

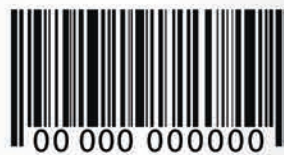
ASBMB TODAY

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

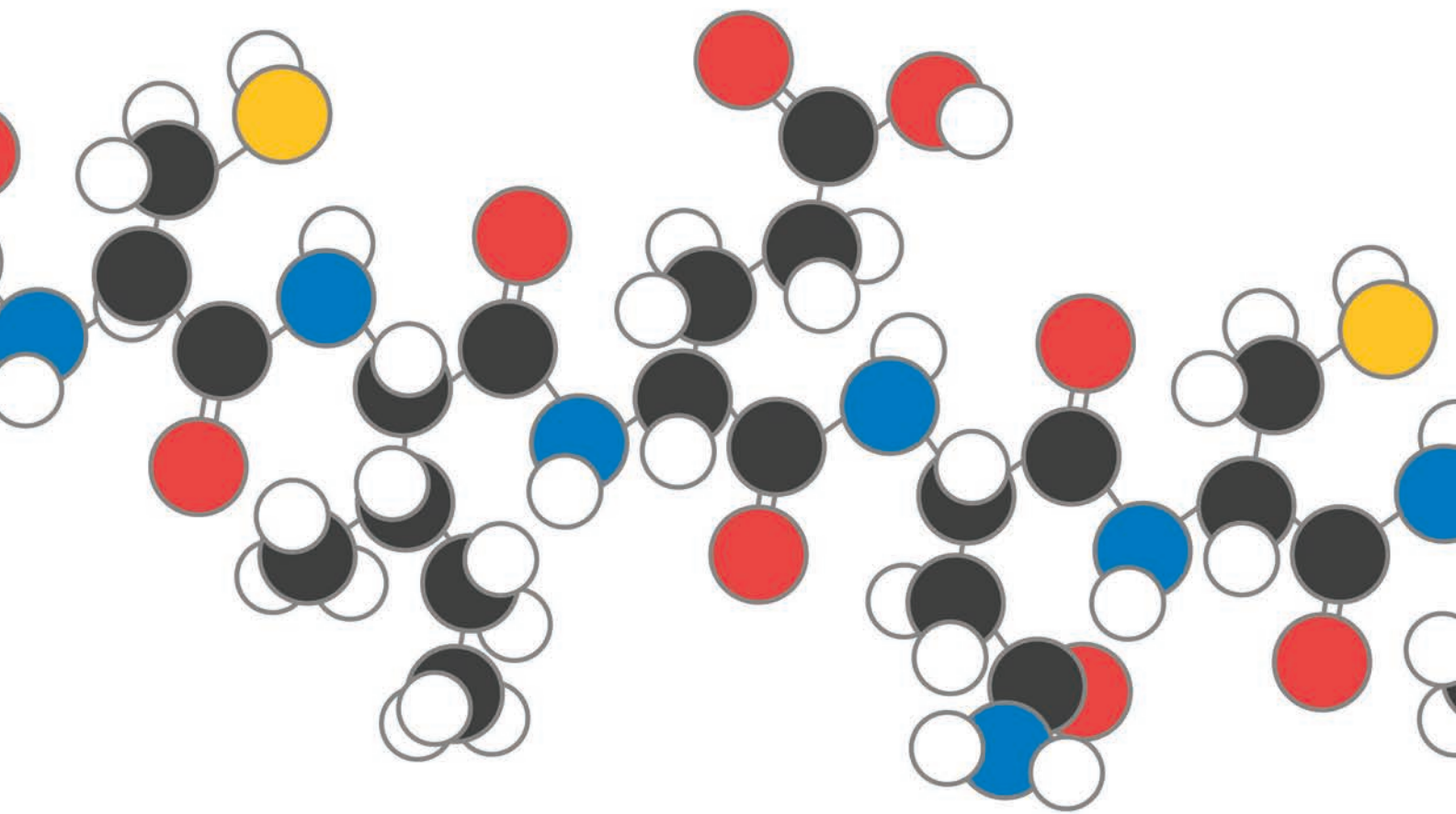


MAKING

O



DONATIONS ARE DOWN.
TRANSFUSIONS ARE DOWN.
DEMAND FOR ONE TYPE
REMAINS UNDIMINISHED.



Best wishes in 2019!

Together, we'll continue to advocate for science,
connect researchers around the world
and build a bright future for biochemists
and molecular biologists everywhere.

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 **ASBMB**
American Society for Biochemistry and Molecular Biology

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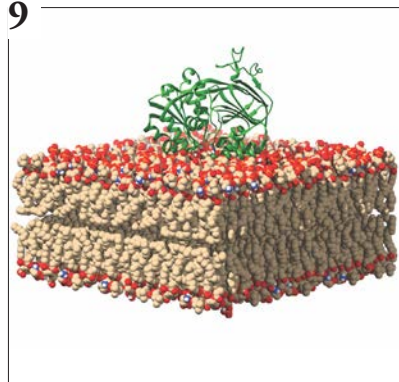
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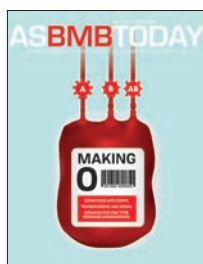
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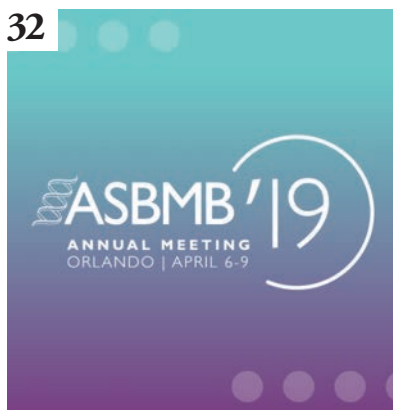
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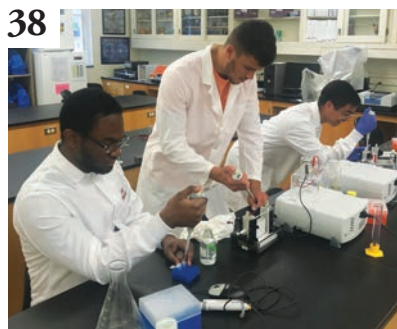
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PRINT ISSN 2372-0409

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EDITOR'S NOTE

Vital fluids

By Comfort Dorn

You never know what you'll turn out to have in common with your co-workers; science writer John Arnst and I bonded over selling our blood plasma.

Plasma, the yellowish fluid in which blood cells and platelets are suspended, is essential for treating trauma patients and those with a number of other medical conditions. It's needed in such large quantities that people get paid for it — though you aren't technically being paid for the fluid; you're being compensated for the hour or so that you spend lying in a padded lounge chair with a big needle stuck in one arm. A healthy person can donate about three cups of plasma twice a week. When I did it, my time was worth about \$30 a pop.

In that hour, a whirling machine separates the plasma from everything else in a process called apheresis and returns the blood cells and platelets to your arm. The machine is mostly clear plastic tubes and cylinders, so you can watch the process, which repeats about six times per donation, and monitor the slow drip of plasma into a plastic bottle. When it's over, a pint of saline gets pushed into your arm to restore the fluid level.

Unlike blood donation, selling plasma is not an altruistic activity. It's about the dollars on a debit card. John said he did it for about six weeks right after he graduated from college. I was an underpaid newspaper editor and single mom when I sold my plasma off and on for about a year, long enough for my arms to develop some suspicious marks and for my iron levels to dip perilously a couple of times.

While reclining in that lounge



ANKAWÜ/WIKIMEDIA COMMONS

chair, I thought a fair amount about the marketing of bodily fluids, so when John mentioned Stephen Withers' efforts to turn other blood types into O and its possible impact on the blood donation industry, all my old questions came back: Why do people get paid to donate plasma but not blood? If people give their blood for free, why does it cost so much when you get a transfusion? How do blood banks persuade enough people with the right types of blood to donate?

I was not the first person to think about this. Just Google "selling blood" and numerous articles on the topic pop up.

John writes that the blood industry is in trouble. Can it be saved by science? We don't have an answer to that question, but our February feature story certainly lays out the issues and explains how blood (both industry and science) got where it is today. It's a good read.



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

Member update

By Erik Chaulk

Garg named endowed chair

Neil Garg, a chemistry professor at the University of California, Los Angeles, has been selected as the inaugural Kenneth N. Trueblood endowed chair in chemistry and biochemistry.



GARG

Founded in 2017, the chair was established in part by a gift from the estate of the late UCLA professor Ken Trueblood and his wife, Jeanie Trueblood.

After joining the UCLA faculty in 2007, Garg was promoted to associate professor in 2012 and full professor in 2013. He served as vice chair for the department of chemistry and biochemistry from 2012 through 2016. His research focuses on developing novel methods for synthesizing organic molecules.

Outside the classroom, Garg has developed several educational tools, including an app called “Backside Attack” that teaches organic chemistry and “The Organic Coloring Book,” which he self-published, to introduce children to organic chemistry concepts.

Moore honored for mentoring

Kathryn J. Moore has received the 2018 Mentor of Women Award from the American Heart Association.



MOORE

Sponsored by the AHA’s Council on Arteriosclerosis, Thrombosis and Vascular Biology, the award is presented to a member

of the council who has demonstrated excellence in supporting the careers of women in those three fields.

Moore is a professor of cardiology and cell biology at the New York University School of Medicine. At her lab, her research focuses on understanding the innate immune system and microRNAs in the regulation of lipoprotein metabolism and atherosclerosis.

Since 2014, Moore has served as an associate editor for the *Journal of Lipid Research*.

The award was presented at the Vascular Discovery: From Genes to Medicine Scientific Sessions 2018 conference, held in May.

HUPO council members elected

Five members of the American Society for Biochemistry and Molecular Biology are among the newest



HILL



MORITZ



VITEK

members elected to the Human Proteome Organization council. They are:

- Michelle Hill of the Berghofer Medical Research Institute, Queensland, Australia
- Robert Moritz of the Institute for Systems Biology, Seattle (HUPO vice president, re-elected to the council)
- Olga Vitek of Northeastern University, Boston
- Lennart Martens of the Univer-

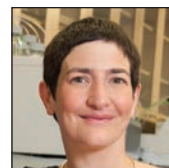
sity of Ghent-VIB, Belgium

• Anne-Claude Gingras of the Lunenfeld-Tanenbaum Research



MARTENS

Institute, Toronto, Canada



GINGRAS

Founded in 2001, HUPO is an international scientific organization that promotes proteomics by aiding in the development of new technologies and techniques to understand human disease better.

The HUPO Council consists of up to 48 scientists who represent the three global regions, Asia/Oceania, Europe/Africa, and North/South America.

The new members’ council terms last three years, from January 2019 through December 2021.

Bennett receives breakthrough prize

C. Frank Bennett, senior vice president at Ionis Pharmaceuticals, is among the nine recipients of the 2019 Breakthrough Prize in life sciences.



BENNETT

Bennett shares the prize for developing Spinraza, an effective antisense oligonucleotide

therapy for children with spinal muscular atrophy.

Bennett and the other recipients were honored at the Breakthrough Prize ceremony, known as the “Oscars of Science,” in November.

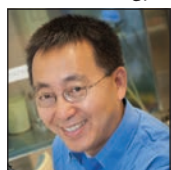
Founded in 2013 and sponsored by Sergey Brin, Priscilla Chan and

Mark Zuckerberg, Ma Huateng, Yuri and Julia Milner, and Anne Wojcicki, the Breakthrough Prizes recognize achievement in life sciences, fundamental physics and mathematics.

The 2019 recipients shared a total of \$22 million for their discoveries.

Liu named department chair

Xiaoqi Liu has been named chair of the department of toxicology and cancer biology at the University of



LIU

Kentucky.

Liu is a biochemist who seeks to develop new cancer therapies by exploring the molecular mechanisms that cause cancer. His research focuses on the enzyme Pololike kinase 1, which plays a central role in many types of cancer.

Liu's lab will be moving into the university's new \$265 million research

building, which opened in 2018.

Liu was previously a professor of biochemistry at Purdue University. He also served as the leader of the Cell Identity and Signaling Program, a research group at Purdue focusing on basic cancer research.

In memoriam: John Vournakis

The American Society for Biochemistry and Molecular Biology recently learned that biochemist and biotech executive John Nicholas Vournakis passed away Jan. 17, 2018. He was 78.



VOURNAKIS

Vournakis was born Dec. 1, 1939,

in Cambridge, Ohio, to Nicholas John and Pota Vournakis. He received his B.S. at Albion College in 1961 and his Ph.D. in physical biochemistry in 1968 from Cornell University.

After obtaining his Ph.D, he was a research fellow first at the Massachusetts Institute of Technology and later at Harvard.

His first tenured position was in 1973 at Syracuse University, where he served on the faculty for 12 years as a professor of biology. He later joined Dartmouth College as a professor in 1985.

Vournakis also was involved in several biotechnology companies. He was vice president for startup companies Verax and Genmap. He additionally co-founded Marine Polymer Technologies and Admune Therapeutics, which developed therapeutic drugs to treat cancer.

He is survived by his wife, Karen, and his son, Christopher.

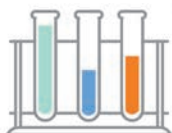


Erik Chaulk (echaulk@asbmb.org) is a peer-review coordinator and digital publications web specialist at the ASBMB.

Upcoming ASBMB events and deadlines

- FEB**
- 1: DEUEL abstract deadline and registration closes
 - 1: Annual meeting outstanding Student Chapters award deadline
 - 4–8: Communications Winter Course begins
 - * 8: Hill Day applications close
 - 24: Catalyst Conversations for Undergraduate Educators
 - 26: Evolution and Core Processes in Gene Expression oral abstract deadline
 - 28: **Rare Disease Day**

- MAR**
- National Endometriosis Awareness Month**
 - 1: Award nominations open
 - 5–8: ASBMB-Deuel meeting
 - 14: Evolution and Core Processes in Gene Expression early registration deadline
 - 16: North Central Networking Workshop
 - 22: Evolution and Core Processes in Gene Expression poster deadline
 - 28: Hill Day



For February, it's iron — atomic No. 26

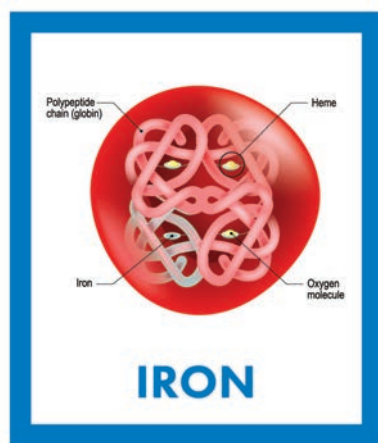
By Quira Zeidan

We are celebrating the 150th anniversary of Mendeleev's periodic table by highlighting one or more chemical elements with important biological functions each month in 2019. For January, we featured atomic No. 1 and dissected hydrogen's role in oxidation-reduction reactions and electrochemical gradients as driving energy force for cellular growth and activity.

In February, we have selected iron, the most abundant element on Earth, with chemical symbol Fe (from the Latin word "ferrum") and atomic number 26.

A neutral iron atom contains 26 protons and 30 neutrons plus 26 electrons in four different shells around the nucleus. As with other transition metals, a variable number of electrons from iron's two outermost shells are available to combine with other elements. Commonly, iron uses two (oxidation state +2) or three (oxidation state +3) of its available electrons to form compounds, although iron oxidation states ranging from -2 to +7 are present in nature.

Iron occurs naturally in the known universe. It is produced abundantly in the core of massive stars by the fusion of chromium and helium at extremely high temperatures. Each of these supergiant, iron-containing stars only lives for a brief while before violently blasting as a supernova, scattering iron into space and onto rocky planets like Earth. Iron is present in the Earth's crust, core and mantle, where it makes up about 35 percent of the planet's total mass.



Hemoglobin is a tetramer that consists of four polypeptide chains. Each monomer contains a heme group in which an iron ion is bound to oxygen. In iron-deficiency anemia, the heart works harder to pump more oxygen through the body, which often leads to heart failure or disease.

Iron is crucial to the survival of all living organisms. Biological systems are exposed constantly to high concentrations of iron in igneous and sedimentary rocks. Microorganisms can uptake iron from the environment by secreting iron-chelating molecules called siderophores or via membrane-bound proteins that reduce Fe^{+3} (ferric iron) to a more soluble Fe^{+2} (ferrous iron) for intracellular transport. Plants also use sequestration and reduction mechanisms to acquire iron from the rhizosphere, whereas animals obtain iron from dietary sources.

Once inside cells, iron associates with carrier proteins and with iron-dependent enzymes. Carrier proteins called ferritins (present in both prokaryotes and eukaryotes) store, transport and safely release iron in areas of need, preventing excess

free radicals generated by high-energy iron. Iron-dependent enzymes include bacterial nitrogenases, which contain iron-sulfur clusters that catalyze the reduction of nitrogen (N_2) to ammonia (NH_3) in a process called nitrogen fixation. This process is essential to life on Earth, because it's required for all forms of life for the biosynthesis of nucleotides and amino acids.

Some iron-binding proteins contain heme — a porphyrin ring coordinated with an iron ion. Heme proteins include cytochromes, catalase and hemoglobin. In cytochromes, iron acts as a single-electron shuttle facilitating oxidative phosphorylation and photosynthesis reactions for energy and nutrients. Catalase iron mediates the conversion of harmful hydrogen peroxide to oxygen and water, protecting cells from oxidative damage. In vertebrates, the Fe^{+2} in hemoglobin is reversibly oxidized to Fe^{+3} , allowing the binding, storage and transport of oxygen throughout the body until it is required for energy production by metabolic oxidation of glucose.

Living organisms have adapted to the abundance and availability of iron, incorporating it into biomolecules to perform metal-facilitated functions essential for life in all ecosystems.



Quira Zeidan (qzeidan@asmbm) is the American Society for Biochemistry and Molecular Biology's education and public outreach coordinator. Follow her on Twitter @quirazeidan.

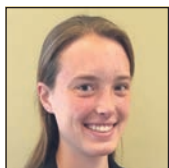
Undergraduate research award winners reflect on their work

By Stephanie Paxson

Undergraduate students who are members of the American Society for Biochemistry and Molecular Biology's Student Chapters program have several opportunities to apply for awards and scholarships exclusive to the program.

One award offered to Student Chapter members is the Undergraduate Research Award, which grants \$1,000 to support each awardee's summer research project. The deadline for this year's award is March 5. Applicants must submit a research statement that includes details of the methods used for data collection and a clear summary of the proposed project.

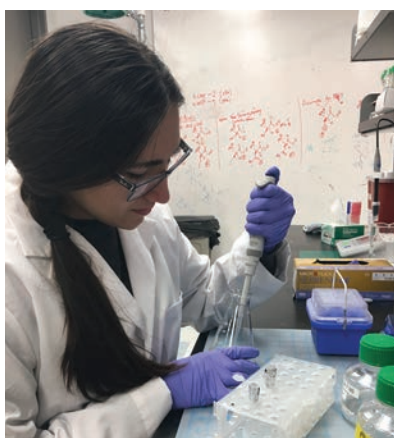
In 2018, a dozen undergraduates at colleges and universities around the country received these awards. We asked some of them to summarize their summer research projects.



BOSTWICK

**Alicia Bostwick,
Hope College:**

My research looks into the regulation of mitochondrial DNA transcription. Certain proteins called nucleoid proteins play key roles in this process, and I am investigating whether post-translational modification of these proteins regulates levels of transcription. This summer, I purified key wild-type and mutant nucleoid proteins, including the mitochondrial RNA polymerase. My mutant proteins of interest have replacement amino acids at specific sites that mimic post-translational modification of the protein at that



COURTESY OF HELEN KARIMI

In her summer research project, Helen Karimi of Wesleyan University used total internal reflection fluorescence microscopy combined with dwell-time distribution analysis as an imaging technique for studying short-lived catalytic intermediates.

site. Going forward, I am measuring the effects of these modifications on the proteins' ability to bind mitochondrial DNA and promote transcription.



LARSON

**Allie Larson,
Bemidji State University:**

Chemotherapy drugs remain the standard combative therapy utilized in ovarian cancer treatment. However, the usefulness of these drugs can be compromised by their side effects. The focus of my summer project aimed to alleviate such a phenomenon. We believe that the coupling of chemotherapeutic medications with an NHE1 protein inhibitor will induce a synergistic effect. This rela-

tionship would allow for a reduction in the administered drug dosage and subsequently patient discomfort.



JODUSH

**Nicholas Jodush,
St. Bonaventure University:**

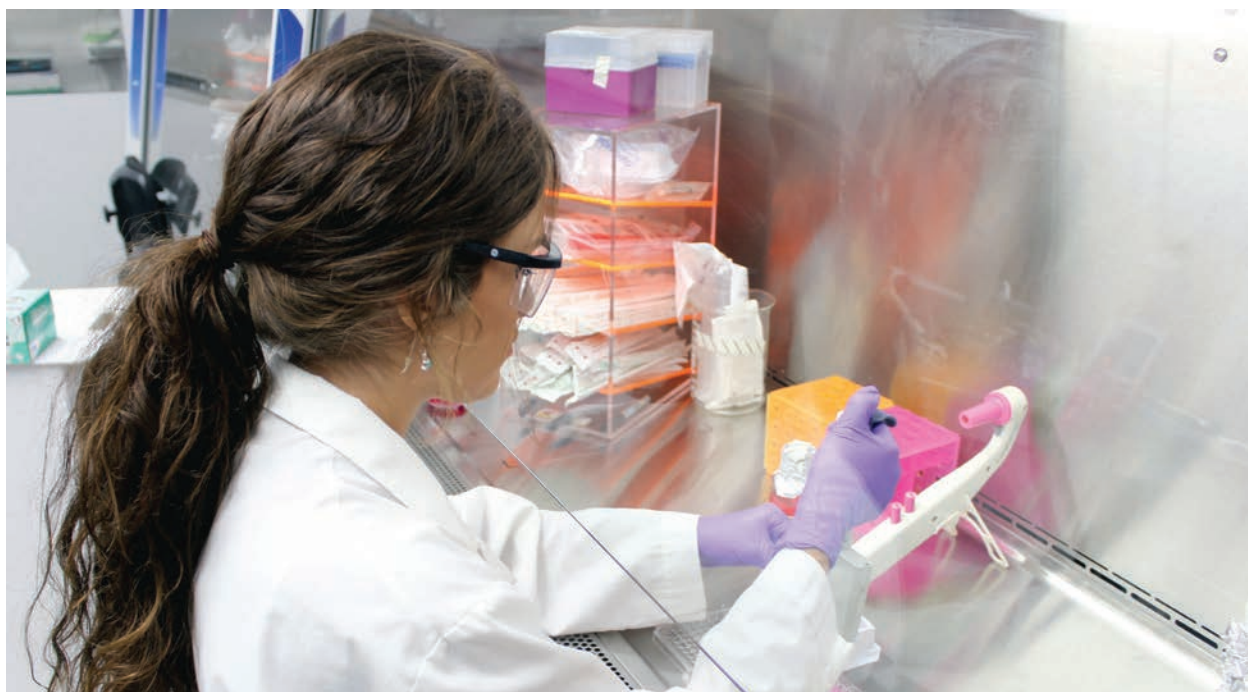
My summer research involved the Arabidopsis thaliana splicing protein SR45. I began by purifying the RNA recognition motif of the protein. I then used this to test potential RNA sequences it may bind to.



TURNER

**Caitlyn Turner,
Trinity University:**

My summer research objective was to discover key residues in Dib1, an essential splicing protein, to further understand its function and importance in splicing. To achieve this, I constructed a random mutant Dib1 plasmid library and performed yeast temperature sensitivity screens via replica plating in order to analyze the effect the mutations have on cell viability. When creating the library, I synthesized randomly mutagenized megaprimers and with them performed PCR oligonucleotide-directed mutagenesis on DIB1 plasmids. Then, I carried out large-scale screens by transforming the plasmid library into yeast and growing them at lower and higher than optimal temperatures. From these cultures, I identified phenotypically different colonies that possibly obtain a temperature-sensitive Dib1



COURTESY OF ALLIE LARSON

In her summer research project, Allie Larson of Bemidji State University investigated the hypothesis that coupling chemotherapeutic medications for cancer with an NHE1 protein inhibitor would induce a synergistic effect, allowing for a reduction in drug dosage, decreasing patient discomfort.

mutation that causes a loss of an important splicing interaction.

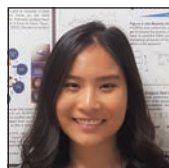


RAPOSO

Colin Raposo,
Tufts University:

Our lab is broadly interested in the variety of roles that repetitive proteins play in organisms across taxa. My project specifically is focused on epithelial adhesin 1 (Epa1p), an adhesin on the surface of *Candida glabrata* responsible for the binding to host cells, and how variation in this protein's repetitive region relates to virulence. We have found that Epa1p contains variable copy numbers between three and ten tandem repeats of a 40-amino acid region in its linker domain located between its cell wall anchor and lectinlike epithelial cell binding domain. We have utilized transgenic expression in the related yeast *Saccharomyces cerevisiae* to study the relation of repeat copy number to protein function and have identified a link

between surface display of Epa1p and repeat copy number, which we have hypothesized to be a result of variable post-translational processing and cell wall linkage of Epa1p.



KHUN

Charya Khun,
Wesleyan University:

Of the many proteins involved in the maintenance of genomic stability of prokaryotes, HU is of interest, as it is highly conserved in prokaryotic organisms and is involved in many fundamental cellular processes including bacterial recombination, transcription, replication and nucleoid packaging. HU binds DNA four-way junctions with nanomolar affinity, and we are interested in understanding the elements of recognition for this non-sequence-specific DNA-binding protein. Using distance constraints obtained from FRET experiments, we have generated a structural model of the HU-junction interaction, which we want to confirm by

generating a crystal structure of HU in complex with a Holliday junction. Our investigation aims to determine the ideal crystallization conditions in which to grow the protein-DNA crystals so that we can determine the 3D structure of the HU-junction interaction using X-ray diffraction.

Additional 2018 award recipients were **Lokeshwar Bhenderu**, University of Texas at Dallas; **Tiana Fleming-Hogan**, Duquesne University; **Aravinda Ganapathy**, Saint Louis University; **Helen Karimi**, Wesleyan University; **Elliot Lowe**, Towson University; and **Grant Tillinghast**, Wesleyan University.

For information on the 2019 Undergraduate Research Award program, visit the Student Chapters page at asmbm.org or email spaxson@asmbm.org.



Stephanie Paxson (spaxson@asmbm.org) is the ASBMB's diversity and undergraduate education coordinator. Follow her on Twitter @stephaniepaxson.

Chapter president joined for journal club

By *Gelareh Abulwerdi*

When she was a high school senior in her home town of Laurel, Maryland, considering what college to attend, Lauren DeLong was attracted to the welcoming personalities of the students and faculty at Salisbury University on Maryland's Eastern Shore.

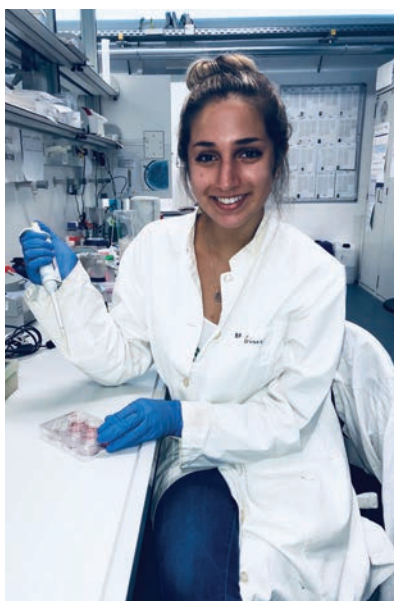
"I emailed professors at Salisbury University to hear about their research," she said. "Unlike some faculty at other schools that wouldn't get back to me, the faculty at SU were very responsive."

DeLong had a general interest in the medical field before starting college. While taking an introductory biology course during her freshman year, she got involved in her professor's yeast research lab and experimented with different strains of wild yeast and their effect on the taste of beer. That experience inspired her to pursue a major in biology.

DeLong also joined Salisbury's American Society for Biochemistry and Molecular Biology Student Chapter as a freshman after some of the upper-year undergraduate research students and professors told her about the chapter's journal club meetings, where members discuss major findings in scientific papers.

"Freshmen are often intimidated reading scientific papers," she said. "Joining ASBMB has improved my scientific literacy since freshman year."

Journal club turned out to be just one benefit of membership. Among other activities, the chapter has taken field trips to both locations of the J. Craig Venter Institute for genomic and bioinformatics research, in



COURTESY OF LAUREN DELONG

Lauren DeLong, a senior at Salisbury University and president of the university's ASBMB student chapter, became interested in biology when she experimented with different strains of wild yeast and their effect on the taste of beer while working in her freshman biology professor's yeast research lab.

Rockville, Maryland, and La Jolla, California — the latter was a side trip during the 2018 ASBMB annual meeting in San Diego. There, members met Hamilton Smith, winner of the 1978 Nobel Prize in physiology or medicine, toured the labs, and learned about laboratory techniques such as mass spectrometry and MinION nanopore DNA sequencing.

DeLong has continued with the ASBMB Student Chapter, and this year she stepped into the role of chapter president. As a member and now as president, she has focused on science communication and outreach. She encourages outreach

by connecting with other organizations such as the student outreach office at Salisbury University, public libraries, and STEM coordinators in local schools. In the past year, the chapter planned five outreach events including scientific workshops where members taught local elementary and middle school students about DNA and showed them how to extract their DNA with a cheek swab.

At first, DeLong found it challenging to communicate science to nonscientists and children during outreach and scientific demonstrations, but she set it as her goal to get better at it.

"In this challenge, we had the biggest learning opportunity," she said, adding that science communication is crucial because "policy decisions are often made based on nonscientific knowledge, and they impact us."

As a senior majoring in biology with chemistry and mathematics minors, DeLong is now applying to Ph.D. programs in molecular biology and molecular genetics and also is considering research fellowships abroad. She loves teaching and aspires to become a professor, in part because of her work with the ASBMB Student Chapter.

"It was through science outreach that I discovered how much I want to share my knowledge of science with others," she said.



Gelareh Abulwerdi (gelareab@umaryland.edu) is a Ph.D. candidate at the University of Maryland, Baltimore. Follow her on Twitter @gelareh_science.

At the interface: sphingosine kinase 1 membrane interaction

By Michael J. Pulkoski-Gross & Lina M. Obeid

Sphingolipids, or SLs, have emerged as critical players in membrane stability and as essential signaling molecules. SLs range from abundant species involved in maintaining membrane integrity, such as sphingomyelin, to scarce and potent signaling species, such as sphingosine-1-phosphate, or S1P. S1P mediates critical signaling functions through interaction with its cognate G-protein coupled receptors in development and in several disease states. In recent decades, many resources have been devoted to understanding how S1P generation is regulated.

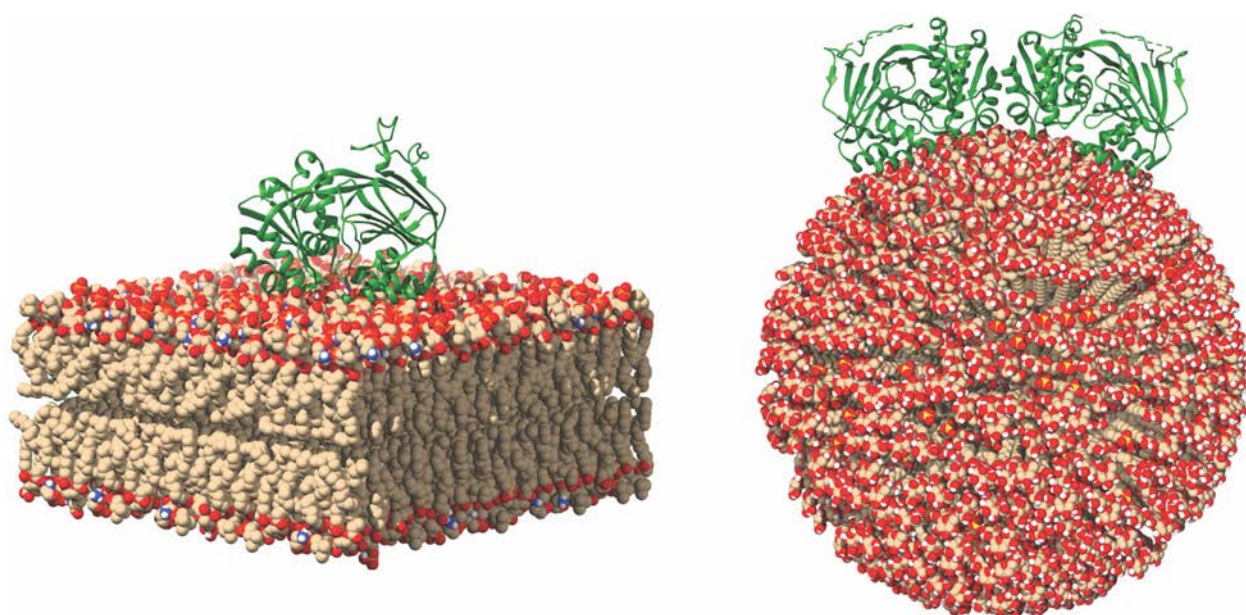
S1P can be generated through the action of two sphingosine kinase isoforms. The more commonly expressed

of the two is sphingosine kinase 1, or SK1. This enzyme has garnered attention as a potential therapeutic target, as it often is upregulated in diseases such as cancer. To gain access to its substrate, sphingosine, and to release its product, S1P, SK1 must interact directly with membranes. However, how SK1 achieves membrane binding has been contested in the literature. How does a cytosolic lipid-metabolizing enzyme without any lipid-binding domains interact with membranes to access its substrate?

Previously, researchers thought SK1 translocation was dependent on other proteins. However, recent data show how SK1 can bind directly to membranes. SK1 possesses an

intrinsic interface composed of two motifs: one electrostatic motif and one hydrophobic motif. Using biochemical methods, we found that these two motifs are necessary for membrane interaction, thus implicating their function as a single entity. Using hydrogen deuterium exchange mass spectrometry, we confirmed that SK1 employs a single contiguous interface that contains the two motifs. In cancer cells, disruption of this interface causes loss of membrane association and decreases SK1 activity. Past research has shown that interaction with membranes is critical for mediating SK1-dependent biologies

CONTINUED ON PAGE 11



MICHAEL PULKOSKI-GROSS

This image of SK1 binding to membranes shows potential SK1 membrane binding poses for SK1 in the presence of flat and curved membranes.

Study sheds light on function of mysterious PCSK9 mutation

By Laurel Oldach

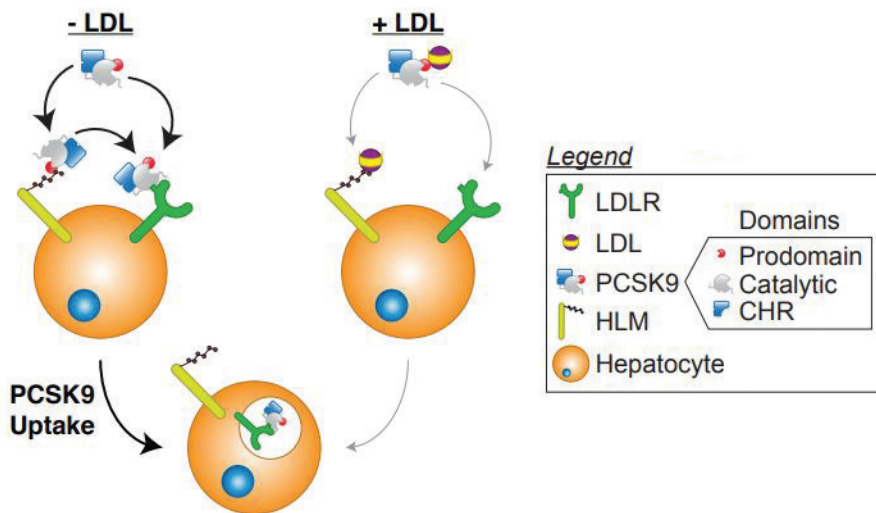
High levels of low-density lipoproteins, parcels of lipids and proteins that carry cholesterol, are a leading risk factor for heart disease. Many cholesterol medications lower LDL, some of them by targeting the protein PCSK9.

Scientists at the University of California, San Francisco, have published an investigation in the *Journal of Lipid Research* into why experiments on PCSK9 give different results in a test tube than they do in liver cells. What they found may explain how a mutation in PCSK9 that long has puzzled scientists leads to heart disease.

Ordinarily, the LDL receptor on the surface of liver cells is responsible for suctioning low-density lipoproteins out of the blood. But after being torpedoed by PCSK9, LDL receptor is brought into the cells and broken down, making the liver less able to control LDL in the bloodstream.

“We have very effective and safe therapies at reducing PCSK9 function,” said John Chorba, a cardiologist and researcher at UCSF. Perhaps you’ve heard of them: Praluent and Repatha are drugs that lower patients’ cholesterol by blocking the interaction between PCSK9 and the LDL receptor.

“But they’re antibody-based approaches,” Chorba said, “and are very expensive. Having a more thorough understanding of how PCSK9 works gives us new opportunities to develop drugs which could be more cost-effective.”



When LDL is absent (left), PCSK9 is likely to bind to the LDL receptor (green) and promote its internalization. When LDL is added, that binding is reduced. But in either case, PCSK9 can bind to heparan sulfate proteoglycans (yellow), which promote PCSK9/LDL receptor binding.

JOHN CHORBA & ADRI GALVAN

Chorba, who splits his time between lab and clinic, worked with medical student Adri Galvan to understand better the biochemistry of the PCSK9/LDL receptor interaction.

In a test tube, LDL particles block the interaction between the LDL receptor and PCSK9. This sounds like a good thing; the more LDL you have in circulation, the more you would want the LDL receptor to work, and the less you would want PCSK9 to disrupt it.

But when Chorba and Galvan repeated the experiment in cells, the results showed that the relationship is more complicated. In cells, LDL does not seem to disrupt the interaction as effectively.

“That’s when we really started to ask, what else is going on with these cells?” Galvan said. “What else is PCSK9 interacting with?”

Chorba said, “We thought there must be something (on the cells) that

was attenuating that effect.”

Around the time Chorba and Galvan were trying to identify the mystery interactor, a Danish group at Aarhus University published its finding that heparan sulfate proteoglycans, extracellular proteins with a particular sugar chain attached, can help PCSK9 reach the LDL receptor.

Chorba and Galvan confirmed that in cells from which that sugar chain had been cleaved, the LDL receptor/PCSK9 interaction on the surface of cells could be disrupted by LDL, similar to what happened in a test tube.

This led them to a clue about how a long-known but poorly understood mutant form of PCSK9 might work. It’s called the S127R mutation, because it changes the 127th amino acid in PCSK9, serine, into arginine.

“S127R was the initial mutation discovered in PCSK9 as a cause of genetic familial hypercholesterol-

emia, but the way it worked has been unknown for years,” Chorba said.

S127R is a head scratcher because the change in its amino-acid sequence disrupts PCSK9 maturation. You’d expect the change to reduce total PCSK9, which would reduce LDL, and that should be good for carriers of the gene. But instead, the mutant raises LDL cholesterol levels, putting patients at elevated risk of heart disease.

Chorba and Galvan found that while removing heparan sugar chains from cultured liver cells affected how the cells’ LDL receptors bound to wild-type PCSK9, it affected their

interaction with the mutant even more. That suggested that S127R PCSK9 might be interacting more strongly with HSPG — and offered a potential way for the mutant PCSK9 to interact more strongly with LDLR.

“I would imagine that S127R PCSK9 would be more likely to bind to the surface of (liver cells),” Chorba said. “So the local concentration of PCSK9 would be higher ... and it would be more likely to run into an LDL receptor that would get internalized and degraded.”

It remains to be seen whether this explanation holds up to further experimental scrutiny. If it does, then

future drugs that disrupt the PCSK9/heparin sulfate proteoglycan interaction, which a spinoff company from Aarhus University is working to develop, could be especially effective for people with familial hypercholesterolemia who carry the S127 mutation.

DOI: 10.1194/jlr.M087189



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CONTINUED FROM PAGE 9

including tumor cell invasion and endocytosis. This could provide a new avenue for targeting SK1 in diseases. Inhibition of membrane binding would deny SK1 access to its substrate, thereby inhibiting all activity.

Recent research shows an important role for SK1 in endocytic trafficking. SK1 presence at endocytic membranes would require membrane binding and curvature sensing. However, how SK1 can do this is largely unknown. Analysis of the atomic structure of SK1 revealed a potential dimerization interface. Such dimerization would align the membrane-binding interface of each SK1 monomer. This would strengthen

the interaction and potentially allow for physical curvature sensing by SK1. This remains to be validated, but it’s an exciting hypothesis. Another way to potentially inhibit activity would be to inhibit dimerization, if that is required for activity and membrane binding.

Significant strides have been made in understanding the structure and function of many SL metabolizing enzymes, and exciting questions remain to be answered, especially for SK1. How can SK1 decipher the difference between the charges of different anionic phospholipids? How does the catalytic cycle progress once SK1 is at the membrane? Is dimerization required for membrane binding/curvature sensing? What role is the

hydrophobic patch playing in curvature sensing?

Biophysical, biochemical and structural research will reveal the secrets of how SL enzymes work and how they might be exploited for therapeutic development.



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Scanning thousands of molecules against an elusive cancer target

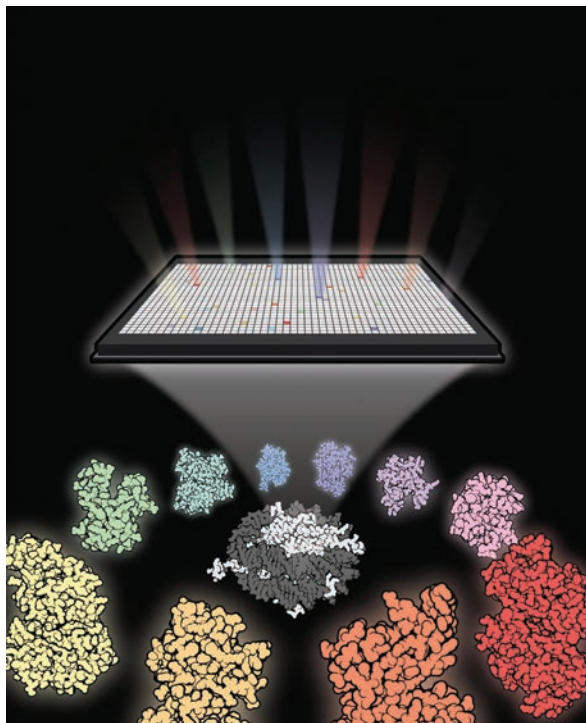
By Sasha Mushegian

Researchers at the National Center for Advancing Translational Sciences, or NCATS, part of the National Institutes of Health, have developed a system to accelerate the discovery of chemical compounds that inhibit an enzyme implicated in a number of cancers. The tools and methods the researchers used to test more than 16,000 compounds are described in a paper published in the **Journal of Biological Chemistry**.

The enzyme, NSD2, is overactive in cancers such as acute lymphoblastic leukemia and certain types of multiple myeloma, so inhibiting NSD2 activity seems like a promising strategy for treating those conditions. But so far researchers have not been able to find any chemicals that reliably block NSD2 even in a test tube in the laboratory, much less to test as drug candidates in living models.

“There’s a total lack of available chemical probes, druglike molecules, to help study (NSD2) function,” said Matthew Hall, the NCATS scientist who oversaw the new work.

It’s been difficult to discover chemical inhibitors of NSD2, in part, because the enzyme is difficult to work with in the laboratory. NSD2 modifies histones, the proteins around which DNA is wound. For technical reasons, scientists ordinarily would study this kind of activity using a fragment of the enzyme and a fragment of histone protein. But NSD2 works on only whole nucleosomes:



MATTHEW HALL/NCATS

A new study developed a set of methods to screen thousands of small molecules to find inhibitors of the cancer target NSD2.

units of histone protein in combination with DNA.

“(NSD2 and similar proteins) are very picky, because they prefer to only act on whole nucleosomes,” Hall said. “They’re snobby when it comes to what they’re willing to interact with.”

Collaborating with the biotechnology company Reaction Biology, Hall’s team, including lead author Nathan Coussens, developed laboratory tests involving whole nucleosomes that could be used to see whether NSD2 was able to modify histone proteins in the presence of various compounds. The compounds the team tested came from NCATS’s massive library of bioactive chemicals.

But finding a compound that

appears to block NSD2 activity is only the beginning. To confirm that the chemicals identified in the initial massive screen were indeed bona fide inhibitors that would reliably and reproducibly perform this function in future researchers’ studies, the NCATS team needed to use multiple types of biochemical methods to confirm the activity of each compound.

“We screened 16,000 molecules, and we got 174 hits, but that doesn’t mean they all really work,” Hall said. “When we whittle away through the (additional screening methods), we get down to 44 molecules. You triage candidates out of your screen after you rigorously ask your molecule to prove itself to you.”

With several molecules now having proved themselves in this round of screening, Hall’s team hopes to continue the search for reliable NSD2 inhibitors that can be used as research tools and then, further down the road, possibly as medicines.

“We are in the process of planning to screen hundreds of thousands of molecules,” Hall said, “in order to find molecules that can be optimized for inhibition of NSD2 and disseminate these to the research community.”

DOI: 10.1074/jbc.RA118.004274



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Wasp venom causes slow burn in roach brain

By John Arnst

For an American cockroach, there is no terror like a jeweled wasp.

While most of its parasitic cousins are content to paralyze their prey with a quick thoracic sting, lay an egg in or on the immobilized critter and abandon it to its fate as living larval foodstuff, the jeweled wasp excels in cruelty. Once it has immobilized a roach temporarily with an initial sting to the thorax, the wasp takes up to two minutes to guide two additional stings to the roach's head ganglia. There, it unleashes a neurochemical cascade that instills hypokinesia, overriding the roach's instinct to flee with an irresistible drive to laze about and groom. The wasp then grabs the distracted roach by its antennae and guides it to a burrow, where it will endlessly primp until a wasp larva hatches. As the puny parasite's primary food source, the roach will be kept alive as long as possible, with its least essential organs consumed first.

While the compound that causes the initial paralysis is mostly the ubiquitous neuroinhibitor GABA, the makeup of the second compound, or compounds, is less understood. To figure out what allows the wasp's venom to override the roach's survival instincts for several days, researchers in Michael Adams' lab at the University of California, Riverside, subjected the enigmatic venom to RNA sequencing and proteomic analysis. They published the details of the venom components, which include hundreds of identified neurotransmitters, hormones and peptide precursors, in the journal **Molecular & Cellular Proteomics**.

"One wonders if there is a magic bullet that causes this hypokinesia or whether it is a consequence of a lot of different components of the venom



DEVEN DADBHAWALA/FLICKR

An emerald wasp drags a cockroach immobilized by the wasp's venom into a burrow. A parasitic wasp larva will hatch about three days later and begin to feed on the roach.

working together," Adams said.

Two of those components are the neurotransmitters tachykinin and corazonin, which have been implicated in behavior and locomotion. When the venom resides inside the acidic environment of the wasp's venom apparatus, however, they're present only in their precursor forms.

According to Ryan Arvidson, a postdoctoral researcher in Adams' lab, one reason for the slow-burning activity of these and other peptides may be their gradual conversion to mature forms as their environmental pH rises to become more neutral within a cockroach.

"There's some support for the idea that we have this pH-dependent activation of these enzymes that could act like a time-release capsule, slowly generating bioactive peptides over time," Arvidson said.

Another time-release venom com-

ponent the researchers found was a ligand for the Toll receptor Spaetzle, which is involved in the activation of NF-kappaB homologs, a protein complex implicated in synaptic transmission in the brain.

"It was interesting because not only was Spaetzle in there, but a serine protease that activates Spaetzle is in the venom, and a serine protease that activates that serine protease is in the venom," Arvidson said. "It looks like it injects the entire activation cascade of Spaetzle into the brain."

The functions of all these already-defined neurotransmitters in the wasp venom aren't exactly clear. In future experiments, Adams and Arvidson hope to explore the mechanisms by which tachykinin, corazonin and Spaetzle interact with the hundreds of other proteins in the venom to suppress the roach's flight instinct reversibly while leaving intact its ability to walk, swim and fly in a wind tunnel.

"Now that we've laid the foundation for what the venom proteome is, we can start asking more hypothesis-based questions," Arvidson said. "As far as I know, corazonin and another hormone called eclosion hormone are not really implicated in adult insects' central nervous system activity, specifically with regard to locomotion."

"The wasp venom has pointed us in directions that could answer questions in neuroscience in general, in signaling systems that were previously not understood or underappreciated." DOI: 10.1074/mcp.RA118.000908



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From the journals

By Gelareh Abulwerdi, Sasha Mushegian & Kerri Beth Slaughter

We offer a selection of recent papers on a variety of topics from the **Journal of Biological Chemistry**, the **Journal of Lipid Research**, and **Molecular & Cellular Proteomics**.

Cleaning up light-sensitive debris in the eye

The receptor tyrosine kinase Mer is expressed in the retinal pigment epithelium, where it plays a key role in cleaning up debris from photoreceptor cells through phagocytosis. Mutations in the gene encoding Mer are

associated with progressive degeneration of photoreceptor cells, resulting in blindness. It was unknown exactly how the accumulation of debris leads to photoreceptor cell degeneration. In a study published in the **Journal of Biological Chemistry**, Jin Zhao and colleagues at Columbia University Medical Center showed that the unphagocytosed photoreceptor cell debris in Mer knockout mice contains bisretinoid fluorophores. These photoreactive molecules appeared to be responsible for light-induced degeneration of the photoreceptor cells of these mice.

DOI: 10.1074/jbc.RA118.005949

Finding protein-coding genes in rice

Did you know that studying the protein content of tissues from the rice plant, *Oryza sativa*, can help us gain a better understanding of the plant's genome? In a recent collaborative study between BGI, the University of Liverpool and Baylor College of Medicine, Zhe Ren and colleagues combined transcriptomics and proteomics analyses of rice to find novel genes and splicing events.

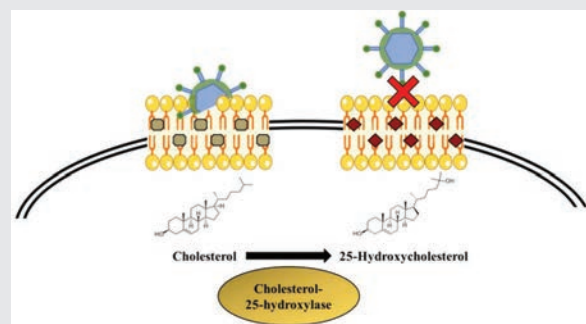
In most eukaryotes, a gene's DNA template is processed through RNA splicing, a process that involves

A pathway for lipid metabolism and antiviral action

The human body possesses a variety of weapons to defend itself against viral infections. For instance, some molecules block viruses from entering cells, and others interfere with viral replication. Understanding these natural responses to infection may be key to developing new antiviral drugs.

Previous studies have shown that the molecule 25-hydroxycholesterol, or 25HC, which regulates lipid and cholesterol metabolism, is also a potent inhibitor of viral infection. Production of 25HC is catalyzed by the enzyme cholesterol 25-hydroxylase, or CH25H. Although 25HC has been recognized for its antiviral functions, the signaling pathways that regulate CH25H expression and 25HC levels are not well understood. In a study published in the **Journal of Lipid Research**, Ying Liu and colleagues from the Hefei University of Technology in China examined the pathways connecting the antiviral actions of 25HC and activation of the liver X receptor, or LXR. Their research aims to understand the mechanisms involved in 25HC production and metabolism that impact its antiviral activity.

LXR is a transcription factor involved in a number of biological processes, such as lipid metabolism. After binding to a ligand, LXR forms a complex with another receptor and interacts with specific DNA elements to promote expression of target genes. Both 25HC and synthetic LXR ligand can interact with LXR to signal



GOMES ET AL./BBA

25-hydroxycholesterol inhibits viral infection by blocking the virus from entering the target cell.

transcription of the CH25H gene. This study showed that binding of 25HC or a synthetic ligand to LXR inhibited certain viral infections, such as herpes simplex virus type 1, in cell culture.

To test their findings in a physiological model, the researchers treated mice with a synthetic LXR ligand and found that viral growth was reduced. Overall, these studies suggest that the LXR signaling pathway may be important for regulating 25HC levels and its antiviral actions. In the future, this pathway may provide a target for antiviral therapeutic development.

DOI: 10.1194/jlr.M084558

— Kerri Beth Slaughter

Protein structure and function in Arabidopsis

Have you ever wondered how some plants in temperate zones survive all four seasons? Unlike many animal species, plants can't control their internal temperature. Instead, they must survive in ambient conditions. Researchers studying this resilience in fluctuating temperatures have found an answer within plants' proteins.

In the journal **Molecular & Cellular Proteomics**, Jeremy Volkening and colleagues at the University of Wisconsin-Madison report on the thermal proteome of *Arabidopsis thaliana*, commonly known as mouse-ear cress.

Thermal proteome profiling, or TPP, is the use of high-throughput mass spectrometry-based quantitation to look at thousands of proteins' melting temperatures simultaneously. Before this method was established, researchers had to go through the laborious isolation of one purified protein at a time to look at physical or chemical properties. The technique takes advantage of the fact that denatured proteins tend to aggregate and precipitate out of solution. By tagging each sample in a temperature gradient with a unique isobaric tag, the amount of each protein remaining in aqueous solution at each temperature can be compared using a technique known as tandem mass tag labeling. Melting temperature of proteins can be used to study the proteins' structure and their ability to maintain their native conformation under increasing temperature — a property called thermostability.

The researchers found substantial variability among proteins; some reproducibly displayed the same melting temperature and others had high variability. The authors showed correlations between protein thermostability and other characteristics such as molecular weight. This information provides the groundwork to utilize TPP in



KARL HAUSER/NIH FLICKR

Arabidopsis thaliana, commonly known as mouse-ear cress, is a small flowering weed that grows along roadsides in Eurasia and Africa.

future plant studies to fill the gaps in the knowledge of plants' protein expression, protein-protein interactions, and their binding sites.

DOI: 10.1074/mcp.RA118.001124

— Gelareh Abulwerdi

removing intervening sequences (introns) and forming the mature messenger RNA through splicing of exons. The use of high-throughput technologies such as RNA-seq and next-generation sequencing has led to discovery of more exon splicing patterns and protein-coding gene sets. However, these genome-wide approaches suffer from some mistaken annotation and low-level data on thousands of genes or genomic regions.

In their paper published in the journal **Molecular & Cellular**

Proteomics, the researchers collected public proteomics, genomics and transcriptomics data to discover approximately 100 new protein-coding genes in rice.

DOI 10.1074/mcp.RA118.000832

Novel enzymes from hot spring bacteria

Extreme environments are often home to unique enzymes. One way to discover new enzymes in these environments is by using functional

metagenomics, a culture-independent technique that allows enzymes to be identified by activity rather than by homology to known enzymes. Léa Chuzel and colleagues at New England Biolabs used functional metagenomics to investigate sialidases in bacteria adapted to hot springs. They found a novel sialidase that defined a new glycoside hydrolase family, which catalyzed sialic acid hydrolysis via an inverting reaction mechanism. The study was published in the **Journal of Biological Chemistry**.

DOI: 10.1074/jbc.RA118.003302

Two studies of one tough spore

Clostridium difficile is a bacterium that causes severe gastrointestinal infections, especially in hospitals among patients who are immunocompromised or have been taking antibiotics. In 2009, its increasing prevalence in health-care settings led the World Health Organization to classify it as an emerging infection.

C. difficile is naturally resistant to most broad-spectrum antibiotics, largely due to the tough protective spore coat that it's able to form. *C. difficile* spores can be transmitted through the environment and latently persist within the intestine, leading to recurring infections. Two recent papers in the **Journal of Biological Chemistry** examined the unique biochemistry of *C. difficile* spore formation, paving the way for development of antibiotics.

In one study, Emma Richards and colleagues at Imperial College London examined modification to the S-layer, a layer of proteins surrounding the cell wall. They found that some S-layer proteins carried a complex glycan modification. This modification was encoded by a large (24 kilobase) insertion in the genome of a subset of known *C. difficile* strains. Mutational analysis showed that without this glycan modification, cells were less able to form spores and adhere to intestinal cells. A class of antibiotics in development for *C. difficile* targets S-layer proteins, and it's still unknown whether this glycosylation — which only occurs in some *C. difficile* strains — affects the action of these antibiotics.

In another study, Héloïse Coullon and colleagues at Université Paris-Sud focused on a layer of the *C.*



Clostridium difficile bacterium

difficile spore coat called the spore cortex. They found that the composition of the *C. difficile* spore cortex differed significantly from that of *Bacillus subtilis*, the most thoroughly studied spore-forming bacterium. They zeroed in on cortex protein modification with glycans called muramic-delta-lactams. Without this modification, *C. difficile* was less able both to form spores and to germinate out of spores and was more sensitive to heat.

Together, the two studies highlight how glycan modifications characteristic of *C. difficile* affect the robustness of its spore — an important consideration when developing treatments.

DOI: 10.1074/jbc.RA118.004530

DOI: 10.1074/jbc.RA118.004273

— *Sasha Mushegian*

Treating high cholesterol with antibodies

Hypercholesterolemia is a common medical condition characterized by high levels of cholesterol in the blood. Many patients with the disorder are treated with statins and ezetimibe to lower cholesterol levels. Statins lower cholesterol levels by inhibiting cholesterol synthesis, whereas ezetimibe

inhibits absorption of cholesterol by the small intestine. In addition, treatment with antibodies to proprotein convertase subtilisin/kexin type 9, or PCSK9, can be used in combination with these medications to help patients reach target cholesterol levels. Recent clinical trials have shown that two approved PCSK9-antibodies reduced low-density lipoprotein, or LDL, cholesterol and the risk of

cardiovascular events.

In a paper in the **Journal of Lipid Research**, Günther Silbernagel and colleagues at the Medical University of Graz in Austria write that they analyzed 245 patients with hypercholesterolemia to study the effects of PCSK9 antibodies on PCSK9 metabolism, cholesterol synthesis and cholesterol absorption. Results of the clinical trial showed that treat-

ment with statins and ezetimibe led to increased PCSK9 in the blood. Additional treatment with PCSK9 antibodies helped decrease LDL-cholesterol levels without significantly affecting the balance between cholesterol synthesis and absorption. These findings are important for understanding how combinations of cholesterol-lowering treatments affect patients with hypercholesterolemia.

DOI: 10.1194/jlr.P088583

Precise portraits of prions

Normal prion protein can misfold and form pathological aggregates, but the high-resolution structure of these aggregates and why some are infective and some are not remain unknown. To begin to address these fundamental questions, Qiuye Li and colleagues at Case Western Reserve University characterized synthetic prion protein aggregates that were generated under the same conditions but possessed different levels of infectivity *in vivo*. Using hydrogen-deuterium exchange and hydroxyl radical footprinting, they found that noninfectious aggregates had a less ordered structure and differed in other key respects from infectious prions. The study was published in the **Journal of Biological Chemistry**.

DOI: 10.1074/jbc.RA118.005622

Angling for Angelman mechanisms

Angelman syndrome, a genetic condition affecting mental development and speech, results from loss-of-function mutations in the UBE3A ubiquitin ligase gene. Overexpression of this gene, meanwhile, is linked to autism spectrum disorders. In a study published in the **Journal of Biological Chemistry**, Simone Kühnle and colleagues at Harvard Medical School characterized UBE3A's interactions with the 26S proteasome. They found

that Angelman syndrome-associated mutations, which did not affect UBE3A's ubiquitin ligase activity, impaired the enzyme's ability to bind to the proteasome. As a result, Wnt/beta-catenin signaling was inhibited. These results implicate this signaling pathway in Angelman syndrome.

DOI: 10.1074/jbc.RA118.004653

What can we learn from the maize genome?

Before it was domesticated, the ancestor to maize was a grass species called teosinte found mainly in Mexico's tropical southwestern region. As it was domesticated, it not only increased in productivity but also spread to more temperate climates, where day length, temperature and local diseases were dramatically different. How did maize adapt so well to varying climates?

In collaboration with the Beijing Institute of Genomics, Hubei Collaborative Innovation Center for Grain Industry, and China Agricultural University, Lu-Guang of China Agricultural University published a paper in the journal **Molecular & Cellular Proteomics** describing the relationship between mRNA and protein levels during this adaptation from tropical to temperate climate by comparing 98 different strains of maize.

The central dogma of molecular biology is that DNA is transcribed to RNA and RNA is translated into protein. With recent advances in understanding of gene regulation, this process is not as straightforward as it looks. In fact, the abundance of the transcript at the level of RNA does not reflect the expression pattern of proteins due to post-transcriptional events such as alternative splicing, post-translational modifications, protein folding, transport and localization.

The researchers showed that although mRNA abundance affects biological functions, post-transcriptional modifications also play important roles in synchronizing expression regulation toward genes in certain biological pathways.

DOI: 10.1074/mcp.RA118.001021

Why two enzymes evolved to stick together

Aminoacyl-tRNA synthetases, or ARSs, link tRNAs to their corresponding amino acids, and a different ARS carries out this function for each amino acid. In animals, glutamyl-tRNA synthetase and prolyl-tRNA synthetase, which produce the tRNAs carrying glutamine and proline, are fused permanently together as a bifunctional protein known as EPRS. Sandeep M. Eswarappa and colleagues at the Indian Institute of Science investigated what the advantage of fusing these two enzymes together might be by modeling the connection between amino acid availability and ARS expression. They suggest that, since glutamine is a metabolic precursor of proline in the citric acid cycle, forcing the ARSs corresponding to these two amino acids to be expressed simultaneously helps keep the cell from critically depleting glutamine levels when synthesizing proline-rich proteins. The study was published in the **Journal of Biological Chemistry**.

DOI: 10.1074/jbc.RA118.005588

Transporting ions or antibiotics

EmrE is an ion-coupled transporter that bacteria use to eject antibiotics out of the cell, enabling antibiotic resistance. A key question about ion-coupled transport is whether ions and substrates are bound simultaneously or competitively exclude each other. In a study published in the **Journal**

of Biological Chemistry, Nathan E. Thomas and colleagues at the University of Wisconsin and Washington University showed that EmrE binds protons and substrates simultaneously but that substrate binding results in deprotonation of a residue outside of the substrate-binding pocket. This suggests that the mechanism of protein-coupled transport may be more complex than assumed by previous models.

DOI: 10.1074/jbc.RA118.005430

Low HDL linked to cardiovascular disease

High-density lipoprotein, or HDL, transports cholesterol and phospholipids through the blood to the liver. The liver is responsible for removing cholesterol from the body or redistributing it to other tissues. Because the main genes that regulate HDL cholesterol level also affect other blood lipids, there is debate in the field as to whether very low HDL levels caused by genetics can independently trigger atherosclerosis and cardiovascular disease.

In a study published in the **Journal of Lipid Research**, Andrew Geller and colleagues from the company Boston Heart Diagnostics and Tufts University were the first to analyze the genetic and secondary causes of severe HDL deficiency in a large population to identify links to atherosclerotic cardiovascular disease. Initially, they screened more than 250,000 individuals and selected 308 eligible subjects for further study based on their low levels of HDL cholesterol. DNA from eligible subjects was sequenced to examine lipoprotein metabolism genes for different HDL deficiency states.

Results from this study were consistent with the finding that in about 40 percent of cases, severe HDL deficiency has nongenetic causes such

as uncontrolled diabetes and increased inflammation. About half of the low HDL cholesterol patients without these causes had mutations or variants in lipoprotein metabolism genes such as ABCA1, LCAT or APOA1. Contrary to other published work that omitted those major genes, results of this study suggested that genetic causes of severe HDL deficiency can lead to premature atherosclerotic cardiovascular disease.

DOI: 10.1194/jlr.M088203

Upregulating antioxidants in the brain

Oxidative stress is thought to be a trigger for Alzheimer's disease, and the Alzheimer's disease brain has diminished antioxidant activity. Reducing oxidative stress in the brain therefore could be a strategy for slowing neurodegeneration, but there are few global antioxidants that can permeate the blood-brain barrier, or BBB. In a study published in the **Journal of Biological Chemistry**, Kelsey Murphy and colleagues at the University of Toledo developed a BBB-permeable activator of Nrf2, a transcription factor for the majority of antioxidant enzymes. This activator, a polysaccharide called mini-GAGR that is administered through the nose, decreased brain mitochondrial oxidative stress and improved memory in mice.

DOI: 10.1074/jbc.RA117.001245

Packing DNA for long distances

DNA is packed efficiently into histone-based nucleosomes, which then are condensed into chromatin. The structure of chromatin determines the accessibility of genes to transcription. Laxmi Narayan Mishra and Jeffrey J. Hayes from the University of Rochester investigated how

histone presence, histone acetylation and the presence of nucleosome-free regions affected the accessibility of DNA to DNA-binding proteins. They found that the effects of histones and nucleosome-free regions affected DNA accessibility beyond the immediate site, suggesting mechanisms of gene regulation via higher-order folding effects on chromatin. The study was published in the **Journal of Biological Chemistry**.

DOI: 10.1074/jbc.RA118.005721

Insights into cytochrome P450

Cytochrome P450 1A1, or CYP1A1, can detoxify drugs and environmental toxins but also can produce carcinogenic reactive intermediates. Therefore, selectively activating or inhibiting CYP1A1 could be a strategy to prevent cancer or regulate activity of anti-cancer drugs. Aaron G. Bart and Emily E. Scott from the University of Michigan examined the structural determinants of how CYP1A1 binds to diverse substrates. Their results, published in the **Journal of Biological Chemistry**, suggest that modifications in the active site allow the enzyme to accommodate large ligands.

DOI: 10.1074/jbc.RA118.005588



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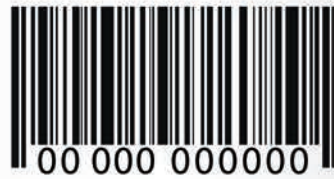
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DEMAND FOR ONE TYPE
REMAINS UNDIMINISHED.**

The blood industry is in a bind. Over the past decade, the amount of blood transfused in the United States has plummeted due to improved patient management and strategic scheduling of elective surgeries. While this has cut costs for hospitals, insurance providers and patients, it has upended the nonprofit business model of blood suppliers in the United States.

In August, the American Red Cross — the country's largest blood supplier, providing around 40 percent of the blood used in hospitals — announced that it would need to raise the price of the blood it sells to hospitals to cover its operating costs. According to Red Cross officials, they already have reduced staff and donor-recruitment efforts. Experts say all this does not bode well for the industry as a whole.

Meanwhile, blood suppliers face a near-constant shortage of universally acceptable O-negative blood. Only 6.6 percent of the U.S. population has Type O-negative, which is used by hospitals in almost all emergency surgeries and traumas that require transfusions.

One step toward addressing the shortage of O-negative blood may be to convert other types of blood to O. Recent work by researchers at the University of British Columbia using enzymes from human gut bacteria to modify A and B red blood cells may bring us closer to the solution.

A quest for enzymes

Human red blood cells come in four major types — A, B, AB and O — based on the presence or absence of A and B antigens on the cell surface. The A antigens cause a person's immune system to produce antibodies against the B antigens, and vice versa, meaning that a person with Type A blood will have a potentially fatal reaction to a transfusion of B red blood cells.

In addition, each blood type comes

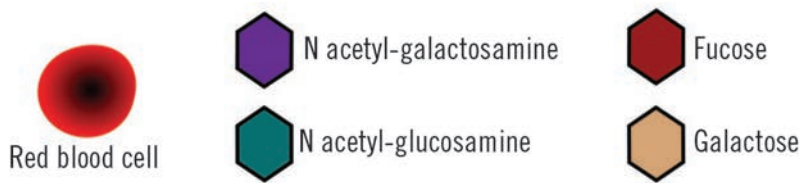
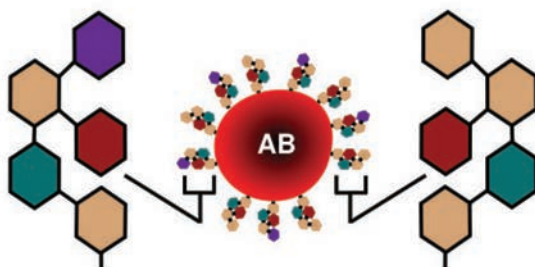
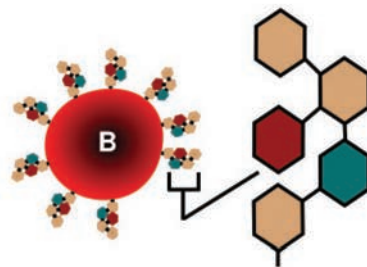
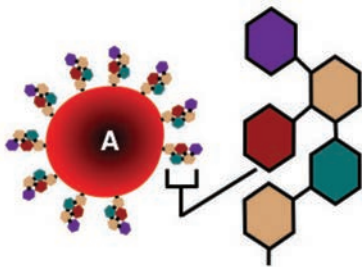
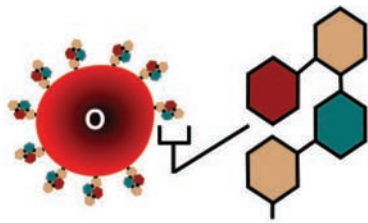
in two subtypes based on the presence or absence of a protein antigen called the Rh factor. A transfusion of blood with a positive Rh factor will generate an immune response in a person who is Rh negative, but the reverse is not true. Among the eight blood types determined by antigens and Rh, O-negative red blood cells lack the A, B and Rh antigens and can be donated to a person with any blood type. Conversely, AB-positive blood can be donated only to patients with the same blood type, and patients with AB-positive blood are able to receive a transfusion of any blood type, because their immune systems do not generate antibodies to any of the antigens.

Beyond these primary eight types, blood comes in more than 600 subtypes, which come into play when transfusions are needed for people with diseases such as sickle cell anemia.

The A and B antigens differ from one another by a single sugar: where the A antigen has N-acetylgalactosamine, the B antigen has galactose. Scientists have been attempting to snip those sugars off A and B red blood cells enzymatically for decades with the goal of creating blood cells with antigens that closely resemble the base antigen found on O red blood cells.

In 1982, a group of scientists led by Jack Goldstein at the New York Blood Center's Kimball Research Institute reported in the journal *Science* that enzymes isolated from green coffee beans could remove the galactose from B blood cells, functionally converting them to O blood cells.

In 1991, the medical device company ZymeQuest, based outside Boston in Beverly, Massachusetts, partnered with Goldstein, intending to create a system that could convert large quantities of blood from B to O. Mechanical engineers at ZymeQuest developed a prototype device and software for washing, convert-



WIKIPEDIA USER INVICTAHOQ

Although they are sometimes referred to as “naked,” Type O blood cells have a base oligosaccharide antigen. The antigens on Type A and B blood cells are made up of this base antigen plus one additional sugar. Type AB blood cells have both A and B antigens.

ing and repackaging red blood cells. However, the enzymes were slow and inefficient. Goldstein died in the late '90s, before his team at the New York Blood Center could find an enzyme that could remove GalNAc from Type A red blood cells.

In 2000, hematologist Thomas P. Stossel joined ZymeQuest’s board of directors. “The bad news was that B is not as common as A, and so converting B red blood cells wasn’t really a

viable commercial exercise,” explained Stossel, recently retired from Brigham and Women’s Hospital in Boston.



STOSSEL

“You really needed to be able to get the A, and the A just didn’t work with the coffee bean stuff.”

In 2007, Henrik Clausen, a biochemist at the University of Copenhagen and consultant to ZymeQuest, reported in the journal *Nature Biotechnology* that a set of novel glycosidases could remove the sugars on the antigens on both Type A and Type B blood cells.

“So then came (Clausen), who was a carbohydrate maven,” Stossel said. “(He) worked on it and ostensibly seemed to have come up with a conversion process.”

The company continued to test Clausen’s enzymes for a few years with disappointing results, Stossel said. The enzyme-treated Type-A cells registered as Type O in serilogic tests but did not circulate when infused into test subjects.



SKILLMAN

According to William Skillman, who came aboard as the company’s chief executive officer in 2014, the failure of Clausen’s enzymes

to perform as hoped began to draw the long project to a close.

“The investment to take it forward ... probably would have been another \$30 million or more,” Skillman said. “Investors were tired, and I think that was the end of the game.”

In 2010, ZymeQuest, by then renamed Velico Medical, sold some of its royalty rights to the universal blood platform and shifted focus to developing a process for spray-drying plasma and storing it at room temperature, as well as an improved medium for platelets.



THE AMERICAN RED CROSS

Collecting blood was an essential part of the war effort during World War II.

Dollars and deciliters

Blood donations began in earnest during World War II in England, and the industry that emerged steadily grew over the next six decades.

By 2008, hospitals in the U.S. transfused an estimated 15 million bags of blood per year, according to the Department of Health and Human Services' biennial National Blood Collection and Utilization Survey. This was a slight uptick from the 14.65 million bags transfused in 2006, 14.18 million in 2004 and an estimated 13.9 million in 2001.

The average price a hospital paid

for a bag of blood was \$223 in 2008, up from \$143 in 2001. It increased slightly in 2011 to \$225 and held steady through 2013, according to the HHS.

The biennial surveys do not include information about how much hospitals charge patients for blood. But according to a Thomas Jefferson University survey published in 2011, hospital patients were charged \$343 on average for a bag of blood in 2007, when hospitals paid suppliers \$210.

For decades, patients routinely received blood transfusions during nonemergency surgeries when their blood levels of hemoglobin, the iron-

based protein in red blood cells that binds to oxygen, fell below 10 grams per deciliter.

This threshold, set in 1942, wasn't scientifically challenged until 1994, when, concerned about the burden of testing blood for HIV and hepatitis, a group of researchers in Canada questioned if patients would do better if they changed the hemoglobin standards for giving transfusions.

The researchers studied 838 intensive-care patients randomly assigned to receive a transfusion when their blood hemoglobin levels fell below either 7 or 10 grams per deciliter. The study, published in 1999, found that after 30 days, the people in the group with the lower threshold had received an average of three fewer units of blood than group with the higher threshold but had the same probability of death.

Over the next decade, more studies provided evidence that hospitals could decrease blood transfusions without putting patients at risk.

A 2007 study in the *New England Journal of Medicine* reported that lowering the hemoglobin threshold in stable, critically ill children to 7 grams per deciliter didn't increase adverse outcomes.

In 2009, Stanford Medical Center began a study that used the hospital's electronic records program to alert doctors of transfusion guidelines when they requested transfusions for patients with hemoglobin levels above 8 grams per deciliter.

The study, results of which were published in 2013 and 2014 in the journal *Transfusion*, found that the alerts reduced red blood cell use by 24 percent from 2009 to 2012, which saved the hospital an estimated \$1.6 million.

More significantly, the drop in transfusions corresponded with a two percent reduction in mortality rate among people who had transfusions, from 5.5 percent to 3.3 percent, for reasons that weren't entirely clear.

In 2012, the American Medical Association held a summit on overuse of five medical interventions, including transfusions of red blood cells, and the American Association of Blood Banks put out new guidelines recommending that transfusions be given to stable patients only when their hemoglobin levels fell below 7 grams per deciliter.

Separate studies at multiple hospitals found that transfusing blood at lower hemoglobin thresholds for patients undergoing cardiac surgery, hip surgery, upper gastrointestinal bleeding, traumatic brain injury and septic shock had the same effect on patient outcomes as transfusing blood at higher thresholds. However, in 2015, more liberal transfusion strategies were found to provide better outcomes for patients undergoing surgery for cancer.



DEVINE

According to Dana Devine, chief scientist of the Canadian Blood Services, these studies had an impact across hospital

transfusion departments and the hematology community at large.

"We want to only give blood if you need to," Devine said, and doctors can avoid unnecessary transfusions by monitoring patients' blood iron levels before surgery and making sure they're in the best possible condition.

"This has been warmly embraced, not only by treating physicians but also by insurance companies who have to pay for blood products," Devine said, adding that patient blood-management programs started by hospitals in the last 10 years have caused demand for blood products in the U.S. to drop by at least a third.

This drop is largely in transfusions during elective surgeries, when the transfused blood would be matched to the patient's blood type. But O-negative blood, which is used in emergency surgeries when there isn't time to determine a patient's blood type, is still in constant demand.



PAUL JOSEPH/UBC

Stephen Withers' research at the University of British Columbia into enzymatically converting Type A and B blood is funded by the Canadian Institute for Health Research.

Gut reactions

After ZymeQuest bowed out of developing a platform to create universal blood in 2010, reports of research into enzymes that could convert A and B blood largely dried up until 2015.

That year, Stephen Withers and a collaborator at the University of British Columbia's Centre for Blood Research, Jayachandran Kizhakkedathu, published findings in the *Journal of the American Chemical Society* about enzymes that could digest the sugars off of A and B blood. According to Withers, an enzymologist who earned his Ph.D. from the University of Bristol in 1977 and began working at UBC in 1982, his foray into blood sugars was inspired by Clausen's 2007 paper in *Nature Biotechnology*.

"In that 2015 paper, we had taken

the tack that there was an existing enzyme ... which could be used to convert A or B blood to something like O. It's not exactly O," Withers said.

While the researchers successfully used directed evolution to make an enzyme that could cleave the GalNAc from a single subtype of A blood, making it resemble O blood, the enzyme didn't work against every subtype of blood within that group.

"We came to realize that this was going to be a pretty long haul if we were going to do this for each of the subtypes," Withers said. "So I thought maybe it's time to take a step back and see if there's a better start point for this. Maybe we can find an enzyme in nature already, using metagenomics."

Withers had begun collaborating with Steve Hallam, a metagenom-

ics researcher at UBC. At first, the two considered focusing on blood-drinking creatures that might harbor sugar-eroding enzymes.

“You’d tend to think of the guts of mosquitoes, leeches, vampire bats and things like that,” Withers said. “But these had to be beasties that are (exclusively) feeding on humans, because it’s only realistically humans that have the ABO blood system.”

So the biochemists turned their thoughts inward, to the trillions of bacteria that make up the human microbiome. The walls of our intestines are lined with a layer of mucin sugars that serve the double duty of protecting our gut from the bacteria that call it home and preventing those bacteria from being swept away. Withers reasoned that, since some of the bacteria had evolved to digest both this carbohydrate surface and other sugars, some of them might also have evolved to digest the sugars on human blood cells.

“It’s an unpleasant but relatively convenient source of materials,” Withers said. “Of course, we’re not opening up humans, we’re just collecting feces.”

Withers and his colleagues didn’t know if there was a connection between blood type and microbiome content, so they hedged their bets and had a colleague with AB blood who hadn’t taken antibiotics in the last month donate stool samples.

What followed was standard metagenomics: the researchers lysed the bacteria from the stool samples, extracted their DNA and sliced the DNA into 30- to 50-kilobase chunks.

Rather than sequence all of the DNA chunks at this step, the researchers next used phages to insert the DNA into *Escherichia coli*. They then grew and lysed the *E. coli* and used a unique assay to test which had gained the ability to chew the sugars off red blood cells.

Once they had a hit, they grew the

bacteria of interest and sequenced the corresponding gene inserts to determine if any novel enzymes from the DNA chunks were responsible for the new digestive capabilities.

“You’re hoping that you don’t see anything you recognize in there,” Withers said. “That’s what we were able to do in this case, get a new enzyme family.”

To their delight, that family, isolated from gut microbes and encoded by *E. coli*, consisted of hundreds of new enzymes, which they hoped would overcome some of the shortcomings of the enzymes Clausen had identified in 2007.

“Their enzymes would not work in whole blood,” Withers said of Clausen’s work. “They had to be separated red blood cells in a low ionic-strength buffer to do this conversion. We were looking for something that’s a little more convenient and a little more active. Indeed, the one we found will work in whole blood, and, depending exactly how you measure these things, it’s something like 30 times more active than theirs.”

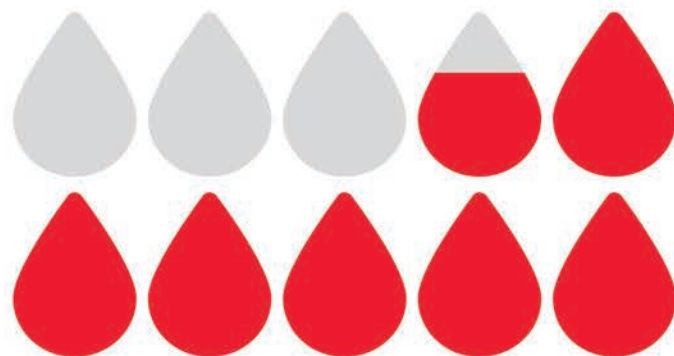
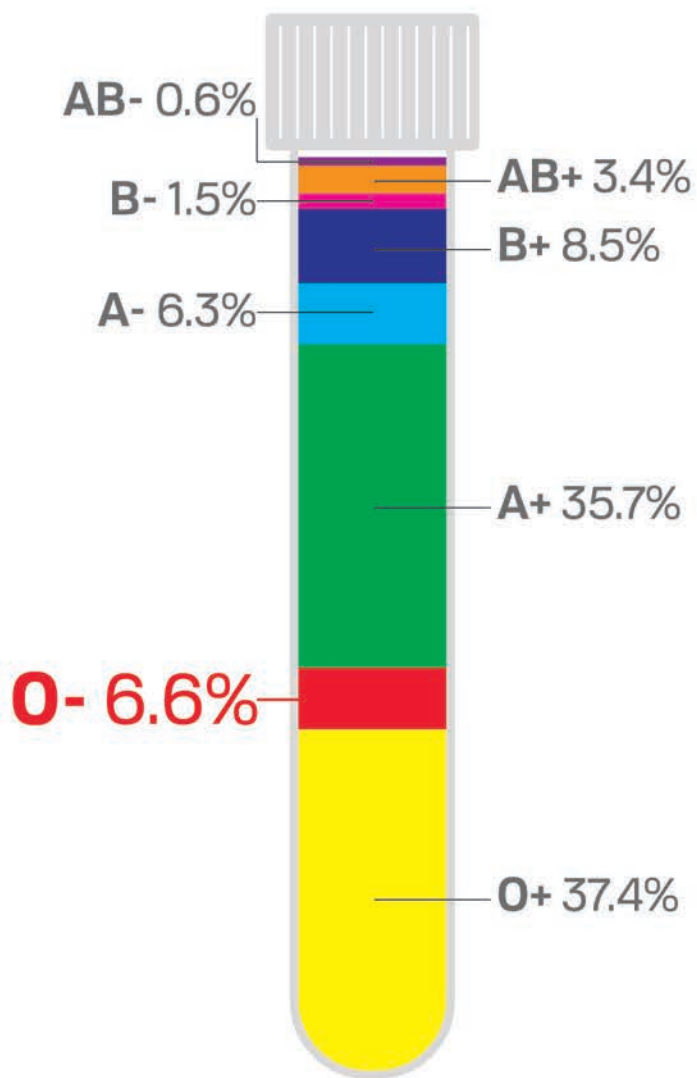
According to the Canadian Blood Service’s Devine, who is also a professor of pathology and laboratory medicine at UBC, one problem ZymeQuest faced in adapting Goldstein’s enzymes isolated in 1982 into a universal blood platform was their relatively low reaction rate. This meant the system needed high volumes of the enzyme, which drove up the speculative cost of the system.

“Steve’s managed (to) make it so that you can add much less enzyme than was originally in the ZymeQuest treatment,” Devine said. “So, in theory, that means you should be able to drop the major cost component in the treatment.”

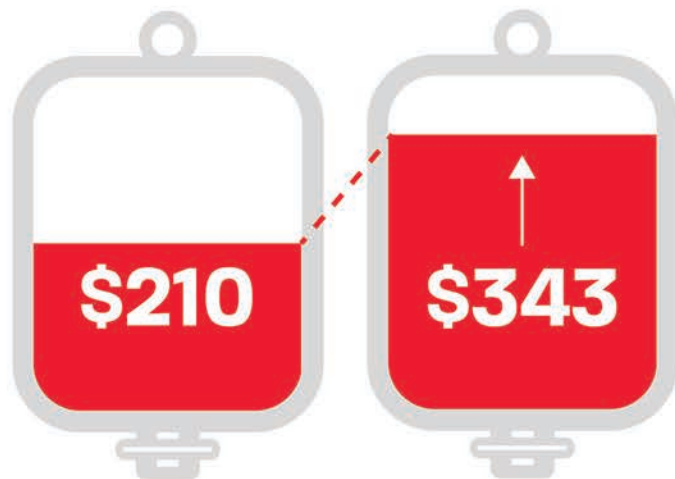
After Withers and colleagues tested a number of their enzymes against synthetic versions of the sugars on red blood cells to narrow their focus, they examined the activity of a subset of

BLOOD TYPE FREQUENCY

PERCENTAGE OF POPULATION



DONATIONS NEARLY
DROPPED
ONE -THIRD
OVER THE LAST DECADE



MEAN COST
OF BLOOD
BAG TO
HOSPITAL

MEAN COST
OF BLOOD
BAG TO
PATIENT

Information about the amounts hospitals charge patients for units of blood aren't collected by the biennial National Blood Collection and Utilization Survey. The most recent published estimates come from a Thomas Jefferson University survey of hospital-based blood bank and transfusion service directors conducted in 2007 and published in 2011.



SCREENING

When a donor arrives, staff review their health history and conduct a mini physical, including checking blood iron levels.



DONATION

A donation consists of one bag of blood, which measures a pint, and several small test tubes. The bag and test tubes will be sent to separate facilities and tracked through barcodes.



STORAGE

After testing is completed, bags suitable for transfusion are labeled and stored in refrigerators at 43°F for up to 42 days.



TESTING & PROCESSING

The test tubes are sent to a testing laboratory and screened for infectious diseases. The bag is sent to a processing center where whole blood is spun in centrifuges into red cells, platelets and plasma.



DISTRIBUTION

Hospitals keep some blood bags on hand, but mostly order it from blood centers as it is needed.



TRANSFUSION

While the better blood management programs have reduced the use of blood in elective surgeries, the demand for universal blood, which is preferred in emergency situations, has remained constant.



NIAID

On average, the human body contains between nine and 12 pints of blood. A person can make a donation, which is one pint of blood, as often as every eight weeks. It takes about four weeks for bone marrow to replace the red blood cells removed in a donation and another four weeks for blood iron levels to return to normal

the enzymes on red blood cells. When they then treated whole Type A blood with these enzymes and ran it through standard typing kits provided by the Canadian Blood Services, the blood successfully registered as Type O.

Bad for business

The drop in demand for any blood that is not O-negative has coincided with a decline in donations.

According to the Centers for Disease Control and Prevention's Office of Blood, Organ and Tissue Safety, the number of units collected for transfusion dropped to 12.2 million in 2017 from 17.3 million in 2009.

The price of blood also has declined. Hospitals paid a median price of \$207 for each bag of red blood cells in 2017, \$14 less than in 2013.

According to Devine, the fall in blood donations, demand and prices, and the shortage of O-negative blood, aren't uniquely American problems.

"The decrease in red cell utilization has happened in all developed countries in reaction to patient blood management," she said. "So, it's good for patients, (but) it's just not so good if you run your blood system like a

business."

The decrease in blood prices and number of transfusions has eaten into the operating budgets of blood providers of all sizes, whose costs largely consist of paying employees to draw, test, process, store and deliver blood, as well as to recruit and track donors.



HROUDA

According to Chris Hrouda, president of bio-medical services at the American Red Cross, his organization and others

have had to cut back on staff and curtail blood drives. "Because of the industry economics, we can no longer afford to maintain the spare capacity that's not productive," Hrouda said.

In the past, blood centers have been able to respond to temporary surges in donors after events, such as snowstorms or hurricanes, caused regular donations to dip. With reduced staffing, blood banks are now slower to bounce back after disruptions.

Additionally, whole blood donations have decreased across the board, and industry experts aren't sure why.

"We just find it harder and harder to recruit donors in the United States, and that adds to the cost challenges,"

Hrouda said. “It could be ... that more potential donors are engaged in the paid plasma industry, where they can go and donate and receive some financial contribution.”

As O-negative blood remains in constant demand, experts say, blood of other types isn’t piling up in refrigerators, collected and unused.



SALAMON

According to Nina Salamon, executive vice president of Blood Centers of America, which represents more than 50

independent blood suppliers, the amount of blood that spoils at blood banks doesn’t play a significant role in the costs of blood operators. In 2017, BCA members “outdated” less than 2 percent of the blood they collected.

“What we are seeing though, is that hospitals are requesting and using a lot more O-positive and O-negative,” Salamon said. “There’s been an overabundance in use of O-negative, so I think that is really where a neutral red cell would gain some traction — in hospitals.”

Tight inventory management has pushed blood suppliers in the U.S. to take action beyond cutting staff. Hrouda, who wrote the open letter in August announcing that the Red Cross was raising prices of most blood products, said last month that those increases already have gone into effect.

“We are not going to push our way to prosperity through cuts of people and productivity improvements — by cutting people and just saying ‘Do more. You just need to work harder,’” Hrouda said. “That is never going to be the solution for a sustainable blood industry in the United States, so we have to innovate, we have to use new technologies.”

A natural challenge

As Withers and colleagues finesse the development of enzymatically rendered Type O blood cells, they will eventually have to reckon with the Rh

factor, a protein present on 85 percent of all blood that attaches to the cells in a manner completely different from that of antigenic sugars, before being able to generate truly universal blood from any type.

Fifteen percent of the population has Rh negative blood, and almost half of that group (6.6 percent of the population) has O-negative — already universal donor. So if the blood of everyone else who is Rh-negative could be transformed into type O, the amount of universal blood available for transfusion potentially could be more than doubled. Blood suppliers and hospitals certainly would welcome this prospect.

“I think it’s a great thing, if it could come to fruition, because we need more neutral blood cells,” said Salamon at Blood Centers of America. “We need more Os, and if there is a way to get a product out that looks like an O, that would be a great thing for hospitals and blood centers.”

The technology to make that product is still in the future, as basic questions remain about the process.

“At this stage, we know we’ve converted A to O, and we’re just now getting into the safety test of this A-to-O type blood,” Withers said. “Is it normal O-type blood, or have we chopped something else and caused other problems?”

Stossel, the hematologist at Velico Medical, also stressed the risk of underestimating the molecular nuances.

“I suspect that, as much as we understand about the carbohydrate structures that determine these blood types, they’re actually more complicated and subtle,” he said. Chopping off sugars with an enzyme might seem logical and straightforward, he said, but “nature is a bitch.”



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

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ASBMB

The student's guide to getting the most out of a conference

By *Marya S. Sabir*

A scientific conference can be an exciting place to increase the visibility of your research, establish new collaborations and develop novel directions for future work.

But attending and presenting at a national conference also can be an intimidating and overwhelming experience. I understand that. Having been part of the biomedical research community for a while, I've had the opportunity to attend and present at several large and small conferences. Along the way, I've picked up some useful knowledge about how to approach these events.

To help you build strategies for a successful experience at the 2019 American Society for Biochemistry and Molecular Biology Annual Meeting (April 6-9 in Orlando), here are some things to consider before, during and after the conference to make the best use of your time and financial investment.

Before

(Some of these deadlines have passed for the 2019 ASBMB meeting. Keep this advice in mind for 2020.)

Select a meeting: Choose a conference that not only interests you but also will benefit you most. For example, early in my undergraduate career, I attended smaller local and regional conferences and more undergraduate-focused meetings, such as the Annual Biomedical Research Conference for Minority Students. As I got better at navigating these events, I started attending larger national conferences, including the ASBMB

and Experimental Biology meeting.

Submit your abstract: Abstracts are due about four to six months before the conference (the ASBMB deadline was in November), so plan your research accordingly. Make sure to follow the guidelines. Your abstract can be disqualified automatically if you exceed the word count, if the abstract has too many spelling errors, and so on.

Apply for travel funding: Most conferences offer travel awards to offset some costs. (The deadline to apply for the 2019 ASBMB meeting has passed, but be sure to apply next year.) I've been able to attend a number of conferences with either partial or full travel funding covering transportation and lodging.

Register early: Most meetings offer discounts; the earlier you register, the less you pay.

Create your poster: If this is your first conference, making a poster can seem daunting, but it doesn't have to be. Most researchers create posters using Microsoft PowerPoint, and the National Institutes of Health has a great resource on its training site. Depending on how much data you have, it may take upward of 15 to 20 hours to make a poster, so be sure to start early. Your poster should not be a wall of text, but it must show your work without requiring additional explanation. The exact ratio of text to graphics depends on the project, but remember a picture is worth a thousand words (literally). For example, instead of writing a block of text for the methods section, add a graphic outlining your experimental workflow

with pictures and a few words. Finally, proofread your poster text with your PI and lab members to make sure it's all correct — any error is magnified when the poster is printed.

Prepare to present: You'll need to plan three versions (two, five and 10 minutes) of your verbal presentation. Practice these with your lab mates, PI, friends and family as if you're talking to someone who's unfamiliar with your work (which, at conferences, you will be). In my previous lab, in place of lab meetings, we held presentation practice sessions — an effective way to solicit honest, constructive feedback from people who have your best interests in mind.

Prepare your elevator pitches: You'll also need two elevator pitches: a one- or two-minute pitch for those in your field of study and a 20- to 40-second pitch for those outside. The pitch for those in your field should capture the essence of your research question, methods (if novel) and significant results, while your speech for those outside your field should communicate the broad impact of your research.

Prepare documents and business cards: You will need to have several copies of your job-related documents (primarily your resume and CV) and plenty of business cards with you throughout the meeting for exchanging with possible collaborators, internship coordinators, graduate/medical school directors, admissions representatives and others.

Schedule yourself: Conferences are hectic. Combat this by scheduling your days beforehand. The meeting

program is a great starting point. But remember to remain flexible: sessions may run overtime or you may need a mental break to gather your thoughts. Also, if the meeting is in a place that's new to you, schedule some time in the evenings to explore.

During

General etiquette:

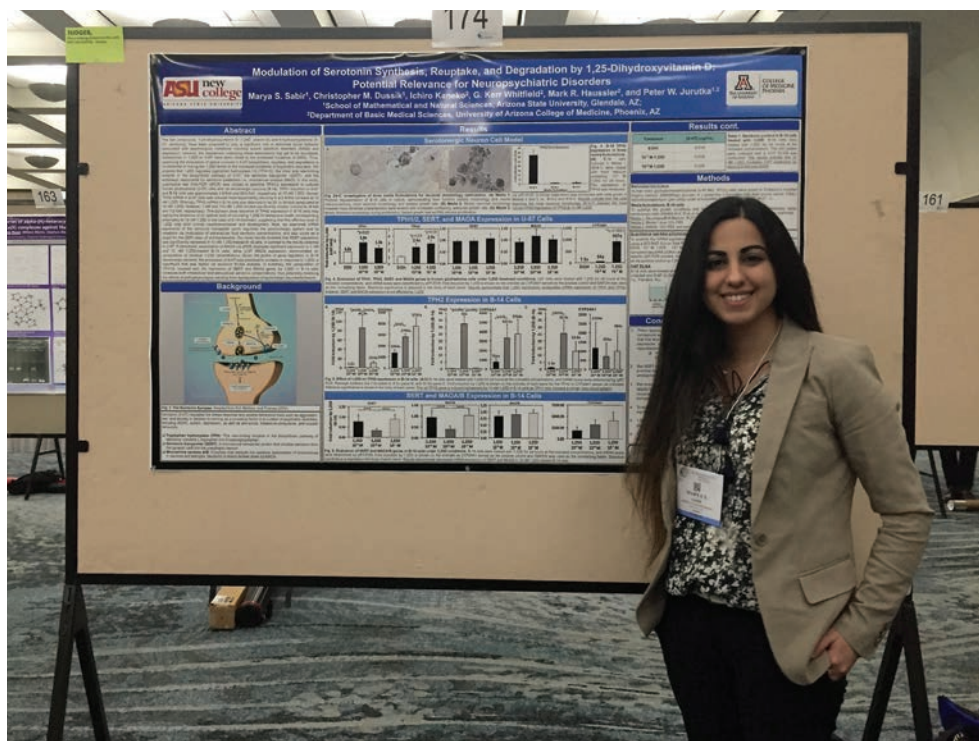
Two rules: (1) Always wear your badge so people can identify you. (2) Dress in business or business casual attire, especially for your presentation.

Present your poster:

Presenting a poster is an art as much as it's about the science.

Do not stand in front of your poster; stand to the side or turn sideways to give the audience an unobstructed view. Make eye contact and smile at those walking by, but don't expect everyone to be interested in a presentation. When someone expresses interest in your work, greet them with a smile and handshake and introduce yourself. Find out who they are and why they are interested in your poster before launching into your spiel so you can address their needs and expectations. Stand tall (everyone has nerves when presenting), speak with enthusiasm (who better to talk about your research than you?) and use hand gestures to illustrate key concepts. Finally, ask your audience if they have any questions before thanking them for their time and attention.

When not at your poster: Take time to attend symposia, lectures and workshops. Don't be afraid to introduce yourself to your neighbors in the seminar auditorium or standing



COURTESY OF MARYA S. SABIR

Marya Sabir stands in front of her poster at the 2016 ASBMB annual meeting, where she received the best poster award in the Cell and Developmental Biology section.

in line at the coffee shop. When I first attended seminars given by established scientists, I was afraid to ask questions, but I've learned that often many people in the audience have the same question I do — so gather up your courage and ask.

After

General tip: On your way home, take some time to decompress and review your notes. While the conference is still fresh in your memory, transcribe your questions and the names of people you want to follow up with.

Follow-up emails: Thousands of people attend big conferences, so it's important to start a correspondence with those you met to create a more personal connection. In the first email, I like to express gratitude for meeting them with a brief line about how much I enjoyed their presentation or conversation along with any remaining questions I may have or

ideas for a collaboration.

Follow up on social media: Connect with the people you've met on LinkedIn or Twitter to stay updated on their professional endeavors. Use Facebook only for more informal connections.

Conferences can feel like science marathons, but equipped with the tools outlined above, you can conquer the conference experience. How can you tell how well you did? Here's a metric given to me by a PI: If you walk away with one new collaborator and one new (and viable) research idea, consider the conference a success.

Peter W. Jurutka assisted with revision of the article.

Marya S. Sabir (msabir@asu.edu) is a post-baccalaureate Intramural Research Training Award fellow at the National Institutes of Health studying neurogenetics. She has presented at numerous local, regional and national conferences including the 2016 ASBMB annual meeting.

Why we encourage undergraduates to attend the ASBMB annual meeting

By Debra Martin and Mary Huff

The American Society for Biochemistry and Molecular Biology annual meeting, held with Experimental Biology, is an excellent venue for professional development and networking. We always look forward to meeting others who share our interests, and we leave invigorated, with our heads filled with new ideas to implement when we return to our home institutions.

But career educators and researchers like us are not the only ones who benefit from these meetings. Over the past decade, the ASBMB has worked to create an environment that encourages undergraduate students to attend and participate in these meetings, and these efforts have paid off. At the 2018 meeting in San Diego, some 24 percent of the more than 2,000 attendees were undergraduates.

So what are the benefits of bringing undergraduate students to these meetings? Here are some that we — and some students we know — have seen and experienced.

Posters

Presenting research at a poster session is a great way to learn how to discuss data in a clear and meaningful way, practice the art of communicating science, and receive constructive feedback. The ASBMB provides several venues for undergraduates to present their projects.

Last year, more than 250 students presented work representing all cat-

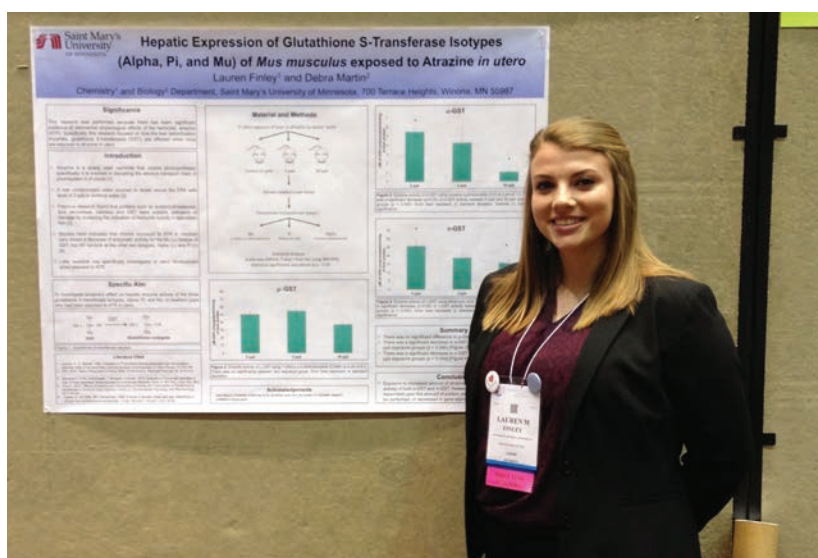


PHOTO COURTESY OF LAUREN FINLEY

Lauren Finley, then a senior at Saint Mary's University of Minnesota, presented her project on the effects of atrazine on the mouse liver protein, glutathione-S-transferase, at the ASBMB annual meeting.

egories of biochemistry and molecular biology, performed at both R1 and primarily undergraduate institutions, at the undergraduate poster competition sponsored by the ASBMB Education and Professional Development Committee. Interactions between faculty judges and students are always positive at this high-energy event, and prizes are awarded to the top poster presentations in four categories. Our students often say how much they enjoy getting to meet people who are like them. And sometimes they don't appreciate the research they've done until they see their level of accomplishment compared to others.

Hannah Bailey, who presented as

an Otterbein University undergraduate last year, said feedback from the poster competition "allowed me to learn how to give a good poster talk."

Katarzyna Hussey, now in graduate school at Johns Hopkins University, remembers the poster session when she was a Bellarmine University undergraduate as helping her practice her scientific communication. "And it was a great networking opportunity," she said. "I got to meet other people in related fields, and even one individual who had worked in the same lab as David Zappulla." As it happened, her poster was on work she'd done during a summer research program in Zappulla's lab at Johns Hopkins.



ASBMB

The 2018 annual meeting included multiple opportunities for career development. Here's a glimpse at one of the sessions, "How to build your CV at every career stage." Learn more about what's slated for undergraduates at #ASBMB2019: asbmb.org/meeting2019/undergraduate/.

The poster session often sparks lively exchanges. Lauren Finley, a student from Saint Mary's University of Minnesota, presented her project on the effects of atrazine on the mouse liver protein glutathione-S-transferase. Although a senior, she was so motivated by questions asked about her project that she came back to campus after she graduated and spent another two weeks performing immunoblot assays to address some of the questions she was asked during her presentation.

During the EB welcoming reception, students can present posters showing their involvement in scientific outreach activities, illustrating how undergraduates are making a difference in their communities with activities designed to generate excitement about science or foster greater understanding of science and its applications.

Careers

An undergraduate degree in science opens many doors, but developing

a career pathway takes planning. The many professional development opportunities at the ASBMB meeting provide tools to identify career goals and gain the skills needed for success.

During last year's Careers Speed Networking event, scientists from multiple fields met with students and shared advice about their career paths. The fast-paced event kept students hopping from one table to another as they absorbed as much information as possible. Many undergraduates said they loved this activity and learned about previously unknown career opportunities.

"The info sessions were awesome," Hussey said. "I remember getting to chat with professionals using their scientific educations in different ways, and it helped to solidify my feelings about pursuing a Ph.D. and working in science."

Among the skills-building activities was a session and workshop called How to Build Your CV at Every

Career Stage and a second session called How to Communicate Scientific Ideas to Novice Audiences, both sponsored by the ASBMB Education and Professional Development Committee. In addition, graduate school representatives from a variety of programs attend the ASBMB poster session each year to discuss what their programs have to offer.

More career development opportunities are sponsored by the Experimental Biology Career Central (look for this year's schedule in an upcoming issue of ASBMB Today). Last year, there were more than 50 sessions, including How to Choose Your Ideal Career, Nailing the Job Talk, and Interview Prep and Networking: A Required Life Skill. One-on-one career counseling helps students develop their CVs and personal statements. All of these opportunities can help undergraduates identify their interests and learn about the skills they will need.

Networking

Sharing ideas and forming relationships is one of the best ways to broaden your network, and the ASBMB annual meeting is a great place to do so. As our students networked with their peers during the poster sessions and the ASBMB reception, they were pleasantly surprised to find that they belong to a much larger community of so-called nerds. They were able to discuss their research, share their own personal goals and college experiences, and make new friends.

“I felt like it was my first opportunity to learn about the scope of science outside of Bellarmine University,” Hussey said, “and speaking with other students about the awesome work they are doing in their labs got me even more excited about a future in science.”

At the panel discussion *How to Organize a Successful Student Chapter*, undergraduates from colleges and universities that have won the Outstanding Chapter Award talked about how they developed active chapters and then opened the floor for an energetic informal question-and-answer session. Hannah Bailey served on the panel for three years, from 2016 through 2018. She said the experience “allowed me to gain insights into what other student chapters are doing and gave me ideas as to what we could do to grow ours, as well as share what was and wasn’t working for our chapter.”

In other informal settings, such as the Meet the Speakers sessions held during the midday poster session in the exhibit hall, students had the opportunity to ask questions and hold conversations with veteran researchers. One student who was shaken and dejected after she felt attacked at her poster developed a different perspective after she met Natalie Ahn (a professor of chemistry and biochemistry at the University of Colorado at Boulder and ASBMB past president). Ahn



ASBMB

At the 2018 annual meeting, attendees had the opportunity to sit down with speakers from sessions they enjoyed. This networking opportunity is back for the 2019 ASBMB Annual Meeting. Check out this year’s schedule: asbmb.org/meeting2019/meetthespeakers/.

told the student and her friends that she too had been questioned aggressively at presentations — more often than she cared to admit. She told the budding scientists that they need to believe in themselves and in their science and know the difference between intelligent criticism and bluster.

Ezra Levy, an undergraduate at Northeastern University, said a highlight of the conference was sitting down with top scientists at the Meet the Speakers sessions. “After attending their talks in the morning, I had the chance to ask them all kinds of questions, scientific and career as well as personal,” he said. “I spent almost an hour with two leading scientists in my discipline, learning about the evolution of my field and drawing out advice about graduate school and beyond. It is a rare opportunity to receive the attention of such experienced and insightful people, and fun to draw them out in a fast-paced and rich conversation.”

Recognition

Every year at the Award for Exemplary Contributions to Education Award Lecture, about 60 undergraduates are recognized for their selection into the ASBMB Honor Society, Chi

Omega Lambda. These students are juniors and seniors pursuing degrees in the molecular life sciences at colleges and universities with ASBMB Student Chapters. Their selection is based on their academic achievement, research accomplishments and involvement in scientific outreach activities. This year’s deadline for applications has passed, but interested undergraduates can visit www.asbmb.org/honorsociety for more information.

Knowledge

Students hear from world-renowned scientists about their innovative work during lectures by more than a dozen ASBMB award winners. For the latest in biochemistry and molecular biology, daily sessions (and spotlight sessions) on research cover broad areas such as metabolism, chromatin remodeling and epigenetics, and links between metabolism and diseases. Undergraduates can learn about the most recent discoveries, soak in knowledge and, if they are curious, ask questions.

Erin Hughes, a student at Otterbein University, said attending the conference and hearing all the great speakers “really inspired me to try

new ideas with my research that I would not have tried previously.”

Hannah Bailey said, “While a lot of the talks went completely over my head, it was fascinating to learn what was going on in other research groups and determine what sort of research I might be interested in for my graduate career and beyond.”

And more

Bobby Murphy, a graduate student at the University of Kentucky, attended the ASBMB meeting in 2012, when he was a student at Bellarmine. “As an undergraduate with very little exposure to the broader scientific world, it opened my eyes to how large the scientific community is,” he said. “I learned that science is incredibly fun and social, and that the job of a scientist reaches far beyond the bench. These realizations, combined with attending several career workshops, ultimately played a huge role in my decision to return to graduate school in 2015. Without experiences like this, I don’t believe that I would have realized the doors that a Ph.D. can open for a scientist,

or how much fun science truly is.”

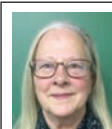
Erin Hughes said the conference brought her closer to the people she traveled with from her research lab. “Also, all of the sessions and talks available at the conference provided me with a wide variety of helpful information on topics ranging from lipids to how to improve the science outreach programs at the university,” she said.

Hannah Bailey agreed the meeting was “an opportunity for our lab to grow closer, as most of us presented our research, which fueled a collaborative environment when we returned home.” This included greater encouragement, help with troubleshooting, brainstorming experiments and questions to ask pertaining to research, and general camaraderie, she said. The conference also “opened my eyes to the greater scientific community and its collaborative nature, and made me excited to be a part of it.”

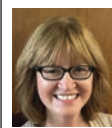
Austin Black is now in the doctorate program for physical therapy at Bellarmine. He attended the ASBMB meeting as a Bellarmine undergraduate. He said, “One of the greatest

eye-opening experiences for me was being able to see the breadth and depth of impact that we can have on multiple facets in society. Biochemists should not be sequestered purely in a laboratory setting (though this is an area that we as a field excel in), but we can be seen as leaders in policy, industry, and innovation, which as a student never dawned on me before being exposed to the very biochemists that are leading this charge.”

If you are an undergraduate and want to learn how you can become involved at the upcoming ASBMB meeting this April, please visit asbmb.org/education/undergraduate.



Debra Martin (dmartin@smumn.edu) is a professor and chair of the biology department at Saint Mary’s University of Minnesota and a northwest regional director of the ASBMB Student Chapters.



Mary Huff (mhuff@bellarmine.edu) is a professor of biology and the interim dean of the Bellarmine College of Arts and Sciences, Bellarmine University, Louisville, Kentucky, and a southeast regional director of the ASBMB Student Chapters.

CALL FOR SUBMISSIONS

ASBMB Today is publishing two essay series in 2019:

What I wish people understood about _____

Is there an aspect of your life, personal or professional, that others just don’t get? Fill in the blank in this sentence, and then set the record straight.

Night shift

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

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

ASBMBTODAY

Accreditation: Participant perspectives, in triplicate

By Cheryl Bailey & Peter J. Kennelly

The number of baccalaureate programs accredited by the American Society for Biochemistry and Molecular Biology has grown steadily. By the end of 2019, just six years after the accreditation program began, the number of accredited programs likely will reach the century mark.

Despite the program's progress, many potential participants still ask, "Why should our program become accredited?"

We have addressed this question in three ways. The first was via a survey of accreditation stakeholders recently published in the journal *Biochemistry & Molecular Biology Education*. The second was the recent publication of a letter describing details of the program in the journal *CBE-Life Sciences Education*. The third was by reaching out to representatives of three diverse accredited programs to learn how ASBMB accreditation has affected their programs:

Douglas McAbee of California State University Long Beach, a large (enrollment 37,000), public, master's granting institution on the West Coast;

Michael Wolyniak of Hampden-Sydney College, a small (enrollment 1,100), private, primarily undergraduate institution in the mid-Atlantic region; and

Paul Black and **Erin Sayer** of the University of Nebraska, a large (enrollment 25,000), public, research-intensive university in the Midwest.



HAMPDEN-SYDNEY COLLEGE

Jason Pough, Tony Rivas, and Khoa Tran, all undergraduates at Hampden-Sydney College in Virginia, work on a summer project designed around the proteomic analysis of mucus from local fish species.

Overall, these programs reported the following benefits of accreditation:

- the focus on concept-based education in the accreditation application helps them critique and improve their programs;
- guidelines from a national society help them strengthen the programs at their institution; and
- accreditation of the program and certification of students through a common exam help create assessments for internal and external use.

On the facing page, in chart form,

are their more detailed answers to our questions.




Want to learn more about the ASBMB accreditation program? Go to [asbmb.org/accreditation](https://www.asbmb.org/accreditation).



Cheryl Bailey (baileyc@mtmary.edu) is dean of the School of Natural and Health Sciences and Education, Mount Mary University, Milwaukee, Wisconsin.



Peter J. Kennelly (pjkennel@vt.edu) is a professor of biochemistry at Virginia Polytechnic Institute and State University.

Questions	 Douglas McAbee	 Michael Wolyniak	 Paul Black and Erin Sayer
What were your motivations for applying?	<p><i>“When ASBMB came out with an accreditation program, we thought this would be a good opportunity to realign our program to shift from a chemistry-focused program to a life sciences/biochemistry-focused program.”</i></p>	<p><i>“As a tool for convincing our administration that a biochemistry and molecular biology major was worth doing, and that a national organization existed to insure that we implement the major well.”</i></p>	<p><i>“To demonstrate to our peers that we are a highly competent and relevant program . . . and to our university that we are recognized as a high-caliber, highly successful program.”</i></p>
What changes were stimulated by your participation in ASBMB’s accreditation program?	<p><i>“Accreditation coincided with a number of curricular changes that included a complete overhaul of the 20-year-old syllabus for our major’s biochemistry lab.”</i></p>	<p><i>“Having to evaluate ourselves was enlightening. It helped us to identify our strengths and weaknesses as a faculty and illuminated the expertise areas to be addressed through future hires.”</i></p>	<p><i>“It helped us develop a program that encompasses all four years. Previously, we lacked course work in scientific writing and analysis within curriculum during the sophomore year. Now our students have a connection to biochemistry spanning all four years. We also revised the sequencing of our two-semester flagship course to better articulate the breadth of information and balance its content.”</i></p>
Do you have any suggestions for improving the accreditation program?	<p><i>“Offer the certification examination in both fall and spring to help address needs of December graduates, and move the spring exam to March to avoid conflicting with the MCAT.”</i></p>	<p><i>“Offer site visits, perhaps as part of a consultant service.”</i></p>	<p><i>“We would like access to individual students’ data on the certification exam to enable us to investigate how well they correlate to grades.”</i></p>
Do you have any additional observations or stories you wish to relate?	<p><i>“Having the accreditation really helped garner resources. The overall trajectory has been positive and has been especially beneficial for our students. Our largest group of majors (in the department of chemistry and biochemistry) is now recognized by a world-class society.”</i></p>	<p><i>“The exam provides a yearly checkup that helps us identify weaknesses and continuously fine-tune our program. The weight of the society has provided us with leverage for obtaining better equipment.”</i></p>	<p><i>“We highly value the ASBMB accreditation exam for our students. It helps us evaluate what we are doing well and not so well. When we talk to faculty and get a broader sense of what they think about the biochemistry program, they take a point of pride of being part of a national accredited program. Some faculty were naysayers, and now it is a point of pride.”</i></p>

Rewriting the rules

SciOut2018 flips the script on traditional symposia

By Nicole C. Woitowich

Most of us have been to scientific meetings in conference halls, hotel ballrooms and university spaces where we've sat through opening remarks, mini-symposia, keynotes and award lectures.

Tried and tested, the traditional format of lectures and coffee breaks followed by a poster session and open bar works well when the goal is to disseminate field-specific information. Yet the most exciting moments of scientific meetings often take place in the hallway, over breakfast or in a shared cab when colleagues discuss overlapping interests and spontaneously develop plans for collaboration.

We decided to flip the traditional script on what we knew or thought about scientific meetings with Science Outreach: Models, Methods and Measures, aka SciOut2018. This special symposium, conceived by the American Society for Biochemistry and Molecular Biology's Science Outreach and Communication Committee and led by Jeanne Garbarino, Edwin Li and myself, was intended to address an unmet need — to bring science outreach practitioners together to tackle big issues in our field, including the scaling and sustainability of outreach programs, engaging underserved populations, and the generation and use of metrics and evaluations.

But that brought us to our aha moment: Who are we to decide what the biggest issues facing the science outreach community are?

Science outreach practitioners are as diverse as the fields we're drawn from. True, some of us are faculty



ALL PHOTOS BY SCOTT RUDD

Susan Renoe of the University of Missouri and the National Alliance for Broader Impacts delivers a flash talk on experiences and perspectives around metrics during the SciOut18 science outreach meeting in October.

or staff at academic institutions, but many are artists, curators, consultants, community organizers or employees in private or nonprofit fields. Thus, our limited perspectives couldn't provide robust programming to meet all the needs and interests of the community we hoped to serve.

We decided to take an “unconference” approach, letting the participants set the agenda. We sent attendees a list of questions related to science outreach, and from their responses we generated a two-day plan with 10-minute flash talk speakers. This approach differs slightly from a true unconference, where the agenda is set after attendees arrive; we still needed some advance structure to feel comfortable, and that was provided in part by Grant Garrison from PUBLIC Inc., who has experience running such meetings.

No one knew what to expect — not the attendees and, to be honest, not even the organizers. We had just asked 120 people, the majority of whom had never met each other, to attend a meeting without a formal agenda. It can be unsettling to be told, “We don't have a plan,” especially for scientists who thrive on structure and meticulous attention to detail.

In many ways, SciOut18 functioned like an enzyme, catalyzing a reaction that otherwise would not happen in a relevant time frame. We brought together people, many of whom would not have met in any other context, and provided the right environment for meaningful dialogue about things that matter the most to them and their community.

Douglas Vakoch, president of Messaging Extraterrestrial Intelligence,



Devon Collins of Rockefeller University enjoys one of the speakers at the SciOut18 conference held in October at the university in New York City.



Among those sharing a moment of lively discussion during a group work session at the SciOut18 meeting are, from left, Edwin Lee of St. Joseph's University, Lou Woodley of the American Academy for the Advancement of Science, Julie Nadel of Johns Hopkins University, Odaelys Walwyn-Pollard of Rockefeller University and Jory Weintraub of Duke University.

attended SciOut18 because he wanted to connect with others who are dedicated to communicating the latest scientific developments to diverse audiences. Since the meeting, two other participants have become members of his organization's advisory council, enabling ongoing collaboration.

"I have never participated in a meeting that so exquisitely balanced structure and spontaneity as SciOut18 did," Vakoch said, noting the mix of speakers and small-group discussions.

"SciOut18 encouraged each of us to take the initiative in deciding priorities for the future of science communication," he said. "We were invited to lead groups in areas already defined by the organizers, as well as on topics that we identified over the course of the meeting."

Christina Marvin, a postdoctoral fellow at the University of Wisconsin-Madison, said she was drawn to science outreach through a desire to connect science and the community.

"I grew up in a small coal-mining town, where many people lacked access to strong science," Marvin said. "I want to demonstrate to young people and their families that the world needs scientists from all back-

grounds in order to enrich discussions and help scientists better serve real communities."

For Marvin, SciOut18 provided new and meaningful connections. "I found myself sitting at the same table as an educator who works with communities in the region I grew up (in)," she said.

At SciOut18, there were no PowerPoints, no poster sessions, and the name tags did not include terminal degrees. The conference website featured information on attendee demographics and highlighted a code of conduct that included a zero-tolerance policy on harassing, abusive, discriminatory and derogatory behaviors. For pumping or nursing mothers, video-conferencing software provided a live feed of the proceedings to a private space. Lodging and travel support was provided to all attendees who needed it. These decisions all were intended to make this meeting as equitable and accessible as possible.

"SciOut18 was a fusion of heady idealism and nuts-and-bolts practicality," Vakoch said. "Science communicators need a clear vision for the future of their profession, as well as expertise to implement that vision in

the real world. SciOut18 provided both, setting the stage for bringing science communication to the next level as an independent profession."

More info

If you are interested in learning more about SciOut18 or would like to be involved with future outreach initiatives through the ASBMB, contact Nicole Woitowich (nicole.woitowich@northwestern.edu) or Jeanne Garbarino (jgarbarino@rockefeller.edu).

Video

Hear participants talk about science outreach and see scenes of SciOut18 at asbmb.org/asbmbtoday.



Nicole C. Woitowich (nicole.woitowich@northwestern.edu) is the associate director of the Women's Health Research Institute at Northwestern University and a member of the ASBMB Science Outreach and Communication Committee. Follow her on Twitter at @NikiWoitowich.

Read and reflect

To mark Black History Month 2019, we have pulled together a collection of articles and essays that address the experiences of people of color working and studying in the life sciences and other science, technology, engineering and math disciplines. See the collection at asbmb.org/asbmbtoday.

Raising a rainbow of scientists

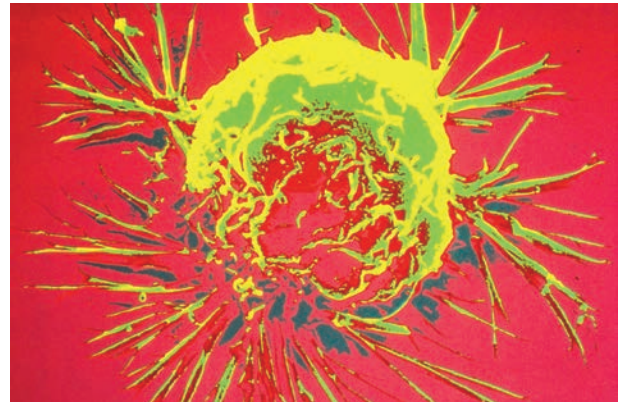
In this essay, Ashley Warfield–Oyirifi, a Ph.D. student at the University of Illinois, Urbana-Champaign, lays out a plan to situate the study of biochemistry and molecular biology in their social context to retain students of color.



COURTESY OF ASHLEY WARFIELD-OYIRIFI

Addressing the tangled roots of health disparities

Life scientists funded by the National Institutes of Health's National Institute on Minority Health and Health Disparities forge collaborations to rethink old questions, train young researchers and engage diverse communities.



BRUCE WETZEL AND HARRY SCHAEFER, NATIONAL CANCER INSTITUTE, NATIONAL INSTITUTES OF HEALTH

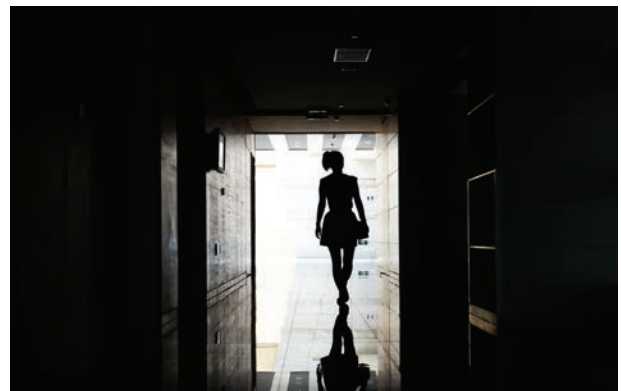
Six questions for three presidents

Sean Decatur, president of Kenyon College in Ohio; Roy Wilson, president of Wayne State University of Michigan; and Juliette Bell, former president of the University of Maryland Eastern Shore; talk about how a background in science serves them at the academic helm.



Colorblindness as ideology

Colorblindness is a popular behavior model that seems to reflect pro-diversity intentions, but Kecia Thomas, an industrial-organizational psychologist and senior associate dean of the Franklin College of Arts and Sciences at the University of Georgia, explains how its practice suppresses diversity and elevates sameness.



African-American men in the molecular biosciences

In a three-part series, Suzanne Barbour, dean of the University of Georgia Graduate School, talks to five black men about their experiences in the molecular biosciences. Their conversations cover the importance of mentoring, managing underrepresentation in science and perspectives for the future.

What's in a name

Johns Hopkins University announced plans to name a research building on its East Baltimore campus in honor of Henrietta Lacks, whose “immortal cells” have been crucial to biomedical progress over six decades, including the development of anti-tumor and anti-viral treatments and the polio vaccine.



KADIR NELSON/SMITHSONIAN

A hero for me

Kyeorda Kemp writes about Charles Drew, whose research in the field of blood transfusion resulted in improved techniques for blood storage and led to the development of blood banks that saved thousands of lives during World War II.

Talking diversity and inclusion

We asked readers to weigh in on the state of diversity and inclusion in biochemistry and molecular biology. They had a lot to say. We published their responses in a special section, “Diversity and inclusion matters.”

Early support goes a long way

Austin Maduka, a recipient of the ASBMB's Marion B. Sewer Distinguished Scholarship for Undergraduates and student at University of Maryland, Baltimore County, wrote about why he engages in education and outreach activities.



COURTESY OF AUSTIN MADUKA

Bringing scientific rigor to issues of diversity

Hannah Valentine, the first chief officer for scientific workforce diversity at the National Institutes of Health, talks about what the agency can and is doing to increase representation.



THE NATIONAL INSTITUTES OF HEALTH

Solving the faculty diversity problem

It's possible to diversify the workforce within a single tenure cycle. Kenneth Gibbs Jr., the lead author of a paper in the journal *eLife*, called into question the notion that the key to diversifying the faculty hiring pool is focusing on building the talent pool of underrepresented scientists. He said the solution is in hiring decisions.



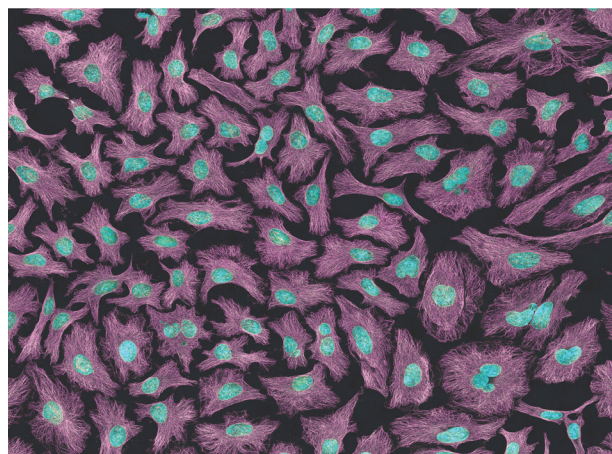
COURTESY OF KENNETH GIBBS

Imposter syndrome and diversity students

Two graduate students and a professor recount their encounters with imposter syndrome.

Sharing the whole HeLa genome

Science writer John Arnst describes how an agreement between the family of Henrietta Lacks and the National Institutes of Health is benefiting researchers by providing access to the “immortal cells” HeLa genome.



TOM DERRINCK AT THE NATIONAL CENTER FOR MICROSCOPY AND IMAGING RESEARCH

Remembering Tuskegee

Squire Booker traces the historical steps that led to the tragic, 40-year-long, government-sponsored Tuskegee syphilis study as well as the changes in public health and medical research policy that have come about as a result.



NATIONAL ARCHIVES

Great achievements in science and technology in ancient Africa

Sydella Blatch writes about the contributions to science and technology by ancient Africans. She writes, in part, “While the remarkable black civilization in Egypt remains alluring, there was sophistication and impressive inventions throughout ancient sub-Saharan Africa as well.”

In need of a new narrative

Natasha C. Brooks writes, “Unfortunately, narratives intended to perpetuate fear for past transgressions, those highlighting health disparities and those regarding minority scientists as exceptional and rare have become the norm. The existing narratives perpetuate the notion that science is 1) perpetrated against them and 2) not for them.”

#BlackandBMB

To mark Black History Month, the American Society for Biochemistry and Molecular Biology will host a Twitter chat in February. Please join members of the ASBMB Minority Affairs Committee to reflect on the experience of being a person of color working in BMB.

Watch our Twitter feed @ASBMB for details about the date and time.

Questions? Contact Allison Frick at africk@asbmb.org or Stephanie Paxson at spaxson@asbmb.org.

CLASSIFIEDS

Rollins College:

Lecturer, Chemistry



The Department of Chemistry at Rollins College invites applications for a unique faculty non-tenure track Chemistry Lecturer position beginning summer 2019. We seek a colleague with a commitment to excellence in undergraduate teaching to teach one section in our general chemistry sequence each semester. This position requires an equal division of teaching (general chemistry) and administrative responsibilities (health professions advising). As the College's health professions advisor, responsibilities include both administration of the program and advising students considering careers in the allied health professions. The successful candidate will work with members of the science division, as well as Admissions (future students) and Career and Life Planning (current students and alumnae), to redefine and sustain a visible signature program.

Qualifications:

- Ph.D. in Chemistry or related discipline
- Post-doctoral experience relative to curriculum requirements highly preferred

Review of applications will close on February 25, 2019.

asbmb.org/Careers/Jobs/79036/

Eastern Kentucky University:

Assistant Professor



The Department of Biological Sciences at Eastern Kentucky University is seeking applicants for a tenure-track, 9-month, Assistant Professor Cell and Molecular Biologist (Biomedical) position, beginning August 15, 2019. Teaching responsibilities will include courses in the department's undergraduate Biology and Biomedical Sciences programs (BS) and graduate degree (MS) program.

The successful candidate will establish an active cell and molecular biology research laboratory (BSL 2 level or lower) and mentor undergraduate and graduate (MS) students. Areas of research may include, but are not limited to, developmental biology, microbiology, stem cell biology, viral pathogenesis, aging, metabolism and cell cycle regulation. Candidates will also be expected to participate in pre-professional advising of Biomedical Science majors. Review of applicants will begin February 1, 2019 and continue until the position is filled.

Minimum Qualifications: Earned doctorate in biology or related field.

Desired Qualifications: Post-doctoral experience preferred

asbmb.org/Careers/Jobs/79175

Rutgers New Jersey Medical School :

Director, Public Health Research Institute



Rutgers New Jersey Medical School (NJMS) invites applicants for the position of Director of the Public Health Research Institute (PHRI) center.

The successful candidate should be a leader committed to maintaining PHRI as a global leader in basic and translational science, supported by federally funded research and strategic initiatives in private partnerships.

The center is located on the Rutgers New Jersey Medical School Newark Campus in the International Center for Public Health (ICPH) building, which is home to the NJMS Department of Microbiology, Biochemistry and Molecular Genetics, a National Regional Biocontainment Laboratory, BSL2 laboratories and BSL3 small-animal vivarium space, and the Global Tuberculosis Center.

asbmb.org/Careers/Jobs/79126

National Cancer Institute, Center for Cancer Research

Chief of Structural Biology

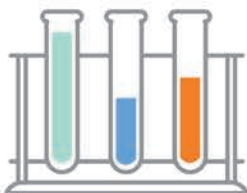


The National Cancer Institute (NCI) is seeking an outstanding, internationally recognized, and visionary scientist to assume the position of Chief of Structural Biology in the NCI Center for Cancer Research (CCR). This position, which is the equivalent of an academic Department Chair, is a key component of a major initiative to expand the structural biology program on NCI's Frederick, Maryland campus.

Tenured faculty or industrial scientists of equivalent rank with a demonstrated commitment to structural biology, biophysics, and/or technology development are encouraged to apply. Applicants should hold a Ph.D., M.D./Ph.D., or equivalent doctoral degree in a relevant discipline, and should possess outstanding communication and leadership skills. Salary will be commensurate with experience and accomplishments. This position is not restricted to U.S. citizens. A full civil service package of benefits (including health insurance, life insurance, and retirement) is available.

asbmb.org/Careers/Jobs/79176

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



Interested in posting a job in ASBMB Today and on our online job board?

Visit asbmb.org/advertise to learn more.



A woman with short brown hair, wearing a light blue ribbed sweater, is smiling and looking towards the camera. She is positioned in the center-left of the image, with a circular graphic behind her containing chemical structures.

A
PROGRAM

A circular inset image showing a microscopic view of cells, likely stained with a blue and pink dye, showing cellular structures and nuclei.

**BEYOND
COMPARE**

Attend the ASBMB annual meeting to learn about the latest developments in biochemistry and molecular biology straight from leading influencers in the field. Find out how to incorporate the latest tools, software and methodology in a variety of expert-led workshops. Plus, receive critical feedback on your work as you build professional connections for future collaboration and reconnect with old friends.

Register today at [ASBMB.org/meeting2019](https://www.asbmb.org/meeting2019).

Advanced registration ends March 20.



Held in conjunction with Experimental Biology