not work so directly with a colleague who can take over and may need to put in more effort recruiting substitute mentors for their trainees.

Changing the mentor on some postdoctoral research awards can be challenging; although he was officially on sabbatical, Ory worked 90% of his time in the new company and spent about 10% of his time advising during the first year of transition. He said, "I wanted to not leave precipitously and leave them in the lurch."

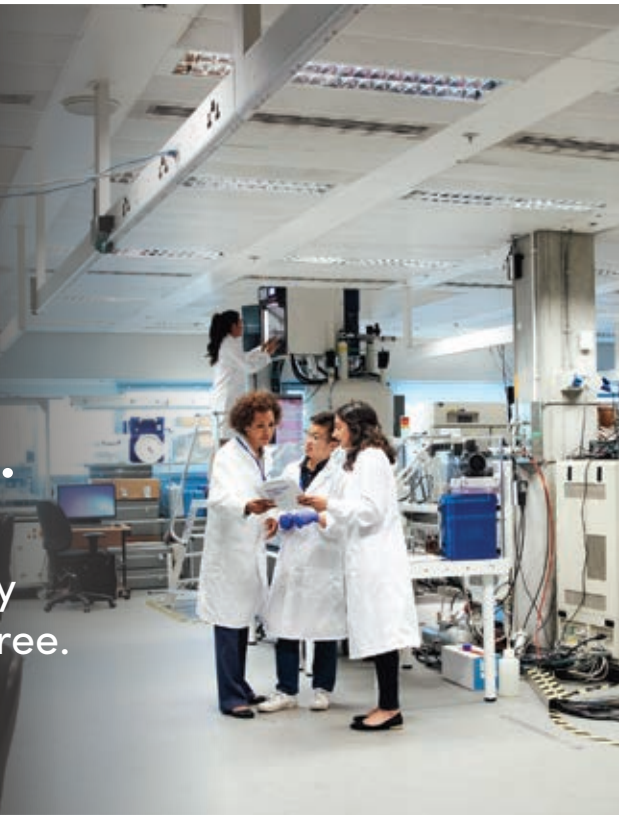
More movers?

The movement of professors from academia to industry rarely is tracked. Both Cohen and Jensen wondered, though, whether uncertainty brought about by COVID-19 might prompt professors who have the option to seek jobs in industry.

"Because of the turbulence … and the fact that schools may be changing what defines tenure and so forth, (professors) are frustrated at times," Jensen said. "I've had several searches where very senior-level professors have been expressing interest."

When they do, according to Cohen, they shouldn't expect an instantaneous transition. "People who are looking to leave academia, for whatever reason, have got their work cut out for them."

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



Meet Natasha Brooks

By Angela Hopp

NATASHA BROOKS

Natasha Brooks, a regulatory affairs manager at the government contracting company Technical Resources International, encourages young scientists to keep an open mind about where their careers might take them. "What's interesting now may not be interesting later," she said. "For example, I thought I'd just be in the lab. I would stay there for hours on end. That's what I loved to do. And then it wasn't."

Natasha Brooks is a regulatory affairs manager at Technical Resources International, a government contracting company based in Rockville, Maryland. She earned her bachelor's degree in food science at Penn State and her Ph.D. in biochemistry at the University of Texas Medical Branch at Galveston. Brooks is also a member of the American Society for Biochemistry and Molecular Biology Minority Affairs Committee.

She spoke to ASBMB Today Executive Editor Angela Hopp about her career path and offered advice for graduate students and postdocs who are trying to figure out their next steps.

The conversation has been edited for length and clarity.

Q: Where did you grow up? Tell me a bit about your early life.

I grew up in Erie, Pennsylvania. It's the most northwest corner of Pennsylvania, right near Lake Erie. I went to an honors high school, and since a very early age I've been interested in science. I participated in the Pennsylvania Junior Academy of Science. I won some scholarships and awards.

I went to Penn State and initially pursued a degree in biochemistry. However, I didn't feel that would be enough to get a job, so I pursued my B.S. in food sciences. There are a lot of opportunities nearby, like at Heinz and Unilever. Our food science program had a lot of contacts with those companies.

When I was a rising senior, I went to Cornell and did a food science summer program. I was able to work in the lab and tour some companies. I realized that I did not want to work at a company. I did a lot of summer research, and that solidified for me that I wanted to go to grad school and stay in the lab.

Q: Why did you settle on UTMB at Galveston for your Ph.D.?

They worked on tropical infectious diseases, and initially I wanted to pursue a laboratory that worked with tropical waterborne pathogens. When I was at Cornell, and at Penn State, I worked on foodborne pathogens, so it seemed like a natural fit. But at UTMB, I was exposed to other things through taking different courses. I decided that I wanted to go into biochemistry. So I circled back.

Q: As a native of Houston who often went to Galveston on a whim, I have to ask: How was it living so close to the beach?

It was a nice beach town. I liked to relax at the harbor and see dolphins, and I liked seeing the historic sites. It's definitely someplace that I could go back and live.

Q: At some point, though, Hurricane Ike hit.

Ike was a devastating hurricane for the island. We were unable to work in our offices or perform experiments. So I completely understand what grad students, postdocs and researchers are going through right now with COVID-19.

Q: Any advice for them?

Know that you'll get through it. Right now, you may not have access to the lab. But make sure you're reading and preparing so when it comes time, when you're able to enter the labs, you can finish strong.

Try to keep your morale up. One thing that helped me after Ike was running. I initially did it to lose weight, but then it became very relaxing and freeing. I did short distances at first. Each time, I was able to progress: Today I ran five miles. Oh, I did 10. I did 20. I like being able to hit those milestones. It's good to have ways to clear your mind.

Q: After Ike, your lab moved from Texas to Sunnybrook Research Institute in Toronto. Were you near the end of your Ph.D. at the time?

I was. I think I had two years left. My PI said, "Well, we're moving the lab to Toronto. You can come, or we can find you another lab." By then, I'd been in grad school for four years and wasn't interested in starting over. I decided to go. Plus, it's only about four hours away from my hometown.

Q: You spent a lot of time while pursing your Ph.D. working on your writing skills. What sorts of things did you do?

I would take so much time to read papers, and I loved it. It really helped me craft my experiments. I knew what I would need, how to develop assays

"At Alliantgroup, we had to write technical reports after we finished doing a research and development tax credit, so if a company ever was audited we could prove why they should have gotten this tax credit."

and plan my experiments. My PI gave me opportunities to write small, one-page papers for his professional society, and I reviewed papers by postdocs and medical fellows. And I did my own writing. I found my niche there. I took time after I graduated to look at other careers, but I knew I wanted to do writing.

Q: When you graduated, you went back to Texas to work at the Shriners Hospital for Children in Galveston as a medical staff research services coordinator. What was that like?

There was a lot to it. I helped write protocols and consents for clinical studies. Some protocols had to be reviewed by the Food and Drug Administration, so I learned, early on, the types of concerns the FDA might have with a study and how to answer said concerns so the study can move forward.

I did a bit of budgeting for the studies to make sure we weren't over budget and we had the supplies that were necessary to, for example, get blood and tissue specimens.

I also worked on new studies, making sure the staff had their credentials and training. And sometimes they'd pull me in to work on grants they were writing, because I had a Ph.D.

I worked there for about two and a half years and touched on everything. I learned a lot about clinical research.

Q: We've all seen the commercials for Shriners — they tug at the heartstrings. What did it feel like to work there?

This particular Shriners was a burn hospital. They also did some reconstructive surgeries, like cleft palates, but most of our patients had a 60% or greater burn injury. I saw a lot of resilience. As much as it tugs on your heartstrings in the commercials — that's how it really is. It's such a loving and great environment for the kids.

Shriners' nurses and doctors really care about those kids and want to see them succeed. A lot of the patients, after they're done with Shriners, stay in the Galveston area. One of them became a research technician at Shriners after she received her care.

Q: How did you decide to then go into consulting?

I learned about the business aspect of science when I was a liaison for a study that worked with a Fortune 500 company. I enjoyed the business aspect and began to look for careers that allowed me to pursue that. I went to work for Alliantgroup, a small consultancy that did research and development tax credits.

At Alliantgroup, we had to write technical reports after we finished doing a research and development tax credit, so if a company ever was audited we could prove why they should have gotten this tax credit. I enjoyed writing those reports, and I got so many compliments on how I wrote the summaries and how they were so thorough. Our legal team read these reports, and they told me, "If this ever has to go through an audit or trial, what you've written won't be in question." That solidified for me that I needed to get more into writing.

Q: People underestimate how much businesses, institutions and nonprofits need good science writing.

I started to talk to a lot of people about what they were doing in science writing, because there are so many things that you can do. There's science writing at universities. There's science writing that is regulatory. There are presentations and pamphlets for pharmaceutical or biotech companies. Some people do science advertising. If a food company wanted to add a new, healthier component and needed to communicate the benefits to laypeo-

NATASHA BROOKS

After Hurricane Ike devastated Galveston Island and the surrounding Houston metro area in 2008, Natasha Brooks took up running as a form of self-care. "I initially did it to lose weight, but then it became very relaxing and freeing," she said. Little by little, her runs got longer. Here she wears her half-marathon finisher medal and Alpha Kappa Alpha Sorority shirt with pride in Houston in 2017.

ple, a science writer would do that. I had to reach out to my contacts to see who they knew so I could talk about and understand these areas.

When I settled on regulatory writing, I decided to move back to the Northeast. There's proximity to government and a lot of biotech and pharmaceutical companies. That ultimately led me to my current position at Technical Research International.

Q: What does TRI do, generally speaking?

TRI is a contract/clinical research organization, or a CRO. We have many government contracts as well as ones with biotech and pharmaceutical companies. We provide research support, such as managing clinical trials and studies, and we provide regulatory oversight, protocol development, and management of pharmacovigilance and toxicovigilance.

Q: You've had a few jobs at TRI. What was that progression like?

I started as a medical writer on a new contract; we wrote protocols for novel cancer therapeutics. Once a grant is approved for testing a drug in a specific population, a team of writers turns that grant into a protocol. I was part of that team. Protocol writing is intimately tied to regulatory affairs. It's the first step in a continuum.

I ended up leading a small team of about six or seven writers on that program. I helped to build it and put a lot of infrastructure in place. We got great results. It really taught me a lot about management.

The company saw that I could manage a team and also save money. Some people went on to take other positions, and the company moved me into the regulatory affairs manager position.

"We're here for the entire lifecycle of a protocol. And when I say lifecycle, I mean from when the protocols are written until they are no longer in place."

Q: So what do you do now as a regulatory affairs manager on a day-to day-basis?

My team is responsible for submitting protocols to the FDA to allow patients to enroll in studies. Another team writes what we call investigational new drug applications, or INDs.

The FDA reviews these submissions to ensure the studies are safe for patients. Once they are approved, we let the National Institutes of Health know, and they tell the study teams that they can proceed.

But that's just one aspect of it. We're here for the entire lifecycle of a protocol. And when I say lifecycle, I mean from when the protocols are written until they are no longer in place.

Sometimes a protocol has a safety issue, such as side effects a patient may have from the drug they received. My team processes those documents to send to the FDA.

And if the study has gone well, the drug might be approved for a specific indication or disease.

We manage 150 to 200 investigational drug applications yearly.

Q: Where are these drugs coming from? Are they being developed at the NIH, or are they being developed elsewhere but the NIH wants to use them in studies?

Most of the time, a drug company has developed the drug. It may be one that's already on the market but not used in a specific patient type or indication. Or researchers might have used the drug in a lab and want to move it into patients. We write a protocol specific to that drug and population, and we start the paperwork so the FDA can review it, ask any follow-up questions they have and then approve the drug for use.

Q: Even longtime managers never have managed through a global pandemic. What's your approach to managing people from afar?

A lot of it is just trying to be flexible with people — understanding what their needs are and recognizing that they are human beings. You have to have compassion. You have to talk to people.

So far, we haven't had any issues in terms of people getting things done, but we had to find out what type of resources they had at their homes. Some people on my team didn't have the space to telework. Some people were dealing with other crises — maybe somebody they knew had COVID-19.

One staff member had just started as we went to teleworking. Having to train new staff, making sure they can do the work — that was completely different for me.

Q: Your path demonstrates that we all have to be willing to try things. Sometimes we get our hearts set on something and end up blind to other, even better, options.

Through all of this, I realized I can't be rigid. As you are exposed to new information, you can go in different directions. What's interesting now may not be interesting later. For example, I thought I'd just be in the lab. I would stay there for hours on end. That's what I loved to do. And then it wasn't.

Carla Harris, vice chairman at Morgan Stanley, once said that, as millennials, we're going to have maybe four to five careers — not jobs but careers. So you want to make sure that you're opening yourself to those possibilities.

Q: You are on the ASBMB's Minority Affairs Committee. What motivated you to serve?

As a scientist and a Black woman, I think that having a committee that understands the issues people face, and that can provide support and guidance, is important. I like that there are a lot of different people on the committee: people of color, women, people with disabilities.

Growing up, I was around a lot of Black and people of color who were professionals. Not everyone has that. When you see somebody who looks like you — who is a doctor, who is a scientist, who is a lawyer, who runs a business — it makes you feel like you can do it too.

Q: You did some substitute teaching and worked at a community center between undergrad and grad school. I'm seeing a theme of service and outreach here.

From an early age, my mother would take my sister and me with her to service projects. We often participated in Day of Caring with the United Way. My love of community service and outreach has continued. I have done service projects with my sorority, Alpha Kappa Alpha Sorority Inc., as well as individual projects.

A family friend who ran a community center asked if I could help run their after-school program. Many of the families that center serves don't have a lot of money or resources. And there's a large population of people who have newly come to America.

Many of my students were seniors in high school, and I would help them write their scholarship applications and essays. They told me the stories of how their families moved from war-torn Iraq or Jordan and what they had to do to come here, to learn the language, to understand the customs. There were also African refugees and people from Ukraine.

I saw, over the year, how they became more comfortable in the English language, more comfortable making friends.

I kept in contact with one student after I helped write her college application. She graduated, and she is now a director of minority affairs at a local university. To watch people grow like that was an interesting part of my journey.

And being in a classroom helps a lot with managing. You run into different personalities, learning styles and abilities. I use all those skills now: making sure projects go on time and individuals have what they need to succeed.

Q: Any final advice to share?

When you are networking, be cognizant of how you're making connections. It shouldn't be "I need a job. Help me, please." It should be "I want to learn about this position. These are the specific questions that I have."

Ideally, you keep up with these contacts so they have an investment in you. Check in every few months: "Hey, I hope you're doing well. This is what I've been up to." Cultivate those relationships so when it's time to start looking for jobs, they might say, "Hey, a recruiter called me and I suggested your name," because they know you and have a vested interest in you.

In terms of looking at different careers: Be open, be flexible and know that it's going to take some time. Enjoy the adventure.

"I kept in contact with one student after I helped write her college application. She graduated, and she is now a director of minority affairs at a local university. To watch people grow like that was an interesting part of my journey."

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

What would Julia Child do?

By Peter Kennelly

By now, you are familiar with the story. Halfway through spring semester 2020, university administrators inform instructors that the remaining portions of all courses, including labs, must be taught online. A mad scramble ensues to decide on content, delivery and testing, along with a crash course in social media. Professors everywhere ask ourselves, "How can we adapt lab exercises 6-10 to an online format?"

As the fall semester loomed, many of us faced the same challenge: to teach a laboratory course online. As I reflected on my experiences from last spring, I was struck by the similarity of my ad hoc labs to TV cooking shows — you know, the ones where the audience watches as a Julia Child wannabe chops, purees, sautés and mixes. There is never enough time for something to bake or roast, so a perfect example of the final product is hidden away to be whipped out at the end of the show, displaying for the viewers how the manipulations they just witnessed ought to turn out.

To an uncomfortable degree, the data we hand out to students in some online labs seem to be the virtual equivalent of a cooking show's final product.

I asked myself to what degree spring semester's extemporized online labs could be described as experiential. What sets a lab course apart from a lecture or demonstration? It couldn't simply be the direct interpersonal contact or participation in physical manipulations. What key element was missing? It soon struck me that separating the different steps involved in planning, preparing and performing an experiment had severed the cause–effect relationships they were intended to illuminate.

As a postdoc, I once made cookies for the lab using baking soda rather than baking powder, with embarrassing and distasteful results. My failure to apprehend that these ingredients were not interchangeable resulted in personal consequences that had a more lasting impact than if some-

COURTESY OF TIM LARSON AND PETER KENNELLY

In an online lab demonstration, Tim Larson, a biochemistry professor at Virginia Tech, shows part of an experiment students would have performed during a module involving polymerase chain reaction and gene cloning. The procedure involves ligating DNA inserts into a plasmid vector and then selecting for E. coli containing the cloned DNA using antibiotic resistance and blue–white selection. Shown are, from top to bottom,the materials needed; a page from the lab manual showing part of the procedure being followed; plating of the transformed E. coli on selective media; and colonies formed after incubating the plates overnight at 37 degrees Celsius. See full description on page 49.

one simply had corrected me as I reached for the wrong container.

Consider a class asked to devise a protocol for determining kinetic parameters for an enzyme. The instructor provides the students with a range into which the parameters will fall. One student might select concentrations for the variable substrate that all fall in the saturating range. Normally, upon executing their protocol in person, this student would be confronted by the realization that something was amiss. After reflection and discussion, they could amend the protocol and try again.

In last spring's online environment, however, I would have given the student written feedback on their protocol but then handed them authentic data collected the previous semester by students who used appropriate substrate concentrations. By so doing, I deprived my online students of the vivid, consequential necessity of figuring out what went wrong — and the direct, tangible affirmation of generating viable results.

More than the lack of sensory and mechanical experiences of processes, such as pipetting, weighing, pH-ing and centrifuging, I would argue that our tendency to compartmentalize individual steps, thereby severing the causal connections between student decisions and future outcomes, represents the most important pitfall in online laboratories. In other words, it is not the analysis of data that constitutes the cornerstone of experiential learning; it is the dynamic, interactive process of decision, outcome and revision leading to reliable, interpretable data.

So how can we design practical online labs that enable students to experience the consequential, causal links characteristic of our best in-person labs? In a limited number of cases, manipulations planned by the students can be executed by proxy, by the instructor or teaching assistants. Cloning, for example, probably can be done this way; we could order primers designed by the students from a vendor, run PCR reactions in parallel and send the images of the resulting agarose gels to the students. We then could prepare ligation mixtures and plate the mixtures according to the students' instructions, with the resulting petri dishes photographed and forwarded to them.

In many other cases, it should be possible to provide virtual results. Given the protocol for generating a standard curve for, say, a bicinchoninic acid assay, the instructor can examine one of the standard curves on file and report back to the students the absorbances obtained. Similarly, enzyme kinetic data can be generated from known Vmax and Km values.

The extra burden on faculty, teaching assistants and staff and the back-and-forth exchanges of instructions, data and feedback between instructors and students likely mean that online versions of these labs will require more time to complete than the in-person versions. Moreover, not all labs can adapt to such a model. However, I would argue that even if we must reduce the total number of topics or techniques covered during a semester, the experiential richness of causally connected online labs will make them well worth the effort.

About the experiment

The photos on page 48 depict an experiment exploring why a particular restriction fragment of phage lambda DNA is resistant to cloning in E. coli. For example, does the segment encode something toxic to the bacteria? The instructor, Tim Larson, screened smaller pieces of the restriction fragment, generated by polymerase chain reaction, including some with mutations in putative promoter regions. The DNA fragments were incubated with a plasmid vector along with DNA ligase, and the contents of the ligation reaction mixed with competent E. coli. During this process, only some of the bacteria took up the plasmid vector, and only a portion of these plasmids contained the piece of DNA the instructors wished to clone, called an insert. To select for those few E. coli that took up the plasmid, and to then determine which ones contained an insert, the bacteria were plated onto agar containing antibiotics as well as an inducer known as IPTG and a reporter substrate known as X-Gal. Only those E. coli that took up the plasmid would grow and form colonies on the plate. Among these, those lacking the insert appeared blue on the IPTG/X-Gal plate. Those containing the insert appeared white.

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What is success for women in STEM?

A conversation with Marilee Benore and Rana Dajani

By Comfort Dorn

Two female biochemists on opposite sides of the planet found a common interest in supporting women in STEM. Here they share their stories, experiences, how they connected and how they are combining their science experiences with the traditional methods of social scientists to enact change.

COURTESY OF MARILEE BENORE

Marilee Benore participated in a climate march in Versailles, France, when she was working on her interview project about a year ago.

Talk about your early interests and influences.

MARILEE: Most of my science and math teachers were nuns, and I was a Girl Scout, so I always assumed that women were a big part of science and could be in charge. I loved biographies, books about clever girls and superhero comics; there was never any doubt I could choose what I wanted to do with my life — and I chose science.

RANA: I spent many evenings with my father reading Scientific American and National Geographic and discussing the latest advances in science. This led me to want to be a scientist and pioneer — to explore the world around me to discover the magic and wonder of nature.

I got a thrill from understanding how molecules interact. Organic chemistry and biochemistry classes were heaven. I was enthralled and awed studying these topics. I would write poetry during the exam because of the elation I felt.

MARILEE: In high school, I coached grade school girls basketball and volleyball, and while I lacked athletic talent, I was a good coach and enjoyed supporting young women.

My college required a focused minor with a thesis, so I selected women's studies. I did volunteer work and wrote for an underground feminist newsletter. I convinced my advisor to let me direct a community outreach project for women instead of writing a research paper.

RANA: I grew up in a family of eight girls. I was the eldest. My parents chose not to have a TV and instead focused on human interaction. We spent our time reading novels, role playing and debating. This trained me in critical thinking, how to engage and convince and how to ask questions. I grew up as a Muslim, and I learned by living Islam to be critical, to use my mind and to question. I learned that it was okay to be wrong and we can only learn from our mistakes.

How did your education and careers evolve?

MARILEE: I studied chemistry, but after a stint in the manufacturing industry exposed me to some ugly sexual harassment, I returned to grad school.

RANA: My father was a physician, and I was the eldest and smart so it was the natural thing that I would be one too, but I chose not to be a physician, because I was afraid I might harm someone by mistake. I became a scientist because scientists find out what causes disease and can help humanity.

There were no Ph.D. programs in Jordan, and although I was accepted to Cambridge University, I was unable to go for financial reasons. I became a teacher and introduced young students to the magical world of science, but in my heart, I wanted to be a scientist.

MARILEE: I took a teacher/scholar position at a primarily undergraduate college so I could combine research, teaching and mentoring. I created a Girl Scout summer day camp with other female science, technology, engineering and math faculty, but outreach was not yet valued, and my senior colleagues pressed me to prioritize research in order to be tenured.

RANA: When I got the chance to apply for a Fulbright scholarship, my husband, who was a lieutenant colonel in the Jordanian air force, resigned so we could go as a family to the U.S. I involved my children in my research and asked for their opinions about the data. They were part of my journey and success.

MARILEE: As soon as I was tenured, I expanded my teaching into interdisciplinary coursework and developed classes in diversity, inclusion and gender in science and engineering, although my teaching focus is still primarily biochemistry.

UNHCR/EVELYN HOCKSTEIN

Rana Dajani is photographed in a laboratory at the University of Richmond, Virginia.

RANA: I returned to Jordan to establish my own lab, aiming to do state-of-the-art research with minimal resources. I took a long time to find the right question. My lab today is the world leader on the genetics of the Circassian and Chechan populations.

At one point, I realized that women scientists don't have time to network after hours, so I developed a mentoring program called "Three circles of alemat" ("alemat" means "female scientist" in Arabic). The program has a holistic approach that is personal and professional and is very easy to implement.

My motto is, "A scientist sees what everybody sees but thinks what no one has thought."

Talk about your recent work.

RANA: When I introduce myself, I like to say that I play five roles in my life or I wear five hats — but I don't wear a hat, I wear a scarf, so I say I wear five scarves. My roles include being a mother, a teacher, a scientist and a social entrepreneur.

My fifth scarf I did not choose. A few years ago, an organization in Britain chose me as one of the 20 most influential female scientists in the Islamic world — that's 1.6 billion people. They gave each of us 20 a title: The cardiologist, the mathematician … and I was the "Islamic feminist."

At first, I said, "No, you can't do that," because when you say Islamic, the Western world looks at me skeptically, and when you say feminist, the Eastern world looks at me skeptically, and I end up with nothing. I asked them to change it, and they responded, "No, Rana, what you write about, what you reflect and what you stand for is your title." Since then, I've been on a journey or pilgrimage to redefine what that means and own it rather than letting it own me.

I embarked on a journey to interview female scientists from around the world to understand better the challenges they face in their careers. I created a list of questions to unpack the root cause of having fewer women scientists. I then expanded the interviews to include women in senior career positions across disciplines, sectors, cultures and religions.

Marilee Benore is a professor at the University of Michigan–Dearborn and studies vitamin transport. She was a founding regional director and former chair of American Society for Biochemistry and Molecular Biology Student Chapters, has served on the society's Education and Professional Development Committee, and is a member of the Women in Biochemistry and Molecular Biology Committee.

Rana Dajani is a professor at Hashemite University in Jordan and author of the book "Five scarves: Doing the impossible — if we can reverse cell fate why can't we redefine success." She organized the first gender summit for the Arab world in 2017.

With the support of an Eisenhower fellowship, I interviewed more than 100 women in the U.S.; then I expanded my reach to interview women in Europe, India, China, South America and Africa. The answers all were the same. Women try to mold themselves to the existing white male framework rather than creating their own framework based on their priorities and needs. This applied not only to women but to all minority groups.

MARILEE: I am in what I call the third third of my life. I spent the first 30 years gaining the education and experience I needed and the next 30 happily doing research and teaching. Now I want to focus on a topic with which I can continue to give back to science, and I decided that an under-studied area was why some women persist in STEM while others leave. Much past research was identifying and changing negative behaviors that exacerbate the leaky pipeline. I thought an opportunity to hear from successful women would be heartening.

I knew that oral history research could provide insight into behavior. I began outlining and learning the psychology and anthropology I needed to conduct surveys and interviews to gather stories from successful women.

How did you hear about each other?

MARILEE: While seeking collaborators, I kept coming across the name of Rana Dajani, who had done similar video work as a Harvard Radcliffe fellow. I sent her a copy of my proposal, and she said it was like talking into a mirror. I was so excited.

RANA: When I received this email from Marilee, it was so wonderful to find someone who had the same ideas and intuition and reflections. We came from opposite parts of the world, yet we both had reached the same conclusions concerning women in science. This points to the universality of the challenges women face, how much we have in common and how we should work together to change mindsets.

MARILEE: I had been feeling a bit unsure of the value of the work, so having Rana confirm the need was precious to me. We began to communicate. Rana came to the U.S. at the same time I went to Europe to begin gathering my oral histories.

RANA: We want to use our scientific minds and skills to approach this problem just as we do with any scientific problem or challenge. We want to learn from each other and build on that learning to create a better world for future generations.

What have you learned so far?

MARILEE: In France and Romania, I met professional women and heard their stories through surveys, phone calls and videos. A few things are clear: Women stay in STEM for many distinct reasons, often personal, but many do not feel as successful as you might expect given their positions in top universities and labs.

Self-efficacy is linked to success, and role models and stories are linked to self-efficacy. My early data indicate that over 80% of the women respondents rated stories about women as significant or important to them. This agrees with Rana's findings that women too often try to fit the wrong mold. I want to continue to conduct surveys and oral histories, find the threads of persistence, and share the stories so others can gain from the insight and experiences of successful women.

RANA: As a scientist, I approach this challenge with the

scientific method. When I look around me, in Jordan and in the Arab world, I find a higher percentage of women than men in the STEM fields, at least in undergraduate and graduate education. Maybe there's something here that the West can learn from us: How do we get more women into STEM compared to the West?

The challenges women face are similar all over the world regardless of culture, religion and background. The problem is that the workplace was designed by men for men — and when women entered the workforce, they didn't change it. They tried to mold themselves to fit it because they assumed that was the only way of success.

I want to propose a paradigm shift, actually asking women what they really want.

MARILEE: Ensuring that all people interested in STEM have ample opportunities to have successful careers is critical for equity and the economy. Education and professional development should be supportive and inclusive; a lack of encouragement and support creates inequity.

Rana points out the number of women in STEM is 50% in some nations — nearly double the U.S. stats — suggesting we can do better.

Why is this work important to you?

MARILEE: I enjoy science so much I want everyone who loves it to have the opportunity to learn, become a scientist or engineer, or even be a citizen scientist. We can only accomplish that if we know what we are doing right, or wrong, to encourage STEM learning and appreciation.

RANA: We owe it to future generations to tell them who we are, to give them role models from us and within us.

I'm a scientist, so I get to put science into everything. This reminds me of the butterfly effect. If each one of us can do one small thing in changing ourselves, changing our family, changing our community, then we can create a change that spreads all over the world.

It starts with you, you know. You owe it to humanity, you owe it to yourself. So go out there, be the change, be the butterfly.

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

More thoughts on folding and form

By Maurizio Brunori & Arianna Brunori

We were pleased to read Sudha Neelam's pleasant and stimulating essay, "The art of paper folding and the science of protein folding," in ASBMB Today.

Outlining the similarity between an origami and a folded protein is quite popular, since in both the form combines beauty and functional relevance. In both cases, the mechanism of folding to achieve the final state is complex. This similarity has been taken further to highlight that a misfolded origami mimics in some way a misfolded protein seen at the onset of neurodegenerative diseases that develop via irreversible population of an amyloid state by extensive misaggregation.

JAWAHAR SWAMINATHAN/ EUROPEAN BIOINFORMATICS INSTITUTE

We should, however, recall one difference between folding a paper sheet and a polypeptide chain, a difference that is of fundamental significance.

The complex course of action to fold a paper sheet to produce origami of a chosen shape demands that precise information be injected in the procedure by an operator (in this specific case, Nihkil, the son of the writer Sudha Neelam). The order of guided steps is essential to overcome the loss of entropy coupled to the creation of an ordered object, such as a classical origami sculpture.

JÖRG BITTNER UNNA/WIKIMEDIA COMMONS

DANIEL ÁLVASD/UNSPLASH

In the case of folding a complex 3D structure starting from one disordered polypeptide, the information guiding the series of events/chemical steps leading to the globular protein is imprinted within the amino acid sequence. The primary structure itself is also the code carrying the instructions on how to fold in water and thereby the information to overcome the huge, unfavorable entropy loss.

In water, the amino acid sequence of a protein conforms beautifully to Aristotle's definition of substance, the intimate ensemble of matter and form (in Greek: "synolon"), insofar as the amino acid sequence contains in itself the reason for becoming what it is (in Latin: "substantia causa sui"). In this respect, we can compare the amino acid sequence to the marble block as seen by Michelangelo Buonarroti. In Michelangelo's view, the artist need only bring into actuality the form that already lies in the marble block by chiseling away the superfluous material.

Likewise, as shown by Nobel laureate Christian Anfinsen, the amino acid sequence embeds from the beginning the properties that will characterize the protein in the final functionally competent native state, needing only water to pass from potentiality into actuality.

Arianna Brunori (arianna.brunori@sns.it) is a Ph.D. student in medieval philosophy at the Scuola Normale Superiore di Pisa. Follow her on Twitter @BrunoriArianna.

Maurizio Brunori (maurizio.brunori@uniroma1.it) is emeritus president of the National Academy of the Lincei and professor emeritus at the Sapienza University of Rome.

"Your diagnostic is only as good as what you understand about a disease"

By Laurel Oldach

5 QUESTIONS WITH RENEE YURA

Pfizer diagnostic expert Renee Yura oversees diagnostic test development that helps to target drugs to the people who will benefit most from them — including, this year, supporting Pfizer's COVID-19 response. Yura carved out some time to tell ASBMB Today about her work. This interview has been condensed and edited.

1 What do you do as a team lead in diagnostics?

We meet diagnostic needs for different drug programs at Pfizer. Personalized medicine has become more and more common; if you develop a drug that will only work for certain patients, you need a test that will identify them. When a test is essential for the safe use of a drug, it's developed in phases similar to the drug development process.

2 Are tests and therapies often developed simultaneously?

That's the ideal path. Ideally, when you take a drug into a first-in-human study, you have the biomarker you'd like to translate into a diagnostic and a guess about how much of it someone needs to respond properly. That's a hypothesis you'll go in with, and you see if it holds true as you generate clinical trial data.

3 One project you were especially proud to work on?

Anytime anything comes to market, it's super exciting — for every one that does, there are five that don't. I was excited to work early in my career on developing a polymerase chain reaction panel for several respiratory pathogens. Now, in the age of SARS-CoV-2, Pfizer has work going on in the vaccine and treatment space, and it's critical to understand the quality metrics around diagnostics on the market.

I've heard people say COVID-19 diagnostics don't work. A lot of them actually should work very well; the thing is, your diagnostic is only as good as what you understand about a disease. If you're collecting the wrong sample, the world's best diagnostic test might give an incorrect result.

4 What got you into diagnostics?

I got into it by chance. I graduated in 2008 — the economy was horrible. I kept applying for jobs and thought, "What's wrong with me?" because no one was biting.

I heard about a three-month contracting position at Johnson & Johnson and just jumped at it. I would have taken a job scrubbing the floors at Johnson & Johnson! That turned into a one-year contract, then a permanent position, that happened to be in diagnostics.

5 Anything you wish you'd known about working in industry?

There are a lot of ways to be close to the science without having to do the science. You can do patient advocacy, commercial work, or get a law degree and then do patent law. I didn't know that 90% of those jobs existed. If people had access to that information earlier, it would help them plan better.

Renee Yura

CURRENT POSITION
Director, nononcology diagnostics, Pfizer

DEGREE
Ph.D., Penn State, 2008

FIRST JOB OUTSIDE OF ACADEMIA
Scientist I, Johnson and Johnson

FAVORITE MOLECULE OR PROTEIN
Meprin, which reminds her of graduate school. "It's funny that you could have nostalgia for a protein."

Read an extended version of this interview at asbmb.org/asbmbtoday.

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

ASBMB

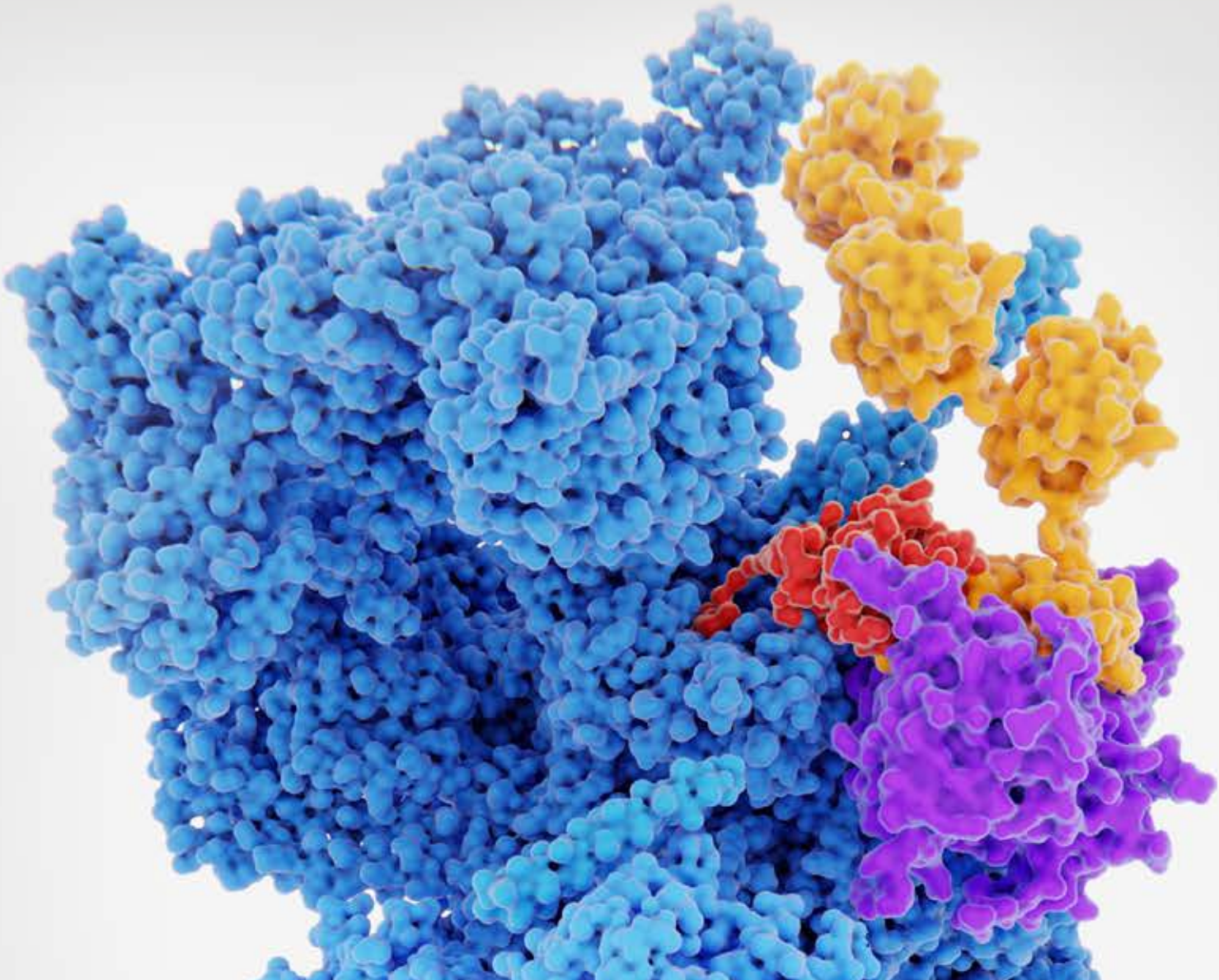
Proteinases and their inhibitors

Feb. 24–26, 2021

This meeting covers diverse and vibrant fields of protease research, such as mechanistic studies on proteases in their molecular, cellular and organismic context. Sessions include proteolysis in cancer; proteolysis in neurosignaling and neurodegeneration; proteolysis in blood coagulation; discovery of protease substrates; mechanisms and engineering of proteases, ligases, their substrates and inhibitors.

Abstract submission deadline: Jan. 11, 2021

Submit your abstract and register at:
asbmb.org/meetings-events/proteinases-and-their-inhibitors



CLASSIFIEDS

Production Technician, Downstream Process Development

New England Biolabs

New England Biolabs, Inc. (NEB) is seeking an energetic and highly motivated Production Technician to join Downstream Process Development in establishing robust production processes. The qualified candidate will support the fast-paced, multi-faceted team by executing laboratory procedures including operation of an array of cutting-edge processing equipment.

Primary Responsibilities:

- Set-up, operate, and sanitize processing equipment
- Compose solutions and media to support process development
- Operate and troubleshoot liquid chromatography, automated liquid handling and capillary electrophoresis systems
- Take in-process measurements and perform quantitative and qualitative biological and chemical analytical tests
- Assist downstream processing in development and manufacturing efforts
- Follow established protocols while maintaining accurate records within an electronic notebook

careers.asbmb.org/job/production-technician-downstream-process-development/55022997/

Post-Doctoral Scientist — Protein Design & Functional Mapping

Zoetis Inc.

The Protein Therapeutics group is seeking a talented and experienced computational modeler / protein engineer to contribute to our efforts in Global Therapeutics Research at Zoetis. The Protein Therapeutics group partners with therapeutic areas and project teams to design and engineer novel biotherapeutics and build robust testing funnels for a variety of therapeutic approaches to improve diseases in companion animals as well as livestock species.

The successful candidate should have knowledge of antibodies and/or protein interactions and relevant experience with machine learning & bioinformatics approaches, in silico protein homology models, protein docking, and epitope mapping. Experience with and understanding of peptide design, protein design and engineering, biochemistry, and protein characterization is preferred. Excellent communication, organizational and interpersonal skills are essential. Some travel required depending on location of candidate.

careers.asbmb.org/job/post-doctoral-scientist-protein-design-functional-mapping/55016224/

Senior Associate Scientist/ Scientist Analytical Development

Obsidian Therapeutics

Obsidian Therapeutics is pioneering controllable cell and gene therapies to deliver transformative outcomes for patients with intractable diseases. We are looking for a scientist with a strong background in analytical development to contribute to building Obsidian's analytical sciences capabilities for process and product characterization within the Technical Operations department driving the development of the first autologous cell therapy product in our pipeline targeting cancer. You will be a vital part of helping to achieve Obsidian's vision by collaboratively translating innovative science into medical breakthroughs for patients.

The Senior Associate Scientist/ Scientist in Analytical Development is a key role within our Technical Operations function and will be responsible for assisting with establishing the company's analytical sciences capabilities. The individual in this role will work collaboratively with the Manufacturing, Process Development, Regulatory, and Quality functions to develop analytical tools for the characterization of viral vectors and cell therapy products to support Obsidian's clinical pipeline.

careers.asbmb.org/job/senior-associate-scientist-scientist-analytical-development/55023232/

Senior Scientist

The Ford Agency

The Ford Agency is spearheading a search for a Senior Scientist to join a DC based consulting firm. The Scientist will oversee scientific projects, draft submissions to regulatory agencies, and provide scientific support to clients regarding risk assessment and regulatory issues as they relate to product safety. The successful candidate will have a strong toxicology and/or chemistry background, including both lab and risk assessment experience. This is a terrific opportunity for a toxicologist or a chemist looking to make a transition from a laboratory or academic environment into a consulting culture.

Responsibilities Include:

- Lead scientific projects for multi-stakeholder groups
- Respond to scientific and technical inquiries from clients
- Research and develop data submissions to multiple regulatory bodies
- Produce safety and risk assessments evaluations for regulatory agencies
- Write and edit articles for several peer-reviewed journals
- Evaluate and oversee study protocols

careers.asbmb.org/job/senior-scientist/55023306/

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

ASBMB
American Society for Biochemistry and Molecular Biology

Thank you for being an ASBMB member!

Over the past 100 years, the ASBMB has grown and changed with the times to become the supportive community of discoverers that it is today.

ASBMB members are driven to better understand what makes life work. With patience, perseverance and insatiable curiosity, and through collaboration and hard work, we seek to uncover the secrets of life.

Thank you for your membership.

If you need to renew your ASBMB membership, you can do so here:

society.asbmb.org/SignInRenew