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ASBMB TODAY

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

LIVE AND LEARN

a special section on education and professional development

Getting over the Ph.D. hump

A lifetime of observation

New Orleans scientists reflect on Hurricane Katrina 10 years later

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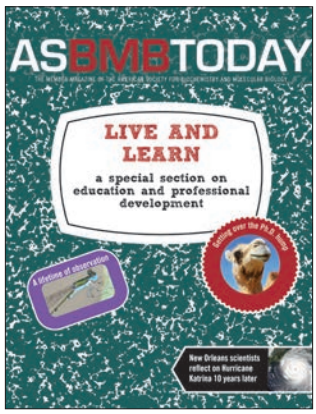

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ASBMB TODAY
THE MEMBER MAGAZINE OF THE AMERICAN SOCIETY FOR BIOCHEMISTRY AND MOLECULAR BIOLOGY

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Welcome aboard!

By Steven McKnight

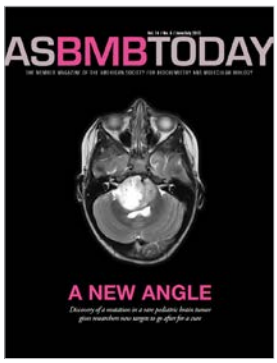
The American Society for Biochemistry and Molecular Biology election returns are just in, and our society is delighted to welcome a new group of leaders:

- **President-elect:** Natalie Ahn of the University of Colorado Boulder
- **Treasurer:** Toni Antalis of the University of Maryland School of Medicine
- **Council members:** Susan Marqusee of the University of California, Berkeley, Rachel Green of Johns Hopkins University School of Medicine, and Wayne Fairbrother of Genentech
- **Nominating Committee members:** Amy Rosenzweig of Northwestern University and Joan Broderick of Montana State University
- **Publications Committee members:** Michael Yaffee of the Massachusetts Institute of Technology and Enrique De La Cruz of Yale University
- **Public Affairs Advisory Committee members:** Dorothy Shippen of Texas A&M University, Martha Cyert of Stanford University, Jonathan Sachs of the University of Minnesota, Richard Page of Miami University and Jeremy Berg of the University of Pittsburgh

We are fortunate that all of these active, practicing scientists are willing to generously share their time, talents and attention with ASBMB. We are a society of scientists serving the fields of biochemistry and molecular biology. We care about many things, including education, the preservation of scientific rigor in our fields and the importance of helping build and sustain an enterprise that is driven by merit and totally committed to a fair and open playing field.

I close by affirming my delight in the prospects of working with President-elect Natalie Ahn over the next few years. Natalie and I have decided to join forces in organizing the 2017 annual meeting of the ASBMB, and we have already worked together for the past two years on the ASBMB Council. All of us who are associated with our society shoulder the vital responsibility of championing the fields of biochemistry and molecular biology so that successive generations may inherit the grit and substance we inherited from our forbearers.

Steven McKnight (steven.mcknight@utsouthwestern.edu) is president of the American Society for Biochemistry and Molecular Biology and chairman of the biochemistry department at the University of Texas-Southwestern Medical Center at Dallas.



CLARIFICATION AND CORRECTION

- The MRI image on the cover of the June/July 2015 issue was courtesy of Weill Cornell Medical College.
- The article "All about ELISA" in the June/July 2015 issue of ASBMB Today incorrectly stated that Solomon Berson and Rosalyn Yalow used radioactively-labeled antibodies when developing the radioimmunoassay. Berson and Yalow used radioactively labeled insulin in their assay.

A step toward sustainability

By Sarah K. Martin

The biomedical research enterprise is unsustainable. A sustainable research enterprise working at peak efficiency balances available funding with workforce size while continuing to produce breakthroughs that improve the health of all Americans. Scientific community leaders have stepped forward to discuss how to address a growing workforce in the midst of dwindling funds. While they have expressed many ideas on this topic, they have presented no clear path to implementation.

To provide clarity to the discussion, members of the American Society for Biochemistry and Molecular Biology published a "Perspective" article in the Proceedings of the National Academies of Sciences that outlined a set of consensus recommendations and implementation plans to move the biomedical research enterprise toward sustainability (see box). "This paper is about action," said Chris Pickett, lead author and ASBMB policy analyst. "The community has had the same discussion many times over. We found where the community is in agreement and suggested concrete plans to begin implementing these ideas."

Analyzing nine sustainability reports published since 2012, the authors narrowed 260 recommendations down to eight distinct but interconnected recommendations agreed on by the majority of reports. These recommendations focused on increasing research funding, relieving regulatory burden and broadening training experiences.

"Researchers — from graduate students to established investigators — have been afflicted by stagnant funding and outdated policies that damage the enterprise, reducing productivity and disenfranchising young and minority scientists," said co-author Wes Sundquist of the University of Utah, chairman of the ASBMB Public Affairs Advisory Committee. "We need to move beyond this." The National Institutes of Health have experienced a nearly 20 percent reduction of purchasing power in the past decade. A 2013 survey of ASBMB members found that 46 percent of respondents laid off or will lay off scientists, and 55 percent have colleagues who have lost their jobs or expect to.

Among the consensus recommendations, a call for an increase in compensation for postdocs to $50,000 per year would reward pretenure scientists for their training and the essential role they play in the workforce. As an example of the interconnectedness of these recommendations, increasing compensation for postdocs to align with the NIH pay scale also would contract the workforce without the federal government increasing overall research and development funding.

The article also identifies issues on which the community has yet to reach consensus. "Improving diversity in the workforce is critical to enhancing research efficiency and eliminating health disparities," said Pickett. "Only one report we analyzed discussed diversity in any detail." In addition, mechanisms to improve how investigators are funded and the need to improve interactions between academia, industry and government were identified as needing further discussion among enterprise stakeholders.

The research enterprise may not be sustainable in its current form, but the recommendations highlighted by the ASBMB paper could steer the scientific community in that direction.

8 recommendations to make the scientific enterprise sustainable

1. The federal government should make research funding predictable and sustainable.

2. The federal government should increase overall research and development funding with 3 percent of gross domestic product as an initial target.

3. Federal agencies should streamline, harmonize or eliminate burdensome regulations.

4. Institutions and federal agencies should increase compensation for postdoctoral scholars with $50,000 a year as an initial target.

5. Institutions and federal agencies should cap the amount of federal funding trainees can receive in order to reduce graduate student and postdoc training periods.

6. Institutions and federal agencies should train students and postdocs for the breadth of careers available to them.

7. Institutions and federal agencies should support more trainees on fellowships and training grants rather than research grants.

8. Institutions should create new job classifications for staff scientists, and federal agencies should incentivize use of staff scientists.

Sarah K. Martin (smartin@asbmb.org) is the science policy fellow at the ASBMB.

American Society for Biochemistry and Molecular Biology

ACCREDITATION & ASSESSMENT *for* B.S./B.A. PROGRAMS IN BIOCHEMISTRY & MOLECULAR BIOLOGY

The ASBMB has launched a national accreditation program for departments and programs offering baccalaureate degrees in biochemistry, molecular biology and other related degrees. Accredited programs gain access to an independently developed and scored examination for assessing student performance that leads to the conferral of an ASBMB-certified degree.

Programs seeking ASBMB accreditation will be evaluated on criteria such as:

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- **University of the Sciences**

ASBMB
American Society for Biochemistry and Molecular Biology

Congratulations are in order

The American Academy of Arts and Sciences announced the members of the class of 2015. The academy has served as the nation's champion of scholarship, civil dialogue and useful knowledge since its founding in 1780. Its members contribute to publications and studies of science and technology, policy, energy and more. The members include some of the world's most accomplished leaders from academia, business, public affairs, humanities and the arts. This class of members includes many winners of notable awards in a wide range of disciplines. The new class includes the following ASBMB members:

Carlos J. Bustamante, University of California, Berkeley

Marc G. Caron, Duke University

Stanley Fields, Howard Hughes Medical Institute and University of Washington

George Georgiou, University of Texas at Austin

Michael J. Lenardo, National Institute of Allergy and Infectious Diseases

Kenneth J. Marians, Memorial Sloan Kettering Cancer Center

Michael Snyder, Stanford University School of Medicine

Gerhard Wagner, Harvard Medical School

James A. Wells, University of California, San Francisco

Wei Yang, National Institute of Diabetes and Digestive and Kidney Diseases

Maquat receives Gairdner Award

MAQUAT

Lynne E. Maquat won a 2015 Canada Gairdner International Award for her discovery of the mechanism that destroys mutant messenger RNAs, nonsense-mediated mRNA decay. The Gairdner Foundation called this discovery "critically important in both normal and disease states" and commended Maquat's work on NMD and another pathway, Saufen-mediated mRNA decay. The work has established new roles for long noncoding RNAs.

Gairdner awards are valued at 100,000 Canadian dollars (US$77,000) and are presented to biomedical scientists whose contributions result in greater understanding of human biology and disease. Maquat holds the J. Lowell Orbison endowed chair, is director of the Center for RNA Biology and is professor of biochemistry and biophysics and professor of oncology at the University of Rochester School of Medicine and Dentistry, where she also chairs the mentoring group Graduate Women in Science. The recipient of numerous awards throughout her career including the American Society for Biochemistry and Molecular Biology's William C. Rose Award in 2014, Maquat is an American Association for the Advancement of Science fellow, a member of the American Academy of Arts and Sciences and a Batsheva de Rothschild fellow of the Israel Academy of Sciences and Humanities.

Bassler wins Shaw and FASEB awards

BASSLER

Bonnie L. Bassler and her colleague E. Peter Greenberg won the 2015 Shaw Prize in Life Science and Medicine. The Shaw Prize is an international award recognizing individuals who have made breakthroughs in the fields of astronomy, life science and medicine, and mathematical sciences. Bassler and Greenberg revealed the molecular mechanism of quorum sensing, a process that allows bacteria to communicate and offers innovative ways to interfere with bacterial pathogens or to modulate the microbiome for health applications. Administered by the Shaw Prize Foundation in Hong Kong, the prize carries a purse of $1 million.

Bassler, professor and chair of the molecular biology department at Princeton University and a Howard Hughes Medical Institute investigator, also won the Federation of American Societies for Experimental Biology's 2016 Excellence in Science Award. This award recognizes women in the biological sciences who have advanced knowledge in a

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particular field through excellence in research. FASEB, the nation's largest coalition of biomedical researchers, represents 27 scientific societies, including the ASBMB, and seeks to promote advancement and education in biological and biomedical sciences. Bassler's award carries an unrestricted research grant of $10,000.

Written by Erik Chaulk

Goodman named vice chancellor

GOODMAN

Steven R. Goodman has been named vice chancellor for research at The University of Tennessee Health Science Center. The position entails further developing the UTHSC's research initiatives, strategies and infrastructure and increasing the $100 million the university currently averages in annual research funding. Goodman comes to the UTHSC from the State University of New York Upstate Medical University, where, in addition to his responsibilities as a professor both in the department of pediatrics and in the department of biochemistry and molecular biology, he served as vice president for research and the dean of the College of Graduate Studies. Goodman's research focuses on the cell membrane skeleton and sickle-cell disease, including recent studies leading to potential biomarkers for sickle-cell severity. His appointment begins Aug. 3.

Serhan joins Corbus advisory board

SERHAN

Corbus Pharmaceuticals Holdings Inc. appointed Charles N. Serhan to the company's scientific advisory board. A clinical-stage biopharmaceutical company, Corbus Pharmaceuticals focuses on rare, life-threatening chronic inflammatory diseases. One of Corbus Pharmaceuticals' principal efforts is the development of Resunab, a drug for chronic inflammatory diseases that can lead to chronic fibrosis. Serhan brings a wealth of knowledge and expertise to Corbus Pharmaceuticals' scientific advisory board. Serhan was the first to identify the role of anti-inflammatory cellular mediators in the pro-inflammatory pathway. Serhan, a professor of anesthesia at Harvard Medical School, was the first endowed distinguished scientist at Brigham and Women's Hospital and served as director of the Center for Experimental Chemistry and Molecular Pharmacology since 1995.

White wins 'educator of the year' award

WHITE

Harold White III was named the educator of the year for higher education by the Delaware BioScience Association. Originating in 2006, the Delaware BioScience Association is dedicated to advancing the growth of the life-science industry and science research and education initiatives in Delaware. It bestows this award upon an individual who makes a profound impact in science, technology, engineering and mathematics education. White is a professor of chemistry and biochemistry at the University of Delaware, where he has been a faculty member since 1971. Additionally, he serves as the director of the Howard Hughes Medical Institute's Undergraduate Science Education Program at UD. White's research interests include the structure, function and evolution of vitamin-binding proteins as well as intermediary metabolism and biochemical evolution. In 2014, he won the American Society for Biochemistry and Molecular Biology's Award for Exemplary Contributions to Education.

Written by Erik Chaulk

Postdoc wins outreach fellowship

ALBINO

ASBMB member Elinette Albino, a postdoctoral fellow at Ponce Research Institute, received the K – 12 Minority Outreach Fellowship from the American Physiological Society. The program fosters communication among young scientists and middle- and high-school students.

"I plan to visit different schools throughout the year and explain to the students the importance of studying physiology, doing research in physiology and examples of physiologists and their contributions to science," she says. "My hope is to inspire them to aim higher in their future careers learning a scientific topic they feel challenged and passionate about."

Albino is conducting research at Martin Hill's lab in Puerto Rico on the cellular reservoirs that sustain HIV in the presence of suppressive retroviral therapy. The lab is investigating macrophages as a reservoir of HIV and whether they are recruited or derived from monocytes from the placenta since it is a de novo tissue.

For more information about the award, visit **www.the-aps.org/k12minorityoutreach.**

Written by Erik Maradiaga

David E. Ong, 1943 – 2015

David E. Ong, an emeritus professor of biochemistry at Vanderbilt University, passed away in April at his home in Nashville. He was 71.

Born on Aug. 16, 1943, in Elkhart, Ind., Ong attended Wabash College on scholarship, graduating both summa sum laude and Phi Beta Kappa in 1965 with a degree in chemistry. He earned his biochemistry Ph.D. from Yale University in 1970. Later that year, Ong went to Vanderbilt as a research associate and National Institutes of Health postdoctoral fellow.

In 1974, Ong joined the laboratory of his Vanderbilt colleague and mentor, Frank Chytil, with whom he produced impactful research in the field of biochemistry with a particular focus on vitamin A. Ong and Chytil discovered cellular binding proteins for two forms of vitamin A, retinol and retinoic acid, changing the understanding of the vitamin's significance. He shared the Osborne and Mendel Award from the Nutrition Foundation with Chytil in 1983 for this groundbreaking research. Ong continued to focus on the study of vitamin A throughout his career and was regarded as a leading expert on the topic.

After his retirement from Vanderbilt in 2008, Ong cultivated his interests beyond the laboratory, including a passion for the arts. An avid music lover with a broad palate, he listened to jazz, gospel and rock 'n' roll and attended many festivals and performances in the Nashville area. Ong was an avid gardener as well, with a specific interest in bonsai trees.

The David E. Ong Memorial Scholarship Fund is being established to aid future students attending Ong's alma mater, Wabash College.

Alexander Rich, 1924 – 2015

Alexander Rich of the Massachusetts Institute of Technology biology department, a biophysicist who contributed pioneering research on the structure of DNA and RNA, died in April in Boston. He was 90.

Born on Nov. 15, 1924, in Hartford, Conn., Rich eventually moved to Springfield, Mass., where he attended Springfield Technical High School. Although accepted at Harvard College, Rich delayed his studies to enter the U.S. Navy's officer training program during World War II, was sent to Portsmouth Naval Shipyard and attended Syracuse University Medical School.

Discharged in 1946, Rich went to Harvard, where he earned his undergraduate degree in biochemical sciences and a medical degree in 1949. Subsequently, he became a research fellow in the laboratory of future Nobel laureate Linus Pauling at the California Institute of Technology. He stayed with Pauling until 1954 and arrived at MIT in 1958, where he worked for the rest of his career.

Although James Watson and Francis Crick famously produced the double helical model of DNA in 1953, Rich's work contributed to a deeper understanding of DNA and RNA structure. In 1973, he employed X-ray crystallography to produce a clear, distinct image of the double helix. The images helped confirm Watson and Crick's model.

In 1979, Rich led a team of MIT researchers that discovered Z-DNA, a different form of DNA that spirals left instead of right and has a zig-zag backbone. Additionally, Rich contributed to the discovery of the three-dimensional, triple-helical structure of collagen, the main structural protein of skin and connective tissue. Among Rich's many awards was the National Medal of Science award from President Clinton in 1995, the highest scientific honor bestowed by the federal government.

Nathan Aronson, 1940 – 2015

Nathan Aronson, former professor and chairman of the University of South Alabama's biochemistry department, passed away at his home in Mobile, Ala., in March at the age of 74.

Aronson was born on Dec. 8, 1940, in Dallas. After receiving an undergraduate degree in chemistry from Rice University, he attended Duke University for graduate school.

Aronson met his wife of 50 years, Judy Fuller Aronson, while earning his biochemistry Ph.D. at Duke.

The two spent the first three decades of their marriage in State College, Penn., where Aronson served as a professor of biochemistry at Penn State University. They moved to Mobile, Ala., in 1992, where Aronson became chairman of the biochemistry department at the University of South Alabama Medical School and served until his retirement in 2007.

Aronson's research, for which he garnered numerous awards over the course of his career, primarily focused on diseases related to the digestion of tissue proteins. He received a Guggenheim Fellowship and a Helen Hay Whitney Postdoctoral Fellowship and was elected president of the Association of Chairmen of Biochemistry Departments of Medical Schools (now the Association of Medical and Graduate Departments of Biochemistry). Additionally, his mentor, Christian de Duve, recognized him during his 1974 Nobel prize acceptance speech.

Written by Erik Chaulk

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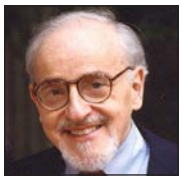
Robert G. Spiro, 1929 – 2015



Robert Gunter Spiro, professor emeritus at Harvard Medical School, died May 16 at age 86 of stomach cancer.

Spiro carried out his research primarily at the Joslin Diabetes Center, where he focused on the kidney complications of diabetic patients. From 1961 until his retirement, Spiro had academic appointments at Harvard Medical School and the Joslin Diabetes Center in Boston. Spiro's wife, Mary Jane Spiro, joined his laboratory in 1966. They collaborated on diabetes research for more than 35 years.

Spiro's studies on the kidney glomerulus in diabetes provided a biochemical rationale for tight blood glucose control, a universally accepted concept. This work won him the American Diabetes Association's Lilly Award in 1968.

Spiro was also a pioneer in the field of glycobiology. He established the Glycoproteins and Biomembranes Section of the Joslin Research Laboratory and served as chief of this section.

In 1954, while a medical student, Spiro noticed the signs and symptoms of type 1 diabetes. He lived with this disease without serious complications. The Joslin Diabetes Center gave him a 50-Year Survival Medal. Spiro in turn announced the establishment of the Robert G. Spiro M.D. Endowed Campership Fund, which helps children with diabetes attend the center's camps.

Spiro received the Claude Bernard Medal from the European Association for the Study of Diabetes, the Rosalind Kornfeld Lifetime Achievement Award from the Society for Glycobiology, and the Diabetes Center Lifetime Achievement Award from Joslin.

Written by Harry Schachter

Irwin Rose, 1926 – 2015

Nobelist Irwin Rose, an assiduous enzymologist who helped to explain how cells destroy unwanted proteins, died in June. He was 88.

Rose did his prize-winning work in the 1970s and '80s at the Fox Chase Cancer Center in Philadelphia and shared his 2004 Nobel Prize in chemistry with Israeli scientists Avram Hershko and Aaron Ciechanover of Haifa's Technion-Israel Institute of Technology.

At a time when other researchers were occupied with how proteins were created, the three found that cells label damaged or old proteins with the protein ubiquitin, which acts, among other things, as a kiss-of-death molecule, keying the proteins to be chopped to bits in proteasomes. This discovery of protein disposal led to the development of a class of cancer drugs and other medicines that can either halt protein breakdown or kill off diseased proteins.

Rose had a reputation for tireless research that was on dramatic display the day he won his Nobel. According to colleagues at the University of California, Irvine, rather than taking time to celebrate the news, Rose fielded some calls and then tucked a couple of test tubes into his shirt pocket and slipped off to analyze their contents at the school's mass-spectrometry facility.

Irwin Allen Rose, whom everyone called "Ernie," was born in 1926 in Brooklyn, N.Y. His younger brother caught rheumatic fever, and when a doctor advised the family to move the boy to a high, dry climate, Rose's mother chose Spokane, Wash., where a sister lived. The boys' father stayed in Brooklyn to work, and Rose, who was 13 at the time of the move, saw little of him over subsequent years.

The teenage Rose developed an interest in medicine and the brain during summers spent working in the psychiatric ward of a local Spokane hospital. But when he enrolled in Washington State College, he found no courses in neurobiology and, as he later wrote in an essay for the Nobel committee, shifted his focus to the science of "less obscure matters."

After a short stint in the U.S. Navy, Rose did undergraduate and graduate work at the University of Chicago and postdoctoral training at Western Reserve University and New York University. When he became a biochemistry instructor at Yale University, he met his wife, Ph.D. student Zelda Budenstein. The two moved together to Fox Chase, where Zelda had a lab studying the metabolism of red blood cells and Rose worked to further understanding of enzyme mechanism.

Zelda's widowed mother lived with the couple and helped care for their growing family of four. Zelda eventually left science to devote herself to peace and justice causes.

Rose's early retirement years were spent in Laguna Woods in Southern California. During an interview with Nobelprize.org, Rose advised fellow scientists not to retire, saying, "I'm very embarrassed when people ask me what are my hobbies.…I mean it's just enough to keep up with the things I'm trying to solve."

According to the Los Angeles Times, Rose worked on a bench in the lab of his friend Ralph Bradshaw at nearby UC Irvine. The school named him a distinguished researcher-in-residence in the Department of Physiology and Biophysics.

Bradshaw told ABC News that in Rose's later years, as he continued to dissect enzymes and publish, the Nobelist also helped students and researchers with experiments, still possessed of an intelligence that was "in the stratosphere compared with the rest of us in the field."

Written by Lauren Dockett

The protective breast

By Indumathi Sridharan

Breast milk contains nutrients and bioactive factors that are essential for babies' health. Proteins, such as growth hormones, enzymes and immunoglobulins, control a baby's nutrient assimilation, growth and immunity. Carbohydrates, such as lactose, provide energy. Fatty acids, such as arachidonic acid and docosahexaenoic acid, stimulate brain and eye development. Vitamins, minerals and bioactive factors, like stem cells, immune cells, and oligosaccharides, also regulate growth and immunity in the infant (1).

But breast milk is more than simply food: It protects babies from infections and confers long-term physical and intellectual benefits. If mothers breast-feed for six months or longer, the babies maximize those benefits. Although approximately 77 percent of women breast-feed right after delivery, only 17 percent continue to breast-feed exclusively until six months. One study estimates that if 90 percent of women breast-fed for six months, it could save the U.S. $13 billion dollars in medical costs over the span of people's lives (2). To promote breast-feeding initiatives in the U.S., the United States Breastfeeding Committee has declared August National Breastfeeding Awareness Month.

Recent research highlights the novel mechanisms by which breast milk protects infant health. For example, human milk oligosaccharides have no nutritional value for the breast-fed infant. They are actually food sources for beneficial gut bacteria. The gut bacteria digest the oligosaccharides using glycosidase enzymes to produce energy-rich monosaccharides. Fucosylated oligosaccharides in the milk resemble the surface receptors of intestinal cells. These oligosaccharides act as decoys for E. coli and norovirus and prevent them from infecting the intestines (3).

Immediately after a woman delivers a baby, milk synthesis and secretion follows with a surge in two hormones, prolactin and oxytocin. For some women, medical issues, like hormonal imbalances, cause low milk supply, which is a common reason for discontinuing breastfeeding early.

So some researchers are seeking biomarkers that signify lactation issues in pregnant women. Shannon Kelleher and colleagues at the Penn State College of Medicine report that zinc transporter protein 2, which transports zinc into milk in the mammary gland, is crucial for proper lactation. Kelleher's team found that loss of ZnT2 impaired mammary gland development by reducing prolactin-induced activation of p-stat5 signaling, which controls mammary-epithelial cell proliferation and differentiation. Lactating mice without ZnT2 produced 30 percent less milk. Additionally, the milk had lower levels of fat and lactose (4).

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Indumathi Sridharan (sridharan.indumathi@gmail.com) earned her bachelor's degree in bioinformatics in India. She holds a Ph.D. in molecular biochemistry from Illinois Institute of Technology, Chicago. She did her postdoctoral work in bionanotechnology at Northwestern University.

New epigenetic function for extracellular Hsp90

By Kamalika Saha

Prostate cancer tops the charts as the most prevalent cancer in men and is second only to lung cancer as a cause of cancer-related death in men. In recent years, new diagnostics and treatment regimens have improved the prognosis of prostate cancer that is organ-confined. However, metastasis, the spread from the primary tumor location to distant organs, continues to be a key factor in prostate cancer mortality. Metastatic cancer cells are more aggressive and are often resistant to chemotherapy. This makes identifying the mechanisms that govern the switch from the localized to the aggressive phenotype in prostate cancers an important research goal. In a recent issue of the **Journal of Biological Chemistry**, investigators at the Medical University of South Carolina report a new epigenetic function for extracellular heat shock protein 90 and describe a novel signaling pathway driving prostate cancer metastasis.

The authors remind readers that a primary factor in cancer progression is the epithelial-to-mesenchymal transition, or EMT, a process whereby cells transition to a more aggressive state. EMT is a part of cancer's invasion–metastasis cascade, a series of steps that consists of cells first invading adjacent tissue, then moving into blood vessels and finally achieving distant colonization.

The authors previously documented the role of the tumor-secreted eHsp90 in metastatic disease. eHsp90 is a chaperone protein that regulates the function of several genes implicated in cancer. But its exact mechanism remains undefined. This motivated Krystal D. Nolan, Jennifer Isaacs and colleagues at MUSC to investigate the link between eHsp90 and epigenetic players that are mostly members of the polycomb group of proteins. Their earlier study noted that eHsp90 is a key driver of EMT in prostate cancer. This one sought to define eHsp90's signaling pathway.

Changes in genes regulating EMT often occur via epigenetic mechanisms that produce chromatin-structure modifications. The authors explored the regulation of EZH2, a key epigenetic regulator, by eHsp90. Their study used epithelial and mesenchymal cell lines. They used epithelial cadherin, a marker of the epithelial cells, as the target gene to study the EMT phenomenon. They found that the mesenchymal cell lines had substantially higher EZH2 and P-ERK protein levels than the epithelial cell lines.

Using a host of molecular biology techniques involving overexpression of eHsp90 as well as Hsp90- and ERK-specific inhibitors, the authors established the eHsp90–ERK signaling axis as mediating EZH2 activity. The study concludes with evidence of a dramatic change in appearance in the localized epithelial cells upon expression of eHsp90. Additionally, the team established the presence of EZH2 as a key contributor of the invasive phenotype.

These findings underscore the complex regulatory interplay between signaling molecules and EZH2, an integral component of the epigenetic machinery. Additionally, they highlight eHsp90 as a novel regulator of EZH2 and EMT in prostate cancer.

Kamalika Saha (kamalika.saha@gmail.com) is a graduate student in the biochemistry and molecular biology department at the University of Maryland, Baltimore.

Small differences equal big results

Insights into sphingolipid structural variants

By Breann Yanagisawa

Since the discovery of sphingolipids in the late 1800s, scientists have made a lot of progress in characterizing some of the diverse interactions and functions carried out by these often complex and enigmatic molecules. However, given the sheer number of these molecules, it seems likely that there are even more interactions waiting to be discovered. The **Journal of Biological Chemistry**'s recent thematic minireview series "Novel Bioactive Sphingolipids" focuses on three structural variants, their functions and their intriguing therapeutic potential.

In the first article, Mitchell Kronenberg at La Jolla Institute for Allergy and Immunology and colleagues focus on the relationship between natural killer T cells (called NKT cells for short) and glycosphingolipids. The authors write about known glycosphingolipid structural variations, especially compounds with a novel alpha-glycosidic linkage, and how these have been shown to vary the immune response that occurs upon NKT cell activation.

Of specific interest is these molecules' capability of producing different types of immune responses, including both anti- and pro-inflammatory responses. Though the field remains controversial, it seems a major factor in determining the type of response is the amount of time the antigen is available to the T-cell receptor. The authors discuss potential mechanisms for determining which type of immune response is induced, pointing out that the binding affinity between the lipid and CD1b, the cell-surface molecule that presents the lipid to T-cell receptors, appears to be particularly important. The authors also mention the prevalence of glycosphingolipids in both microbes

and mammalian cells, indicating they may play a role in microflora and immune-system development. Ultimately, because of the glycosphingolipids' ability to produce contrasting immune responses, the authors posit that they may have clinical roles as immune-modulating agents.

But it's not only the end products of sphingolipid synthesis that hold potential therapeutic applications. Though originally thought to be nonfunctional intermediates, the dihydroceramides, the subject of the second review in the series, also have proved to have important functional roles. Scott Summers and colleagues at the Baker IDI Heart and Diabetes Institute in Australia note that dihydroceramides previously were believed to be rare. But recently these intermediates were found to be increased in a variety of conditions, including autophagy, hypoxia and, more controversially, apoptosis. Interestingly, this increase is correlated with inhibited cell proliferation, an effect most likely brought about by the oxygen-dependent function of the dihydroceramide desaturases. Responsible for the insertion of a double bond that converts dihydroceramide to ceramide, these enzymes likely are behind many of the biologic effects related to dihydroceramide levels. Indeed, numerous drugs that interfere with dihydroceramide desaturase function also decrease cell proliferation. Moreover, these regulatory aspects indicate the potential role of dihydroceramide desaturases in numerous diseases, including cancer, periodontal disease, AIDS and metabolic disorders.

The mysteries of sphingolipids don't stop there. Recently, scientists identified strange structural variants capable of producing uncommon effects. In the final minireview of the series, authors Jingjing Duan and Alfred H. Merrill Jr. at the Georgia Institute of Technology explore yet another sphingoid structural variant, the deoxysphingolipids. Though scientists are only beginning to elucidate the biology of these molecules, the deoxysphingolipids already are known to influence numerous cellular processes. For example, they have potent effects on cell growth and survival. Initially studied because some have considerable cytotoxic effects believed to serve as defense mechanisms for some fungi, these molecules also have been found in mammals, including humans. Not only that, but these molecules also have been correlated with several illnesses, including neurologic disorders, diabetes and liver disease. There even have been a few clinical trials with deoxysphingoid base analogs. Learning more about these structural variants will reveal more therapeutic possibilities.

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Super-fast spins hurt lipoproteins

By Rajendrani Mukhopadhyay

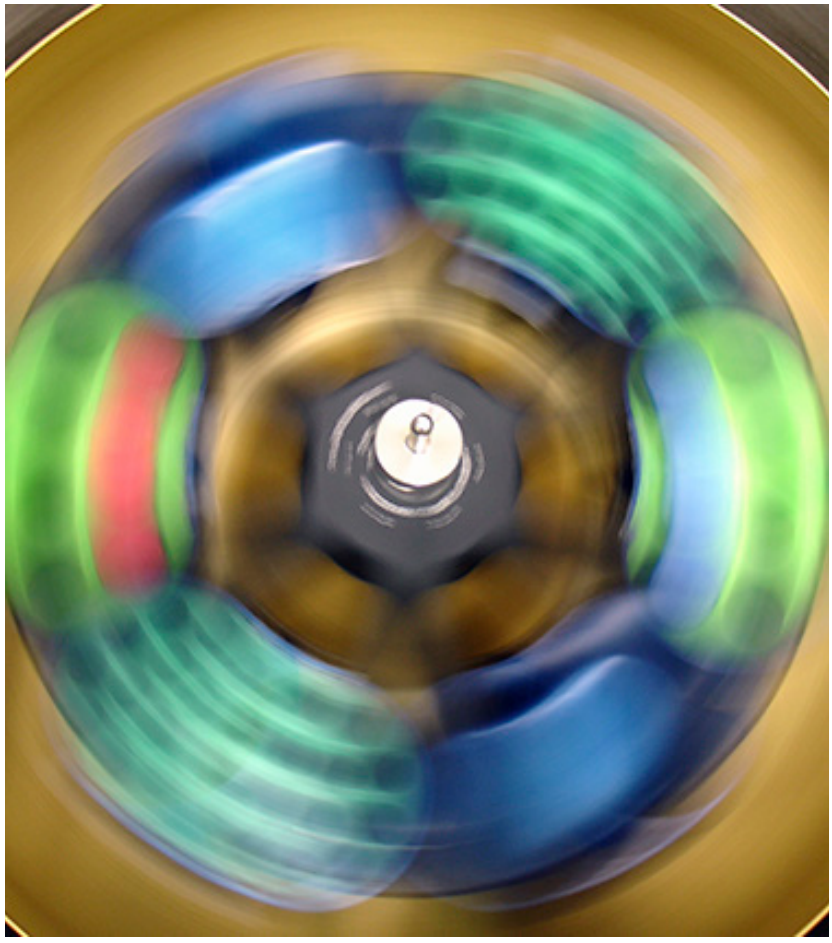
Sometimes the end doesn't justify the means. In a recent paper in the **Journal of Lipid Research**, investigators describe how spinning high-density lipoproteins fast, a typical way to isolate them quickly, damages them. The finding suggests that the current understanding of the hydrodynamic properties and composition of HDL "is incorrect," states William Munroe at the University of California, Los Angeles.

HDL, known as the "good cholesterol," is an important lipoprotein in diagnosing cardiovascular disease. Its abundance in the bloodstream is considered to be a sign of good cardiovascular health, because HDL carries away cholesterol.

Ever since the discovery in 1949 that lipoproteins can be separated and isolated in an ultracentrifuge, spinning lipoproteins like HDL at speeds of 40,000 rpm or greater has been the norm. Samples often get spun at speeds of 65,000 to 120,000 rpm within 48 hours to hasten the isolation process.

But there have been whispers in the lipid community that the high speeds damage the molecules. So a trio of researchers at UCLA, led by Verne Schumaker, decided to see how speed affects HDL. "The phenomenon of HDL potentially exhibiting sensitivity to the ultracentrifuge speed is sometimes mentioned between lipoprotein researchers," says Munroe, the first author on the paper. "However, there was little in the literature describing this phenomenon."

In their JLR paper, Munroe, Schumaker and Martin Phillips showed that damage to HDL began as soon as the ultracentrifuge speed hit 30,000 rpm. Using mouse plasma samples, the investigators demonstrated that the damage got worse as the rotor went faster. Proteins, which are integral to the lipoproteins, got ripped out of the protein–lipid complexes, leaving few intact particles. "With enough gravitational force or time, this protein-deficient HDL undergoes further damage to lose lipid," notes Munroe.



To try to circumvent the damage, the investigators tested out an alternative method for isolating HDL. They poured a potassium bromide density gradient over their sample. Next, they spun the gradient with the sample at a low speed of 15,000 rpm. Admittedly, the isolation took longer at 96 hours, but at least the amount of HDL that rose to the top of gradient was significantly higher than when using the conventional method.

Based on their findings, the investigators now want "to identify HDL-associated proteins that previous identification studies may have missed because certain proteins may have been completely lost from the recovered HDL particle during its isolation by ultracentrifugation," says Munroe. "This may give insight into additional roles the HDL may participate in besides reverse cholesterol transport."

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Paul wins Tabor award for Huntington's work

By Breann Yanagisawa

Bindu Paul, a neuroscience instructor at Johns Hopkins University, received the **Journal of Biological Chemistry/Herbert Tabor Young Investigator Award** for her ongoing research into the role of cysteine and its derivatives in Huntington's disease.

Paul works on understanding regulatory mechanisms present in neurodegenerative diseases in the laboratory of Soloman H. Snyder at Johns Hopkins. Since joining the lab, she has discovered a depletion of the biosynthetic enzyme for cysteine, which mediates disease progression in Huntington's. Now Paul is looking at the role of cysteine and hydrogen sulfide. She is interested in how the interaction of hydrogen sulfide with other gasotransmitters like nitric oxide and carbon monoxide affects regulation of both neuroprotective and neurodegenerative states.

Bindu Paul won the Tabor Award in May at the third European Conference on the Biology of Hydrogen Sulfide. JBC associate editor Ruma Banerjee issued the award.

Paul is hopeful about the applications of this new research. "Understanding the interplay of these three messenger molecules would pave the way to develop novel therapeutics in diseases involving dysregulated gasotransmitter signaling," she says.

Paul grew up in India and received her Ph.D. from the Indian Institute of Science in Bangalore. Her graduate work focused on transcriptional regulation and DNA-binding proteins. Paul went on to postdoctoral studies at the National Institutes of Health in the laboratory of Yun-Bo Shi. There she studied the tissue-specific effects of thyroid hormone and used her expertise in transcriptional studies to understand better the gene regulatory pathways affected by the hormone.

Bree Yanagisawa (breannwoelfel@gmail.com) is a graduate student at the Johns Hopkins School of Medicine and managing editor of the Biomedical Odyssey blog.

Better wine through better yeast hybrids

By Soma Chowdhury

If you enjoy a perfectly chilled glass of sauvignon blanc or a rich merlot, you can thank heterosis. Heterosis occurs when an offspring has increased vigor or superior biological qualities compared with its parents. In a recent **Molecular & Cellular Proteomics** paper, researchers analyzed the molecular basis for heterosis in yeast, microorganisms on which the entire wine industry relies.

Plant and animal breeders have capitalized on heterosis for a long time when crossbreeding to create hybrids with desirable traits. But according to Michel Zivy, corresponding author of the MCP paper and a researcher at the National Center for Scientific Research in France, understanding and using heterosis more efficiently "is one of the bigger challenges in plant genetics and breeding." He adds that understanding the molecular mechanisms is essential to predict heterosis reliably. Currently, there is no single unifying way to predict it.

Zivy and colleagues used a novel approach to understand better the underlying factors augmenting heterosis. The investigators used yeast because the microorganisms are "less complex than other systems like plants," says Zivy. Also, hybrids of common brewer's yeast, such as hybrids between Saccharomyces cerevisiae and S. uvarum, are known to be better at wine-making than their parents. In addition, using high-throughput proteomics allowed the researchers to analyze in a fast and automated way how heterosis affected the abundance of more than 1,300 proteins from the yeast strains used.

The researchers grew all the yeast strains in the same batch of freshly squeezed white grape juice at two different temperatures, because temperature can influence yeast growth and metabolism. Once fermentation was complete, they extracted the proteins from the yeast samples and quantified them.

The investigators showed that offspring born of parents of different species showed stronger heterosis than those born of parents of the same species. They also showed that heterosis depends on the functional category of the protein. For example, the proteins involved in response to environmental changes — such as energy and virulence — showed more heterosis.

Zivy hopes to improve the experimental method that the team used so that it can be applied to more complex systems, such as crops. And wine lovers, rejoice: Zivy and colleagues, one of whom works for the wine research company Laffort, now are using their newly found knowledge of the yeast proteome and heterosis to create better yeast hybrid strains for more aromatic wines.

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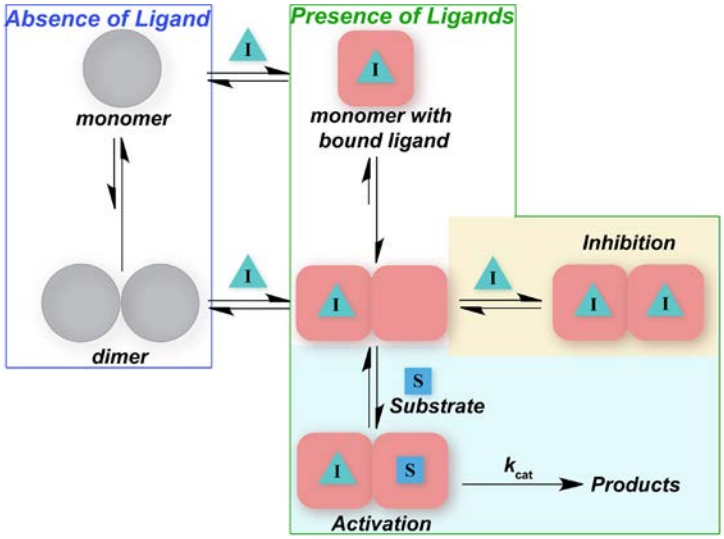
Targeting the Achilles' heel of MERS virus

Molecules shut down activity of an essential viral replication enzyme

By Elizabeth K. Gardner

The MERS virus is in the international spotlight again as South Korea faces the largest outbreak outside the Middle East. As of July 30, the World Health Organization reported 36 deaths and 186 confirmed cases in South Korea and China.

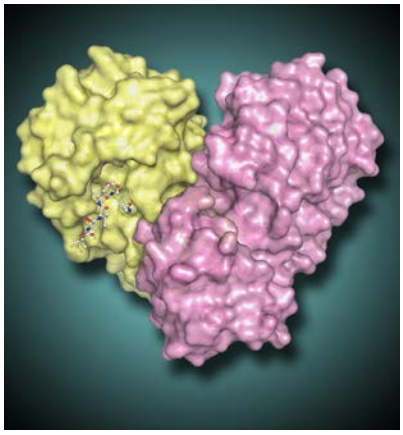
In a paper published in the **Journal of Biological Chemistry**, researchers studying the viral enzyme nsp5, aka 3C-like protease, successfully blocked its function with inhibitor molecules. In the process, they also uncovered behavior that differentiates the enzyme from its counterpart in other coronaviruses.



IMAGES COURTESY OF MESECAR LAB AT PURDUE UNIVERSITY

The behavior of MERS 3C-like protease when ligands are absent and present.

"This enzyme is a prime target – an Achilles' heel of MERS and other coronaviruses — and we were thrilled our inhibitor worked, but the results were puzzling," says Andrew Mesecar, a Purdue University professor of structural biology, who leads the research team. "The behavior was very different from what our work with SARS and other related coronaviruses predicted."



Inhibitor helps MERS 3C-like protease form a dimer.

3C-like protease is responsible for slicing a long strand of viral protein into smaller individual proteins that serve various roles in viral replication, and without it, the process shuts down, Mesecar says. Like other enzymes of its type, 3C-like protease must form a dimer to perform its function. The dimer is formed when two identical single 3C-like protease monomers join together.

Most coronavirus monomers have a strong attraction to their identical counterparts. However, Mesecar and his colleagues found that the MERS protease monomers do not have a strong attraction for one another and do not form its dimer readily. The researchers found that a MERS 3C-like protease monomer will remain single much longer and its dimer will break apart much more easily than those of other coronaviruses, he says.

However, when the team added small amounts of inhibitor molecules to interact with the protease, its activity increased.

"We were surprised to see that this inhibitor molecule that could potentially shut down the virus may also have the potential to increase its activity," he says. "At low inhibitor concentrations we saw an increase in the protease's activity, but at high concentrations it was shut down completely."

It turns out that the MERS protease requires a ligand in order to form a strong dimer. The intended ligand is part of the strand of viral protein it is meant to cut, but the team found that the inhibitor molecule also did the trick.

"At low concentrations the inhibitor served as the ligand and triggered the protease to rapidly form a dimer," he says. "If the second protease in the dimer had a vacant binding site, it was capable of binding to and cutting the strand of viral protein necessary for replication. However, at higher concentrations, we filled the target sites of all of the 3C-like proteases and its activity was successfully blocked."

The team studied the interaction of the inhibitor molecule with 3C-like protease isolated from the MERS virus and next plans to study the interaction of the inhibitor with a complete virus inside a cell.

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What's in your dimer?

By William L. Smith

The term "homodimer" — shorthand for "sequence homodimer" — connotes a protein molecule composed of two monomers with identical primary structures. It often is assumed these proteins function as pairs of independently operating monomers, but there are other scenarios. Many homodimers show a substrate or cofactor binding with high affinity to only half of the seemingly available sites and behave as conformational heterodimers (1). This permits allosteric regulation that is not possible with true conformational homodimers.

Prostaglandin endoperoxide H synthases are homodimers that function as conformational heterodimers. These enzymes, commonly known as cyclooxygenases, or COXs for short, catalyze the committed step in prostaglandin synthesis — the conversion of arachidonic acid to prostoglandin H2 (Fig. 1) (2). There is a constitutive COX-1 and an inducible COX-2. These enzymes are composed of catalytic (Ecat) and allosteric (Eallo) monomers (Fig. 2). With COX-2 at least, Ecat and Eallo each remain fixed in the same form during the biologic lifetime of the dimer (3). Ecat binds heme more avidly than Eallo, and as originally observed by Richard J. Kulmacz and coworkers, maximal COX activity requires only one heme per dimer (4, 5).

COXs are regulated by fatty acid tone — the cellular composition and concentration of free fatty acids. Different free fatty acids bind with different affinities to Ecat and Eallo (5, 6). Free fatty acids binding to Eallo regulates the catalytic efficiency of Ecat. In general, the most common free fatty acids including palmitate and stearate and oleate inhibit COX-1. In contrast, palmitate is relatively specific for stimulating COX-2. Overall, high ratios of common free fatty acids to arachidonic acid, and low concentrations of arachidonic acid, activate COX-2 while suppressing COX-1. COX-1 and COX-2 are also differently affected by the omega-3 fish oil free fatty acids. For example, eicosapentaenoic acid inhibits COX-1 but not COX-2 (2). The molecular basis for the differences in these free fatty acids effects remain to be resolved.

Interest in COXs as drug targets highlights their importance. For example, low-dose aspirin targets platelet COX-1 (7, 8). Aspirin, naproxen (ALEVE®) and ibuprofen (Motrin®) are mixed COX-1 and COX-2 inhibitors called nonsteroidal anti-inflammatory drugs, which relieve pain by targeting COX-2. Celecoxib (Celebrex®) is a coxib — an NSAID more specific for COX-2 (8). Mechanistically, most NSAIDs and coxibs bind more tightly to Ecat than Eallo. Naproxen is unusual in being a direct competitive inhibitor of COX-1, but an allosteric inhibitor of COX-2 (5, 9). As a consequence, naproxen can inhibit 100 percent of COX-1 activity but only 70 percent of COX-2 activity. This may explain why naproxen has limited

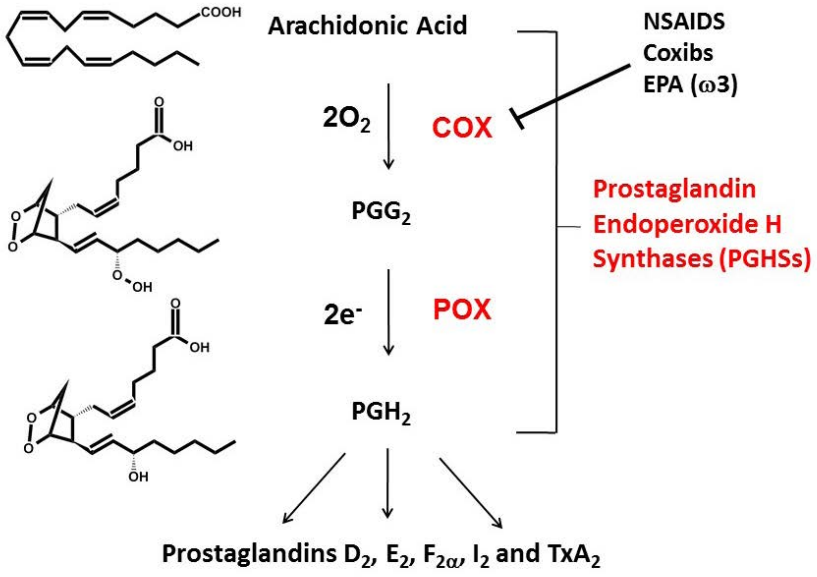

Figure 1. The cyclooxygenase (COX) and peroxidase (POX) reactions catalyzed by prostaglandin endoperoxide H synthases (PGHSs). There are two isoforms that are commonly known as cyclooxygenases-1 and -2 (COX-1 and COX-2).

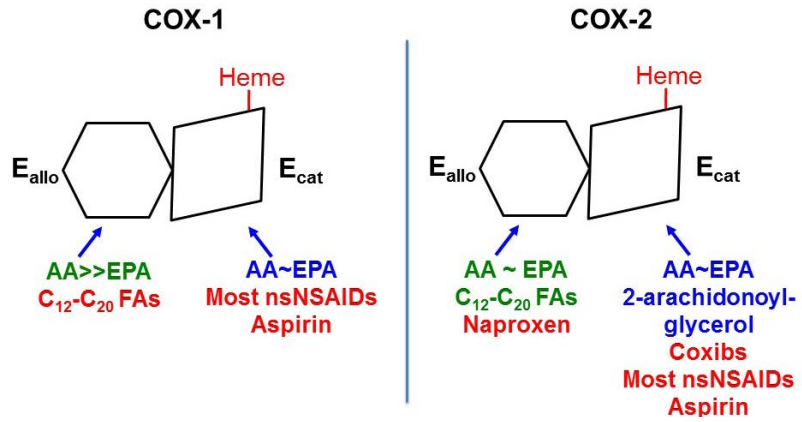

Figure 2. The two COX isoforms are sequence homodimers that function as conformational heterodimers. Both enzymes appear as structurally symmetric homodimers in crystal structures but function in solution as conformational heterodimers composed of an allosteric (Eallo) and a catalytic (Ecat) subunit. The subunits of COX-1 and COX-2 differ in their affinities for ligands and in their responses to ligands. Substrates are in blue. Ligands shown in green stimulate COX activity, and those shown in red inhibit activity.

adverse cardiovascular side effects compared with other COX inhibitors (10).

There is much more to be learned about these COXs including identification of likely dietary influences on these enzymes. Additionally, differences in cellular fatty acid tone may well contribute to adverse effects of COX inhibitors, thereby impacting therapies. Understanding the structure, chemistry and regulation of these enzymes remains an exciting area of investigation.

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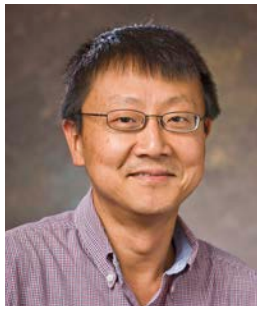
Meet Patrick Sung

A new associate editor of the Journal of Biological Chemistry

By Rajendrani Mukhopadhyay



Patrick Sung at Yale University last summer became an associate editor for the Journal of Biological Chemistry. His expertise is in how cells repair double-stranded breaks in DNA. The American Society for Biochemistry and Molecular Biology's chief science correspondent, Rajendrani Mukhopadhyay, interviewed Sung to learn more about his scientific interests, career trajectory from Hong Kong to the U.S., and work and life philosophies. The interview has been edited for length and clarity.

What is your research focused on?

We have been focusing on yeast cells and human cells. We want to understand the conserved mechanism of how cells go about eliminating DNA double-strand breaks using homologous recombination as a repair system. (Homologous recombination) is one of the two major DNA repair systems dealing with DNA breaks. The other one is non-homologous DNA end joining.

How did you become interested in studying DNA repair?

I worked for a couple, Satya and Louise Prakash. They are my mentors. (Author's note: Sung was a research associate with the Prakashes at the University of Rochester in the 1980s. The couple is now at the University of Texas Medical Branch in Galveston.)

I worked with them on a completely different DNA repair pathway and actually did very well. The DNA repair pathway that I worked on is called nucleotide excision repair, which doesn't deal with DNA breaks but rather functions to eliminate bulky lesions from chromosomes, such as those induced by ultraviolet light. At that time, I was very happy doing that. But when it came time for me to look for a job and something independent to do, I didn't want to be doing the same thing, because, for one thing, I didn't want to compete with my own mentors. They spent a lot of time talking to me and helping me shape my future. They convinced me that homologous recombination had a great deal of potential. I knew very little about it at that point, but I was convinced this was something in which I could be making some impact in the future.

How were the Prakashes pivotal in your career?

They were so patient. They took me by the hand and not only taught me how to go about proper scientific thinking but also how to put a grant together, how to write a research paper and so on. I remember that we used to write papers during the weekends. We didn't have computers then. We would write every single sentence together. I really give them the most credit. From them, I learned the virtue of being patient. I learned the virtue of not getting too agitated about things.

What were the questions in the field when you started out, and what are the big questions now?

I was trained as a biochemist when I was a Ph.D. student. I did classical enzymology, doing a lot of kinetic analyses and so on. When I entered the field, there were already a handful of really powerful geneticists. Genetics was never my forte, although I understand and appreciate genetics a lot. But I could bring my expertise to understand the (DNA repair) mechanism at the biochemical level.

Our forte has been, in the past 20-some years, to reconstitute very complicated reactions and learn how they work. When I entered the field, there was very little biochemical information available, so by taking one protein at a time, I started to look at the key players of the (homologous recombination) pathway and slowly began to make contributions in elucidating how they work.

Because I was ignorant about homologous recombination when I started, I wasn't constrained by what people thought about how things should work. I started in the field fresh, doing what biochemists always do — the careful titrations of pH and so on. I found things that nobody had found before because of that. Ignorance has served me quite well in that particular regard!

Reconstituting a very complicated reaction entailing 12 or 15 different proteins to try to capture what happens in cells is very hard. So the intellectual question has remained the same over the last 20-something years: How does DNA repair work? The complexity is quite astounding. We are doing single-molecule work in collaboration with others. We are also doing structural biology in collaboration. We still do a lot of genetics by ourselves and also in collaboration with others. But we have made pretty significant contributions, I would say, in understanding the biochemical mechanism of homologous recombination to repair DNA.

What sparked your interest in science?

My parents always wanted me to go to medical school. I have a brother who always was at the top of his class. He ended up going to medical school. I always was a B student, even a C student at times, depending on how much I studied. I never liked studying. I just couldn't focus on flipping through a textbook. I hated it.

But I knew that I needed a career. I thought I would go to graduate school. I found that I liked it because it required constant thinking. Every day, I did something different rather than same-old, same-old. That really interested me and convinced me that research was something that I could do reasonably well. My initial goal was rather modest — to find a career to pay my bills.

As I got more and more involved in research, I realized I could do it rather well! At that point, I made up my mind that I wanted to be a faculty member. This was around the time when I was getting done with my Ph.D. at the University of Oxford.

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How did you get to the U.K.?

I was born and raised in Hong Kong. I finished high school and was mulling over where to go for college. I wasn't good enough to get into the local university. Yes, seriously. Not even close. I was more focused on partying than studying. But I did focus on getting good grades in my advanced level exams, and I did reasonably well. (Author's note: Advanced level exams are pre-university courses in the British education system.)

I was admitted into different universities in the U.K. I picked the University of Liverpool because the soccer team was the best at the time. I love soccer. So I went to Liverpool for my undergraduate work because of the soccer team.

Fishing is one of Patrick Sung's favorite pastimes.

You've been a JBC associate editor for a year. What does it mean to you to be an associate editor for the journal?

I believe I am playing a very important role in shaping nucleic acid biochemistry, at least within my realm, in selecting the best work to publish. I think I'm playing a very important role, particularly in helping younger people to get their best work published.

What are your hobbies?

I don't play soccer anymore because of time and age. I enjoy going to soccer tournaments with my 16-year-old son. He's a pretty good soccer player, and I really enjoy going to soccer games with him. I love fishing, but I haven't done any fishing in three or four years, because time is an issue.

Any advice for young scientists?

Just be patient. Develop a superior work ethic. That is absolutely essential. There are so many things going on outside of the lab, so many different distractions. In order to be successful, one has to be completely focused. Every single project one undertakes now is so much more complicated. It used to be you could write a paper on the biochemistry or genetics of a research question. These days, you have to combine biochemistry with some cell biology or genetics. Unless one focuses, it's really hard to compete.

What's your motto in life?

Stay optimistic! Tomorrow will be a better day. When I'm all down and out, I tell myself that tomorrow mostly likely will be a better day. Most of the time, it turns out that things have a way of resolving themselves.

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In conversation with Raymond Cypess

Chairman and CEO of ATCC has had an unusual career path

By Rajendrani Mukhopadhyay

As a teenager, Raymond Cypess cut his teeth in business at his father's bakery. These days, Cypess applies that business education as the current chairman and chief executive officer of American Type Culture Collection, better known as ATCC.

Raymond Cypess joined ATCC in 1993 as the president of the organization and became its chair and CEO in 2006. Before leading the ATCC, Cypess was a dean, a professor of microbiology and immunology, and the vice provost for research and research training at the University of Tennessee, Memphis. He also held appointments at the University of Pittsburgh and Cornell University. Cypess has a doctorate in veterinary medicine from the University of Illinois and a Ph.D. in parasitology from the University of North Carolina.

In an extensive interview with the American Society for Biochemistry and Molecular Biology's chief science correspondent, Rajendrani Mukhopadhyay, Cypess described his vision for ATCC, passion for science and unusual career path. The interview has been edited for clarity and length.

What was your vision for ATCC when you were hired, and how has it changed?

When I was interviewed, the (ATCC) board asked, "What's your vision?" I said, "Basically, my vision is that the ATCC is a standards organization."

I said, "You're a knowledge company, because the microbes that you have stored away are full of information, the keys of which we haven't yet been able to identify. But when we get the right keys and unlock the doors, we're going to find information." This was before the genomic revolution.

Well, recently (the board) asked me again what my vision is. I said, "A standards and knowledge company." That hasn't changed, except now it's been realized. We are the standards company. I'm fascinated by the im-

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About the ATCC

ATCC was established in 1925 by several scientific societies as a centralized collection of microorganisms. But starting in the 1990s, ATCC expanded its role and services. Headquartered in Manassas, VA, the nonprofit organization now is the leading collector, preserver and supplier of reference standard microorganisms, cell lines and other biomedical research materials. The organization, known as a "biological resource center," also offers technical services and educational programs.

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portance of standards and their role in science and society.

In 1993, ATCC had a huge capital deficit, and we were in a death spiral. I said to the employees, "You don't know how good ATCC could be. A little creative imagination, a little leadership could probably realize that potential."

I also said to them, "Nobody can help you but you. Stop looking for divine intervention or saviors from industry, agencies or (scientific) societies. You've got to help yourself, so let's roll up our sleeves and get it done. " That's how it all started.

Why are you fascinated by standards?

The methodology of science is built around replication. Replication requires minimizing variation. Science is the study of constants and wrestling with the variations.

I have a way of looking at things that's very eclectic. I like to take ideas from other fields and apply them to what I'm thinking about. I always was creative. I may not always spell correctly or write grammatically, but I have "the vision thing" and can create new structures and programs. I have the ability to look at problems, processes and structures with a very open mind without placing limits. When I looked at ATCC, I realized that while we had some of the finest biological materials, we had to find a way for ATCC to reinvent itself without throwing out its mission. One way we reinvented ourselves was focusing on standards.

When I looked at ATCC, I realized that while we had some of the finest biological materials, we had to find a way for ATCC to reinvent itself without throwing out its mission. One way we reinvented ourselves was focusing on standards.

Some people on the board felt that ATCC could be a beacon for the scientific community. I said, "I agree with you. But we have to fix up this place."

What were those fixes?

There are some key components to business success. I call them the three R's. The first R is recruitment. The second is retention, and the third is resource development. We had to get better people. We had to get the right people. We had to decide who to keep and not to keep and what to keep in the business and what not to keep in the business. I had to focus on resource development, because we had to get financially sound. We didn't even have a good place to work. (Author's note: Before Cypess took over, ATCC was based in Rockville, Md.) The utilities couldn't support the place. You couldn't plug in instrumentation. We were bursting out of the seams. We were in really antiquated facilities.

Another change was that I, with Judy Vaitukaitis (former head of the National Center for Research Resources at the National Institutes of Health), created the concept of a "biological resource center" that emphasized the sourcing, authentication, preservation, manufacture and distribution of standards. ATCC was originally put together by scientific societies for the purpose of storing the genetic diversity of the microbial world. There's some element of that still, but it's much more about providing the standards to do research.

We're also a public collection. It's very important not only that scientists replicate what they do but also that they share what they do. Nobody has deposited anything significant at ATCC since 1985 with the change in biotechnology patenting laws. With the Bayh-Dole Act and the fact that you can patent biologic material,

everything changed. Nothing significant was being deposited anymore. I coined the term "scientific philanthropy" to describe the depositing of materials and sharing. If people don't share, you cut off quality control. The whole issue of sharing of materials is a big problem, and I think a biologic resource center is one of the ways of dealing with that.

What happened in your childhood to spark your interest in science?

I grew up in an immigrant community. Working-class Brooklyn. You wouldn't go near the place. I was a skinny, freckle-faced redhead with big glasses. I was recognized as being very smart in school. Well, that was tough, except I was a good athlete. I ran and I could play baseball really well. That kept me alive.

But my other outlet was reading. I read everything I could get my hands on. Sick in bed, Mom taking care of me, sometimes I think I got sick because I wanted to read. I started reading books about science. "Microbe Hunters" was one of my favorites. I became fascinated with science. With the imagination that I have, I could live vicariously by reading books.

The other influence on me was music on the radio. In the 1940s and 1950s, radio was the hot medium. I played woodwinds – the bass clarinet and saxophone. I listened to music on the radio, like to Benny Goodman and Woody Herman. They were great clarinetists. That's probably why I played the clarinet. I love music. Music permeates everything I do.

In the summers, my parents would take me to the (Catskills) mountains, and I loved the farm there. I got involved with chickens, cows, horses and tractors. In many ways, it was an escape from the city.

What did your parents do?

My parents were immigrants. My mother wanted to be a journalist, but she became a frustrated seamstress. My father's whole family was farriers and farmers. In the U.S., my father became a professional baker. He loved it. It was creative, because he was a cake baker. He was a very interesting man. In 1923, he said that the family had to leave Europe. The family was in Lithuania and Poland. One reason, he said, was that there was no opportunity for education for the working class, and education is the key to everything. The family had to go to a place where there would be educational opportunities. He was right. In many ways, he saved the family.

He was full of energy. He loved working, and he loved his family. That influenced me quite a bit.

How did you become a scientist?

When you were from the immigrant class (in the 1950s), there were only certain professions open to you. One of them was teaching. In the New York City school system, the pay and benefits were very good. So it was natural for me to be thinking about teaching. When I was pursuing a bachelor's degree in biology, I got a minor in education. I was a certified New York State teacher and substitute-taught.

In order to advance in my teaching career, I had to get a master's degree. I always was interested in entomology. University of Illinois had one of the great programs. I went to Illinois as a graduate student.

When I was in my first year as an entomology student, my advisers said, "If you want to advance in the field, you better get a health-related degree." I said, "I always wanted to be a veterinarian." They said, "Apply to vet school." I did and Illinois let me in.

I never finished my entomology master's degree. It was a 6-year program (at vet school). The dean

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of the vet school at Illinois said, "I'm accepting you into vet school, Raymond, because this field is going to need academics. You're going to be an academic." I said, "You're probably right." But I did practice veterinary medicine for a short time.

Why and where did you do your Ph.D.?

My veterinary degree was a stop on my way to getting a Ph.D. I did my Ph.D. in parasitology at a combined University of North Carolina-Duke University program. My wife became an assistant professor of Latin American literature at Duke. She did her Ph.D. in Illinois when I was at vet school. North Carolina was the only place we could get two jobs together, a problem that plagued us throughout our two careers.

When I graduated, University of Pittsburgh offered me a tenure-track position in the school of public health. At Pittsburgh, I really grew into being a scientist and a teacher. What am I proud of? I've won every teaching award in every institution where I've taught. I'm very proud of that.

I was a competitive, tenured scientist at one time. I worked on the genetics of susceptibility and resistance to parasites. I used Nematospiroides dubius as a model, which is a natural helminth of the mouse. I also came up with a diagnostic test for Visceral larva migrans, which is the dog roundworm that gets into children's eyes. Before my work, eyes sometimes got taken out, because the infection bears a similarity to retinoblastoma. (Author's note: Retinoblastoma is a cancer that forms in retinal cells.) I came up with the ELISA test for the roundworm.

I left Pittsburgh to become the director of the veterinary school's diagnostic laboratory at Cornell in 1977. I also planned and obtained funding for the department of preventive medicine and became its first chair. With these substantial administrative posts, my career in experimental science came to a crashing close. With my successes in academic management, I was recruited to be vice provost and dean of the graduate school at the University of Tennessee, Memphis. But when there was the possibility of becoming the provost at another university, I said, "No, this isn't what I want to do anymore."

Where did you get your taste for business?

People always do ask me, "Where did you learn to be a businessperson?" The answer is in my father's bakery. From the age of 14 to about 20, I was running the business part of my father's bakery. That's how I learned the retail world. That's how I learned how to deal with the customer. I learned how to do a budget, read a financial sheet and manage risk. Then I just kept learning and reading. You watch good people and listen.

When I got to ATCC, the business part of me came out fully. I am very comfortable in the business world, because I can talk the talk and understand the talk. I understand investments, strategic planning, finance, performance evaluations and recruitment. I understand all the things that a businessman has to understand but without an MBA.

But I still have an academic appointment at Pittsburgh as an adjunct in epidemiology. (Author's note: Cypess' appointment allows him to stay abreast of the field and maintain contacts in public health.)

How do you find synergy between science and business?

I love problem solving and teaching how to solve problems. My friends in the academic world are aghast when I say this, but management is an experimental science. It's different from chemistry and biology, but it is a science. A science background can be productive in the business world. The ability to teach also is valuable, because teaching is communication. The three most important things in business are communication, communication, communication.

We need more people who understand management both in science and in business. You can find scientists who can dabble in business, and once in a while, you find someone who's really good at it. Then you find some businesspeople who have an understanding of science. But it's rare when you can find someone who does both really well.

What's your advice to young scientists?

Don't specialize too fast. Get a well-rounded education. (One of) my sons is an MD/Ph.D. He says the two most important classes he took were Spanish and typing. There were times when he was a medical student on the hospital floor and the only one who could speak Spanish to certain patients and their families.

Make sure you learn how to write. Make sure you learn the fundamental courses that contribute to science: Know your statistics, basic math, physics and chemistry. These skills will give you more flexibility and options along your career path. Don't become a reductionist too quickly. When I look at a frog, I can see a frog. I don't see a bunch of molecules. But I can get down and look at molecules if you want me to. After you specialize, appreciate the bigger picture, because it helps to find perspective and identify the next questions. Always think about how it all works together.

Rajendrani Mukhopadhyay (rmukhopadhyay@asbmb.org) is the chief science correspondent for ASBMB. Follow her on Twitter at twitter.com/rajmukhop, and read her blog at wildtypes.asbmb.org.

LIVE AND LEARN

a special section on education and professional development

Inside this special section

Getting over the Ph.D. hump

A few years into earning their Ph.D., it hits them. They hate their topic. They are disillusioned with academia. They dread the years they have left to their dissertation defense and the years of brutal competition after that. They are convinced they are denying themselves a real life with sane hours, time with loved ones and a defensible salary. They start to feel like they are doing it for the wrong reasons.

There are so many reasons to stop.

And in fact, half of all doctoral students do quit. But what is the story with those who don't? To find out, we asked scientists to write and tell us what got them over the "I'm dropping out" hump and what steadied them on their paths to the Ph.D. Here is what they said.

A Ph.D. is an asset, no matter what

By Ulli Hain

HAIN

I'd spent more than two and a half years and countless reagents tying to crystallize a protein in order to determine its three-dimensional structure. I needed the structure so I could design antimalarial drugs that would stem the deadly scourge in Africa and, you know, graduate. X-ray crystallography appeared to be a mix of science, magic, luck and persistence — or maybe masochism. One crystallization guidebook even suggested a beard might be useful, since facial hair can seed crystallization.

At this point all I could think of was how nice it would be to quit and join the Peace Corps and trade in a fluorescently lit, chemically scented sterile lab for exotic places like Botswana or Fiji. But I still loved science, even if it didn't seem to love me back all the time. The more I investigated science careers, such as teaching, writing and policy, the more I realized a Ph.D. would be an asset. Even the Peace Corps recruiter said I would have a greater impact if I had my doctorate. Rather than push extra hard and put in more weekends during this time, I did more activities outside of the lab. I trained for and ran my first half-marathon and TA'd a class to explore a career in teaching.

By my third year, I'd finally gotten protein crystals and was able to collect data. While it took several more months to determine the structure, I knew I was over the infamous third-year hump. Seeing my elusive protein on the computer screen for the first time was amazing, reminding me why I liked research in the first place. Though I later left bench science to pursue science writing, I'm thankful that I persisted and was able to experience the thrill of discovery.

Ulli Hain received her Ph.D. from the Johns Hopkins University, where she studied the malaria parasite. She is passionate about communicating science and writes two science blogs, Science Extracted and Bench and Beyond, which address issues at the intersection of gender, ethics and science. In her free time, she enjoys traveling, reading and painting.

A cost–benefit analysis

By Nikolai Slavov

SLAVOV

As part of my doctoral research, I developed a conceptually new network inference algorithm and published it as a single author. This publication resulted in multiple recruitment offers by top financial firms and a possibility to continue the quantitative aspects of my research at Google. I chose to continue my experimental research in biology for two primary reasons.

The first reason was a cost–benefit analysis. I was extremely excited by my experimental research and did not think that the extra money could compensate for not being able to do the experiments that I was burning to do. Furthermore, I expected that the aspects of academia that I dislike the most and find most disappointing — the career-building priorities and the ego-centric, self-serving politics — are likely present in all intellectually stimulating and, thus, competitive careers. If I am to endure political shenanigans as the price for pursuing intellectually stimulating work, I might as well pursue the line of work that I find most meaningful and exciting.

The second reason was that I saw leaving academic research as a weakness and a betrayal of my ideals. I saw it as missing the opportunity to contribute ideas that can accelerate scientific research and open new fields. I saw it as a failure to contribute to education, which I consider of prime importance. I believe that many catastrophes in history — including the despicable evils of the Third Reich — happened because a majority of well-intentioned people did not resist staunchly enough a minority of ill-intentioned people. Thus, I will be deeply unhappy if I see myself as not being strong enough to stand up for my ideals and values. This is not as idealistic as it may sound; it is also self-serving, because living up to my values contributes to my own happiness.

Nikolai Slavov did his doctoral research at Princeton University and his postdoctoral research at the Massachusetts Institute of Technology.

Writing through it

By Jen Grant

GRANT

So many pals of mine pointed out that their advisers hadn't given them permission to write yet. First-years, second-years, even fourth- and fifth-years. I often asked them why they needed permission. No answer! Well, I never stopped writing.

Every experiment is a chance to write up some part of your thesis. No usable data? Instead, there are methods to write or technical challenges to discuss. At the very least, there is the background and the literature search on the project. At some point, my thesis started writing itself. Explanations and new experiments suggested themselves.

I wrote through the good times, I wrote through the bad times, and I wrote through the stale times. I knew I had the project I was meant to have when I realized I had such a passion that I couldn't put my nascent thesis down.

I graduated on track. And perhaps most importantly, I am a scientist and have a career that involves both discovery and competing for grants. Indeed, I've never stopped writing. Writing sharpens critical thinking. I never have to scrape for material for posters or presentations. I have illustration skills to be envied. When projects don't work, I am able to write through it and find the answer.

Now I hire students. It's difficult to choose sometimes, but I may ask potential candidates to write a one-page summary of why they want to work on a given project. By looking at what they write and how they write it, I've recruited many of the best students into my lab.

So a good mantra I teach my students is "Never stop writing."

Jen Grant is an associate professor at the University of Wisconsin–Stout and an award-winning scientist and educator. Her undergraduate degree is from Oberlin College, a college passionate about writing, and she completed her Ph.D. at the University of Wisconsin–Madison. She pursues protein chemistry and mass spectrometry.

Small steps to a dream fulfilled

By Samarpita Sengupta

SENGUPTA

It was three years ago this summer that I defended my Ph.D. thesis. Twenty-six years of formal education culminated in five years of toil, sweat and tears and the biggest presentation of my life. The euphoria that I experienced immediately after my committee chair said, "Congratulations, Dr. Sengupta!" was something else!

I came to the U.S. on a student visa. I had the biggest reality check when I started my first year with 70 of the best students from across the world. I was no longer the best but one of many. I still clung to the hope that I would be able to do phenomenal science.

But graduate school was harsh: Experiments didn't work most of the time, and troubleshooting consumed my life. I realized well into my third year that the project I was working on was going nowhere. Thankfully, my principal investigator came to the same realization and gave me another project. I chipped away at the new project.

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Slowly but surely, I started making progress. Each successful immunoblot would lift my spirits a little and motivate me to come in the next day. I kept on going this way, and, at my final committee meeting, my committee members were satisfied with my progress and gave me the green light.

It was the small steps that kept me going. It seemed easier to quit, but I am not a quitter. I kept on putting one foot in front of the other, and, ultimately, I had the coveted three letters after my name.

Samarpita Sengupta completed her Ph.D. at the University of Texas Southwestern Medical Center at Dallas. She is now a postdoc at UT–Southwestern.

Science can be service

MIRIGIAN

By Lynn Mirigian

After three years of career sessions and reading about the science job market, I formed a mantra: "If and only if I am the very best at research, writing, teaching and networking, then I have a chance of getting a job in science." In the middle of my third year of graduate school, my eyes burned with tears I refused to let fall as I stared at what felt like my 800th failed experiment. I was developing a new protein pulse-chase assay, and yet again I was staring at a gel with zero labeled protein. Awesome. Never mind all of the other stuff — I couldn't even get my stupid assay to work. Defending a thesis and getting a job one day? Ha! I ripped off my gloves and sat down at my desk to host a moderate-size pity party for myself.

As I scrolled through various Web articles, I came across a piece on glorifying God at work. As I read it, I realized I had been making each day all about me — my wants, my dissertation and my career goals. Frankly, it was exhausting and changing who I was as a person. I had lost sight of pursuing science to help others.

Yes, in a few years, my assay could lead to therapeutic targets for osteogenesis imperfecta and so was in itself a worthwhile task, but serving others went beyond getting that assay right. Each day I could help others by simply assisting my lab mates with experiments or volunteering for lab maintenance duties. Measuring my success by how my work got me closer to that elusive science job was not getting me anywhere. Instead, determining the success of each day based on working with integrity, serving others and trusting that doors would open as the time came is what got me over the hump.

Lynn Mirigian recently defended her dissertation under an individual graduate partnership with the National Institutes of Health and the University of Texas Medical Branch. She is a postdoctoral fellow with the National Institutes of Health and a science communications and outreach intern at the ASBMB.

A weight is lifted

By Rajendrani Mukhopadhay

My Ph.D. training at Johns Hopkins University was the first time I was in the lab on my own. Much to my alarm, I found that experimental design wasn't intuitive and that I lacked the instinct and dexterity for experiments and the patience for research. Surrounded by peers who seemed at ease in the laboratory, I realized there was no way I could compete against them for academic or industry positions after graduation.

MUKHOPADHAY

I grew miserable and scared. As a 16-year-old, I had set my sights on being a scientist. Now, seven years later, it was horrifying to realize that I might have set off on the wrong path.

My misery increased through the second and third years of graduate school, and I knew I had to find a way out of academic science. But in my time, other careers in science were not publicized much, and some faculty openly discouraged them.

To get a break from science, I enrolled in an evening writing class. As soon as I set pen to paper, a weight lifted. This was what I wanted to do for the rest of my life.

I began learning about people with academic training who opted for careers in science policy, law and communications and asked faculty members how I might combine science and writing. My department chair told me that if I could communicate the excitement of science to nonscientists, there was a career for me.

I devoted evenings after I finished in the lab to building my portfolio of writing clips. By the time I finished my Ph.D., I had my first job as a science writer in hand.

My scientific training helps me understand the scientists I now interview. I now recognize that one publication represents years of work and that the Eureka moment is rare. The Ph.D. helped me become the writer I am today — insatiably curious, healthily skeptical and always asking for evidence for statements. I may not be at the bench, but I feel that in my career as a science journalist, I continue to play a role in the quest for knowledge.

Rajendrani (Raj) Mukhopadhyay is the chief science correspondent for the ASBMB. She got her start as a writer after completing her Ph.D. from Johns Hopkins University. Follow her on Twitter (@rajmukhop) and read her ASBMB Today blog, Wild Types (wildtypes.asbmb.org).

Is a professional science master's degree right for you?

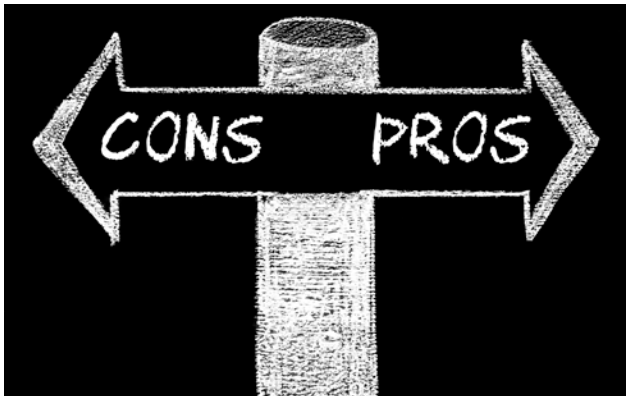
By Weiyi Zhao

The transition between college and graduate school isn't always as clear-cut as one would like. Most science majors are encouraged to matriculate into Ph.D. programs after graduation. Some choose to get advanced degrees in medicine, dentistry or veterinary science. But if none of these options works for you, what are some other choices? What if you are a nontraditional student looking for a career change but would still like to acquire additional training and knowledge? Are there training opportunities worth considering?

In 1997, the Sloan Foundation began an initiative that awarded grants to research universities to establish professional science master's programs in the natural sciences and mathematics. Over the years, the initiative funded more than 50 universities and established more than 100 degree programs. PSM programs have expanded to include training in biotechnology, bioinformatics and social sciences.

The rise of PSM programs coincides with the recent economic recession. More and more graduates are worried about their competitiveness in today's job market. What distinguishes a PSM from other advanced science degrees is that, in addition to offering advanced training in math and science, these programs also help students gain practical experience through internships.

Both the institutions that offer PSM degrees and the types of degrees offered are diverse. Michigan State University offers a master's in industrial mathematics. Rice University offers master's degrees in a variety of areas, including bioscience, health policy and nanoscale physics. The University of Connecticut's master's program has applied genomics, microbial systems analysis, and applied financial mathematics options.



The University of Oregon has an industrial internship program that prepares students for work in industrial research labs and offers tracks in bioinformatics and genomics, polymers and coatings, optical materials and devices, and photovoltaic and semiconductor device processing. Students begin with intensive summer courses and then interview for internships with partner companies. Successful candidates complete nine-month paid internships and, according to the program's director of recruitment and marketing, Lynde Ritzow, the average annual internship pay is about $46,000.

"What's wonderful about this program is that it enables students to graduate with work experience — something every employer seeks in their hires," Ritzow says. She notes that 98 percent of the program's students have completed internships successfully, and 90 percent have been offered jobs at host companies.

A professional science master's is obviously not the right fit for everyone. But even for those who think this may be a viable career option, is a PSM a worthy investment? A survey conducted by the Council of Graduate Schools in 2013 found that the majority of PSM graduates from the 2011 – 2013 classes earned more than $50,000 annually while working full time. The survey also found that earning a PSM degree provided value and benefits that go beyond annual salary. The benefits include fulfillment of personal interest, acquiring specific skills and knowledge, and more opportunities for promotion.

To learn more about PSMs, visit the National Professional Science Master's Association at www.npsma.org or ScienceMasters.com's searchable directory.

Weiyi Zhao is the program director at Grocery Manufacturers Association Science & Education Foundation. This article first appeared in Enzymatic, ASBMB's undergraduate newsletter.

The perfect match

A graduate program director offers advice on finding the right fit for you

By David J. Katzmann

As a graduate program director, I want to find the applicants who best fit our training program. As an applicant to graduate school, you want to find the program that best supports your career goals. There are three parameters, each of which you have control over, that will influence this matching process: your selection of where to apply, the application itself and the interview.

Where to apply: Do your homework

This is a decision that will help shape the trajectory of your career, so you want to get it right.

Some institutions have name recognition that may resonate with you, but even the best program in the country is only a good fit if it matches your scientific interests. You'll want to make sure the institution's environment aligns with your long-term goals.

Is the program department-centric, cross-discipline, or interdepartmental, or a mixture? How does this fit with your own level of certainty regarding your chosen research area?

How large is the program, in terms of class size, and how does that affect your access to faculty?

How are student training costs covered? This includes general stipends, training grants and opportunities for teaching assistant or research assistant positions.

Most programs will not constrain students to a specific lab, so don't select a training destination based on the work of one investigator. Instead, find out how many investigators are doing the sort of research that you find interesting. Who are they? Are you inspired by their publications? Where have their trainees gone after leaving the lab? Select an environment that will foster your intellectual curiosity and be certain that there are a number of individuals who could serve as part of your mentorship team.

Select an environment that will foster your intellectual curiosity and be certain that there are a number of individuals who could serve as your mentor and as part of your mentorship team.

The ideal environment would have a number of productive, impactful labs doing work that you find stimulating and that meshes well with your interests and goals. This is critical for a variety of reasons: Faculty members may move or retire, labs may fill to capacity, personalities may clash and/or the focus of a lab may change radically in short order.

The application: Be true to you

The application is a means for you to convey your passion and aptitude for research. Your grades and GRE scores provide a general assessment of your intellectual horsepower and your academic diligence, but the admissions committee also is trying to understand you as a person, your motivation for pursuing graduate studies, your aptitude for research, how you will respond to challenges, and how well you align with the graduate program and its research interests. These criteria are best addressed through your personal statement and recommendation letters.

The admissions committee wants to understand what initially drew you to science and your particular field of study. Committee members especially want to understand your research experiences.

Research is hard. Successful researchers have found strategies to deal with what can at times seem like a barrage of negative results and failures. So it is essential that you spend significant time performing research prior to joining a graduate program. Perform hypothesis-driven research in a self-directed manner, get out of your comfort zone, and generate novel information.

Don't shy away from describing research failures in your personal statement. Rather, highlight how these challenges made you better and more motivated to succeed.

Don't shy away from describing research failures in your personal statement. Rather, highlight how these challenges made you better and more motivated to succeed. The admissions committee cares less about the number of techniques you have learned than the scientific processes you have undertaken.

In your application, focus on why the scientific question was important, how you chose to investigate the problem and what you learned about the topic (and yourself) through this experience. The ability to choose a technique will be learned during graduate school training, but curiosity cannot be taught. It is critical that you convey your motivations in your personal statement.

Also, be sure to use your personal statement to convey your research interests for the future. The admissions committee is trying to identify individuals whose interests align with the interests of the faculty in the program. Studying different graduate programs will enable you to represent your interests appropriately.

Imagine that you are a reviewer with two applications in front of you. One of them describes the burning desire of the applicant to perform studies that are not well represented at the institution. The other describes how the research of eight faculty members at the institution sounds amazing and meshes well with the applicant's interests, history and goals. How would you react? The reviewer will be more inclined to select the individual who took the time to ensure that the program is indeed a good fit and can articulate his or her reasoning.

Before you send your personal statement, write multiple drafts until you feel your words represent who you are, what you have accomplished and what you want to do in the future. Then ask someone who knows you well to read it and tell you whether you described the real you.

The interview: a two-way street

The final component of the application process is the interview. You have an opportunity to learn more about the program you investigated, and you get a chance to understand what life as a graduate student in the program is like.

The interview is a two-way street. Be prepared to be more explicit about your motivations, your research experiences and your research interests. But also be prepared to explore whether the graduate program is the right fit for you by coming up with appropriate questions based on your homework about the program.

Graduate school is a stepping-stone, not a destination

Graduate school is a stepping-stone in your career. With curiosity, resilience, resourcefulness and hard work, you will be able to succeed wherever you choose to pursue your studies. If you encounter multiple programs that are great fits, start considering other parameters. When you encounter programs that are not a good fit, ignore those and don't look back. Even if you delay graduate school for a year or so while you identify the best program for you (of course enhancing your research portfolio in the interim), this will be time well spent in the long run.

If you encounter multiple programs that are great fits, start considering other parameters.

David J. Katzmann (Katzmann.David@mayo.edu) is a consultant, associate professor and graduate program director for biochemistry and molecular biology at the Mayo Clinic, Rochester. A longer version of this article first appeared in Enzymatic, ASBMB's undergraduate newsletter.

Lessons learned

Senior scientists share what they gleaned from their mistakes

By Jen McGlaughon

It's a scene in the lab that many of us are all too familiar with: You've reached the end of an experiment that has taken hours or days only to find out it has failed. As you're looking through your lab notebook wondering where you went wrong, it hits you. You added the wrong buffer at step 13. Or perhaps your calculations were wrong and you added 10 microliters when you should have added 100. Whatever the mistake, big or small, most of us can relate. Part of being a successful scientist is learning from your mistakes and moving on. Scientists are only human, after all. Even the most successful and respected scientists can recall instances when they learned lessons the hard way. We asked a handful of senior scientists to share such stories and the knowledge they gained from the experiences.

Ruma Banerjee

University of Michigan Medical School
Associate editor, Journal of Biological Chemistry

In my first foray into research as a summer intern in (Obaid) Siddiqi's laboratory at the Tata Institute of Fundamental Research in Bombay (now Mumbai), I found myself working on the sugar-digesting enzyme found in Drosophila legs. Being averse to wasting especially precious reagents, I did not see the point of repeating controls — i.e., assays lacking enzyme — only to get the expected answer. So I dispensed with running (what I thought were) wasteful controls after the first set of experiments and charged ahead with generating data. As I proudly displayed my results at the group meeting, I was dismayed to be told that my data were not usable and was made to understand why. I smile when I think back on that experience, especially as I regularly pound away about inadequate or insufficient controls in my own lab meetings.

Henrik Dohlman

University of North Carolina School of Medicine
Associate editor, Journal of Biological Chemistry

The first story is about a colleague whose undergraduate adviser had encouraged him to apply to graduate school and that he should consider attending Washington University (in St. Louis). He did apply, did great things, met his wife, earned his Ph.D., and is now an accomplished scientist at the National Institutes of Health. The only thing is that he misunderstood the advice and attended the University of Washington, not realizing they were different schools in different states. Happy ending.

The other anecdote is about how my thesis adviser wanted to help another graduate student isolate receptor preparations from whole cell lysates. He picked up a centrifuge tube from his student's ice bucket and demonstrated how to decant the soluble material carefully without disturbing the pellet. Only after the liquid went down the drain did the student have the courage to say that he had meant to discard the pellet and analyze the supernatant. Despite the setback, the student, Lewis "Rusty" Williams, went on to a brilliant career at the University of California, San Francisco, and in industry and was later elected to the National Academy of Sciences. The adviser, Robert Lefkowitz, did even better and won the Nobel prize in 2012.

F. Peter Guengerich

Vanderbilt University School of Medicine
Interim editor-in-chief, Journal of Biological Chemistry

When I was a graduate student, I needed to prepare ^{15}N-labeled lysine for my thesis research. I ordered $^{15}NH_4NO_3$ to do the appropriate reaction. I proceeded through the synthesis and did the labeling experiment with my molds. However, no ^{15}N label was in the expected product of lysine. After backtracking, more detective work and finally calling the company, they admitted that they had sent me $NH_4{}^{15}NO_3$ — the ^{15}N label in the wrong nitrogen. Although the company did replace this with the correct material, I lost a month of my time. So I have warned my students and postdocs not to trust blindly things they buy. Most are what we order, but over the years we have received wrong chemicals, bad oligos

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Fostering science careers with individual development plans

Suggestions for students and mentors from a co-creator of myIDP

By Philip S. Clifford

Sports teams would never go into competition, military units would never go into battle and contractors would never construct a building without having detailed plans. Why should a young scientist's career be any different? We created the freely available myIDP (myIDP.sciencecareers.org) to help graduate students and postdoctoral fellows take charge of their careers by mapping out short- and long-term goals.

Research-based evidence supports the value of career planning. People with well-considered career plans rank themselves higher on career satisfaction (1) and achieve better salaries and promotions and higher levels of responsibility (2). A nationwide survey of postdoctoral scholars found that those who developed structured plans with their advisers reported greater satisfaction, more papers published, more grant applications and fewer conflicts with their mentors (3). Another survey revealed that a majority of postdocs and their mentors found the process of working through an individual development plan to be beneficial (4).

An IDP is a four-step process that helps users understand themselves, understand the breadth of career paths available, set goals to prepare for a desired career path and get started in the right direction.

Self-assessment

The first step consists of simple exercises to assess skills, interests and values. Users identify skills that need improvement and the activities they most enjoy. They are able to zero in on the things they value most, which often turn out to be the overriding factors in career decisions. Is it most important for them to work independently or as part of a team? To have predictable job duties and hours or engage in activities that change frequently?

Career exploration

myIDP provides an extensive list of career paths that correspond to users' skills and interests and lists numerous resources to help them explore these career paths. They can learn about Ph.D. scientists who enjoy satisfying careers as academics, as science writers for pharmaceutical companies or as field application specialists for state-of-the-art scientific equipment. We encourage users to start out by reading about scientific careers, attending career events and gathering insights from people already on their desired career paths. The career-exploration process is time consuming; it's not something users should expect to complete in a day, a week or even a month.

Goal setting

Once users narrow choices down to a plan A and plan B, it's time to determine what skills they need to develop to be competitive. They are en-

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Supporting your student's IDP: suggestions for mentors

- Encourage and assist your trainees in creating their IDPs. Offer constructive feedback about their scientific skills. To help, use the assessment form from the "skills summary" page in myIDP.
- A recent survey (5) found that less than 40 percent of principal investigators encouraged their postdocs to participate in professional development. Familiarize yourself with your institutional career resources and explicitly encourage your trainees to take advantage of them.
- Help your trainees understand the value of developing a network. Introduce them to your contacts both inside and outside academia.
- The old apprenticeship model for graduate and postdoctoral training is outmoded and inadequate for today's Ph.D. scientists. Training in skills like effective communication, intellectual property, budgeting, negotiation, teaching, leadership and management is accomplished more efficiently at an institutional level. Lobby your administration to provide such training through courses and workshops organized by your graduate school, postdoctoral office or career center.

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and so forth. If things aren't going smoothly in your experiments, check your commercial reagents to be sure they are what you think they are.

Alex Toker

Beth Israel Deaconess Medical Center, Harvard Medical School
Associate editor, Journal of Biological Chemistry

I recall, as a freshly minted Ph.D. from the U.K., arriving in the U.S. for a postdoc in the lab of (Lewis) Cantley, who had just discovered (phosphoinositide 3-kinase). A major recurring lab requirement was purification of PI3K enzyme from rat liver. Everyone in the lab took turns in this ordeal, which included many steps of column chromatography in the cold room followed by assaying fractions with ^{32}P-ATP. PI3K is a notoriously unstable enzyme and, given the many steps involved, the purification sometimes failed, meaning no one in the lab would have active enzyme for their experiments and projects. As I took my first few stabs at this purification as the new postdoc, I ended up with dead inactive enzyme each time. Even though this was a tough purification procedure, the experience was pretty disheartening. Obviously, I made mistakes at different steps, but it taught me one important lesson that I have carried with me since and try to instill in all my students and postdocs — persevere. Always persevere in science, and if you love what you do you will succeed.

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couraged to set what we call SMART goals — specific, measureable, action oriented, realistic and time bound — that will ensure they develop those skills. If someone's plan A is to teach science in a primarily undergraduate institution, he or she will need real teaching experience, not just a lecture here or there. That user's SMART goal will entail getting experience through a university's faculty-preparation program or contacting a local community college to inquire about teaching a full course for a semester.

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Implementing a plan

Users should discuss their IDPs with their mentors and agree on or revise the goals they've set. They also should recruit additional mentors in areas where they need assistance. For example, if their PIs are not the most effective communicators, they might want to ask other faculty members to critique their presentations. Talking with labmates about their goals also will provide some accountability, as will reviewing their progress on a regular basis.

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Increasing funding for minority scientists

Recap of ASBMB workshop on grant writing and mentoring

By Marion Sewer

The third annual American Society for Biochemistry and Molecular Biology Grant Writing and Mentoring Workshop was held in June in Washington. Spearheaded by the society's minority affairs committee, this year's workshop brought experienced mentors and program directors from the National Science Foundation and the National Institutes of Health together to guide assistant professors and postdoctoral scientists best practices for writing grant proposals and to offer practical advice about navigating the academic world.

Emphasizing that more than a third of the mentees from previous workshops have been funded, organizers for the 2015 workshop introduced new features, including one-on-one mentor–mentee pairing that will extend beyond the workshop and through the submission process.

Workshop mentors shared two important characteristics: they were recipients of extramural funding, including NSF, NIH, Howard Hughes Medical Institute or other foundation support, and they were committed to initiatives that diversified the professoriate. Mentees were a diverse cohort with respect to gender, race, geographical location, research interest and institutional settings.

Mentors provided feedback about research proposals and led lively discussion about sustaining careers in academia.

Cameron provided tips for building and maintaining a research team; Sumter discussed strategies for balancing teaching, research and service; Allen covered building fruitful research collaborations; and Flores led a discussion on mentoring and the importance of saying no. Bandarian and Acevedo led a discussion for postdoctoral participants about interviewing and negotiating for a faculty position.

Other components of the workshop included an NSF-style mock panel review and a presentation about crafting a strong proposal. Program directors from the National Institute of General Medical Sciences and the Molecular and Cellular Biosciences Cluster of the Biological Sciences Biodirectorate at the NSF discussed the grant-review process at their agenicies and provided tips for communicating with funders. In addition, William Trenkle of the Office of Research Integrity at the U.S. Department of Health and Human Services delivered a sobering presentation on research integrity.

Former mentees Folami Ideraabdullah of the University of North Carolina at Chapel Hill and Hugues Oullet of University of Texas at El Paso, whose work has been funded, also served as peer mentors and led a well-received panel discussion about the approaches they used in the grant-preparation and -submission process. They also touched on their experiences as junior faculty members who are training and mentoring students while also adjusting to the demands of managing a research program and teaching.

Looking forward, the organizers hope to expand the popular workshop's reach by developing Web-based interactive resources.

The mentors were:

- **Orlando Acevedo** of the University of Miami
- **Karen Allen** of Boston University
- **Vahe Bandarian** of the University of Utah
- **Squire Booker** of Pennsylvania State University
- **Craig Cameron** of Pennsylvania State University
- **Sonia Flores** of the University of Colorado, Denver
- **Marion Sewer** of the University of California, San Diego
- **Takita Sumter** of Winthrop University

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From Drosophila to kit design

Danielle Snowflack is teaching science in a creative way

by Soma Chowdhury

Danielle Snowflack is a scientist by background, an artist at heart and a passionate science educator by profession. As part of her job as the director of education at Edvotek, a biotechnology education company, she designs scientific kits, protocols and programs and attends trade shows to help teachers communicate science in an effective and user-friendly way. In an interview with ASBMB Today's science-writing intern Soma Chowdhury, Snowflack shared her experiences at Edvotek and her career path away from the laboratory bench. The interview has been edited for clarity and length.

What do you do at Edvotek?

I am the director of education. We try to translate cutting-edge science into a format that can be useful and easily brought into classrooms. A lot of what I do as the director of education is to look at what's going on in science and figure out a way to bring it to the classroom. A big part of my job is traveling to education conferences where I present hands-on biotechnology workshops. This is an important opportunity because it helps our teachers get comfortable with the experiments. But I am also responsible for developing educational materials and YouTube videos and working on our official media presence. I am still in the lab doing some of the research myself. I have my hands in a lot of different pots.

What inspired you to take this job?

It's kind of a long and crazy path. When I was an undergrad at Muhlenberg College in Pennsylvania, I did a lot of tutoring, was involved as a learning assistant and ran educational training sessions. I really liked teaching. When I went to graduate school, I started doing teaching as a graduate student and getting involved with some K – 12 outreach activities, which furthered my desire to work in the classroom. So I did what everyone does, which is network. I was in the right place at the right time, because Edvotek happened to be looking for someone like me.

What skills did you acquire in graduate school that are useful in your current job?

My Ph.D. is in molecular biology from Princeton (University). I worked on post-transcriptional regulation of RNA during early Drosophila development. My work focused on the mechanisms used to keep the unlocalized nanos RNA from being translated during oogenesis and embryogenesis. But it's not just using my Ph.D. knowledge from the laboratory. A lot of what you learn during your Ph.D. is also how to communicate clearly to other people, how to interpret information and figure out how to get it out there in a way that everyone can understand.

What new skills did you have to learn?

A lot of what I've really learned here is customer service: how to work with people who are outside of your field and try to get them to have the best experience possible. The other set of skills I started picking up was with social media and trying to connect our customers in a different way.

Did you always want to get away from bench research?

I didn't necessarily want to be 100 percent away from bench research. My job gives me a nice ability not only to have the teaching experience in terms of developing the materials but also in terms of traveling to education conferences and teaching people the techniques. I also go into the lab to develop some of the experiments myself.

You have taken a very unusual path. Was it hard?

It was. One thing that I found when I was looking for jobs is that many jobs in science education want you to have a degree in science education or experience with K – 12 students as opposed to having any experience with science. I did go on some interviews where they said, "You have to have three to five years of teaching experience in a high-school classroom before we can consider you for this position." The employer looks for keywords in your resume and cover letter or you don't even get seen. It's tricky. That's why I think that if you are a scientist trying to get out of your traditional science careers, networking is extremely important.

Can you describe a typical

DANIELLE SNOWFLACK

Danielle Snowflack is director of education at Edvotek.

day in the office?

This is a kind of job where there's no typical day. But I'll say a lot of my time is spent in developing our educational resources and protocols, writing blog posts and connecting with educators. I'll fill in on technical calls, and I'm probably in the lab two or three times a week trying something out to see if I can get it to work and be reproducible.

What did you find most challenging when you joined Edvotek?

It's the time management. I feel like when you are a graduate student, you have no concept of what a normal day should be. You get to the lab early, you leave late. Now I am really trying to manage that work–life balance. Sometimes it can be difficult.

What advice would you give to anyone looking to have a career similar to yours?

I wish I had identified that I wanted to be in this field earlier as a graduate student. I would have worked more with kids, done more outreach, perhaps taken some more education classes and learned more of the pedagogy behind the field. I do find that I am learning a lot of that on the fly. I think especially for people who don't know whether they want to do bench research, the best thing to do is to try out some things if they have the opportunity as graduate students.

What do you do when you are not working?

I love to ride my bike and like to get out as much as possible. My husband and I like to do some traveling. I am very interested in art, and I try to take art classes when I can. Both my parents are very creative, and I actually was a studio art and natural sciences major as an undergraduate. It serves me very well at Edvotek, because one of my very proud accomplishments was to redesign our protocols, making them more illustrated and more visual so that we are describing our experiments not only in words but also in pictures.

What do you anticipate the next steps of your career will be?

I like being involved with science education and with the teachers. Sometimes I do wish I had more time to work with students on the front line. As a woman in science, I think it's important to get girls comfortable and inspired by scientific fields. I have a lot of freedom to do exciting things at Edvotek — I don't know that I would be willing to trade that freedom to be in the classroom right now. I hope I am still in education developing these amazing experiences — and hopefully with Edvotek.

Soma Chowdhury (chowdhurysoma15@gmail.com) is an intern at ASBMB Today and at the NIH Catalyst.

How to pick a postdoc

By Preethi Chander

In the biological and biomedical fields, a postdoc is a huge commitment that can play a decisive role in a scientist's career path. We asked a diverse group of current and former postdocs to weigh in on finding the right placement and spoke with a principal investigator to get a supervisor's perspective on this all-important search. The opinions they expressed do not represent those of their current employers.

Here are the six points that emerged.

Know yourself

GUTIERREZ

Danielle Gutierrez did her postdoc in mass spectrometry analysis at the National Institutes of Health intramural program and at Texas A&M University. She says graduate students should get clear on their core values before embarking on a postdoc quest.

"If you know what you want to do, your time as a postdoc has the potential to be much more fruitful. You can focus your efforts on obtaining that goal, not only through your efforts in the lab, but also through networking conferences, seminar attendance — for any opportunity that comes along, you can ask yourself- will this help me obtain my goal?" she says.

BANERJEE

Antara Banerjee, a scientist at Takeda California, did her industry postdoc at Schering–Plough Biopharma. She knew definitively that she did not want to be in academia.

"I wanted to get into industry as fast as I could, so my first option was an industrial postdoc. The few academic institutions that I contacted were focused on labs with applied projects with industrial applications," she says.

Geographic location

Having a regional preference, or a family or avocation that will be affected by a move, can make geography a major concern.

RAMASWAMI

Sitharam Ramaswami, a postdoc in dermatology at Columbia University, says, "I loved New York and didn't want to leave my interests in the local organizations that I volunteer with. Since there are plenty of well-known science and research institutes here, I started looking into research labs that work on immunology and cancer research primarily focusing on New York City."

REDMOND

But Michael Redmond, who heads the lab for Retinal Cell and Molecular Biology at the NIH, cautions that geography should not override other considerations.

"It should not be the only consideration. If you are limited to one geographic area due to insurmountable considerations, do not be afraid to cast your net wide in that area so that you can make the best choice. Likewise, when your postdoc training is complete, it is ideal that you be open to look beyond where you are — i.e., be ready to move to where a job might be and not expect to find it in your backyard!"

Institution

Apart from understanding a lab's research projects, applicants should ask about pay, leave benefits, mentoring and training opportunities, and exposure to career options. Some institutions might encourage postdocs to teach at local colleges, take courses offered in other departments or make time for summer internships.

According to Gutierrez, "For postdocs applying for training grants through NIH funding and looking to become professors, they will need to show that their mentor and facilities will provide the best training and opportunities. Additionally, the institution's reputation for training in a particular field can open job opportunities."

Lab culture

A new lab may offer experience setting up a research team and building infrastructure, skills that are critical for starting a lab in the future. But an established lab can provide a head start on experiments, with access to protocols and projects that have been developed over the years. The latter might also have a large alumni base for networking. Either way, it's crucial to understand a lab's dynamics.

Ramaswami is on his second postdoc. He says, "My earlier postdoc was in a large lab with an established (principal investigator). The lab culture was very set in its ways, and

the guidance I required for my project was hard to come by. Having a mentor who was extremely accessible was critical to me, so I picked a smaller lab with a new investigator where I interact with my supervisor multiple times a day. I look forward to steady publications in good journals rather than waiting for the next big Cell or Science paper."

Research mentor

An investigator who prioritizes postdoc success is crucial to a future career. For those pursuing an academic track, it is important to have conversations about taking your projects with you when you leave.

Gutierrez says, "It can be helpful to know the expectations and personality of your PI before starting. Some PIs may have very specific requirements about hours worked, number of publications, number of projects, etc., and others may be more hands-off. Placing yourself in a situation where you know you can perform well and work with your PI is advantageous. I've been blessed to have talented mentors who provided great examples as successful scientists and committed parents and spouses."

A flexible mentor who can adjust if things do not go as planned is also key, says Redmond. "Given the current state of science funding, getting that first faculty position and/or R01 takes longer and longer, and there is increasing competition, so alternate paths may be necessary or desirable. Is the mentor amenable to allow you to consider this?"

Scientific topic

Whether the postdoc research will be an extension of Ph.D. work or a branching out into other areas, applicants should pick topics that piquie their curiosity.

KATPALLY

Umesh Katpally, now a business analyst at Novartis, did his postdoc and Ph.D. in the same virology lab at the Donald Danforth Plant Science Center in St. Louis. "The most important element is to work on increasing your skill set and being productive, by actively publishing and forging new collaborations. My Ph.D. work resulted in a patent, and we started collaboration with industry. I was more than happy to continue to see the work to fruition. I did not see any reason to move," he says.

Banerjee, alternatively, decided to diversify. "I wanted to do something very different than what I had done during graduate school to increase my perspective and experience. I was always interested in antibodies. But in order to do that I needed to have a strong foundation in immunology and infectious diseases, and so I found a lab that supports both," she says.

Preethi Chander (chander.preethi@gmail.com) did her Ph.D. in biochemistry and molecular biology and her postdoctoral work in eye and vision research. She is interested in science policy and communications.

INTRODUCTION

JEFF SCHMALTZ, NASA

This image of Hurricane Katrina in the Gulf of Mexico on Aug. 28, 2005, was captured by NASA's Terra satellite.

Memories of Hurricane Katrina: 10 years later

By Angela Hopp

The National Hurricane Center in 2011 published a memorandum titled "The deadliest, costliest, and most intense United States tropical cyclones from 1851 to 2010 (and other frequently requested hurricane facts)." As the name implies, the 47-page technical memo is swollen with data points about storms of all sizes and consequences.

The memo notes that Hurricane Katrina, a Category 3 storm that came ashore in Florida on Aug. 25, 2005, and then in Louisiana a day later, was the third deadliest and by far the most costly hurricane in U.S. history. The storm killed 1,200 people, and subsequent flooding killed hundreds more. It caused $108 billion in property damage.

Memo authors Eric S. Blake and Ethan J. Gibney focus primarily on those things that are quantifiable: wind speed, coordinates and air pressure. But they also emphasize things that are not so easily measured: urgency, attitudes and vulnerability.

Importantly, they raise the concern of forgetting. They say sociologists warn that people remember only "the worst effects of a hurricane for about seven years." They say that those at the National Weather Service's hurricane preparedness office worry that coastal communities will put too much faith in forecasting and technology. They say, "Katrina provided a grim reminder of what can happen in a hurricane landfall."

In the weeks after Katrina, the American Society for Biochemistry and Molecular Biology provided small grants to a few dozen Gulf Coast scientists who had lost just about everything. Ten years later, we asked some of those grant recipients and one of our regular contributors from the region to tell us what they remember and how their lives and careers were affected. In the following pages, we've printed their (shortened and edited) responses.

Like the memo by the hurricane center, their reflections are part technical and part cautionary. Perhaps they will help us not to forget.

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

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‘Part of the fabric of our existence’

By Andrew Hollenbach

“So what are your plans?”

I was confused by my department chair’s question. Consumed by a family health emergency, I had been out of touch with the world around me for weeks. I gave her a vague answer unrelated to the outside world.

“You haven’t been watching the news, have you?” she asked.

That’s when it hit me: “Katrina?”

After preparing the house, boarding up all of the windows, gathering our essential documents and important keepsakes, and loading up the car with the dog and cat, we left for Memphis, where we stayed with friends. Over the next few days, we watched coverage of the storm’s approach. When it missed the city, we felt great relief that New Orleans had dodged a bullet, only to wake up the next day to images of the city lying under water, the result of a man-made disaster that would be compounded in the following days and weeks by ineptitude, politics and confusion. After two weeks in Memphis, we traveled to my parents’ house near Philadelphia, where we stayed for six weeks, returning home to New Orleans in late October.

Everyone knows this part of the story. But what many people don’t realize, and what we scientists hadn’t considered as we packed up our personal lives, was that many of us would lose years of research, reagents and work to Katrina. Once the levees broke and the city was flooded, electricity was gone. This meant that refrigerators, freezers and liquid nitrogen storage had no power, and there was no air conditioning. This was New Orleans in August, when temperatures routinely reach the upper 90s and humidity hovers around 80 percent to 90 percent. Everyone lost all bacterial stocks, cell lines and valuable reagents, and for many of us this amounted to years of hard work. Even more devastating, many people at regional research institutes lost valuable clinical samples or animal models that were housed on the lower floors of buildings and sat under water for weeks.

IRIS LINDBERG

Lower floors of Louisiana State University Health Sciences Center’s towers were immersed in the flooding that engulfed more than 80 percent of New Orleans.

Every June 1 to Nov. 30, also known as hurricane season on the Gulf Coast, residents sit poised to evacuate at a moment’s notice. We live with the specter and memory of Katrina. It has become a part of the fabric of our existence. However, we don’t dwell on it. It is a part of our history, a terrible event in the past that affected and changed us in many important ways — as a city, as a region, as a people and, for us in academic science, as institutions.

Now we have distinct protocols in place that include the long-term off-site storage of important reagents and supplies. Individual labs have developed detailed evacuation plans that can be implemented with little warning, and that will guarantee the safety of years of work. As a result of the extended evacuations after Katrina, many of us established lifelong collaborations and professional friendships, and, if the unthinkable were ever to happen again, we know we have places we can stay and work for extended periods of time.

More importantly, I think many of

us have learned from Blanche Dubois, that indelible character created by Tennessee Williams, to "rely on the kindness of strangers." This not only includes the general kindness of businesses, hotels and people from all over the country who so generously took care of us in the aftermath but also collaborators, colleagues and friends in the academic world. My postdoctoral mentor, Gerard Grosveld at St. Jude Children's Research Hospital, offered me lab and office space and gave me access to any and all reagents and supplies I required to regenerate my lost stocks. Thanks to his generosity, our lab was able to recreate everything we had lost within weeks, and I was able to generate the data that would become my first published manuscript from my independent work.

Given the enormity of the loss we all suffered, it isn't a surprise that our productivity slowed. Many of us experienced, and still to this day experience, the catch-22 of a conspicuous publication gap. Many were unable to publish in the years after the disaster, which left a gap that must be explained to reviewers. However, we can't explain this gap, because, as a reviewer bluntly put it to me, they are "tired of hearing the Katrina excuse."

Despite how this gap looks on paper, I will say that when our institute finally did open and we returned to work, we were all hyperfocused on what needed to be accomplished. We knew we had no time to lose and set to work harder and more focused than we had been before the storm.

So does Katrina still factor into our lives? Of course it does. It has to. So many of us were traumatized by what happened and what we lost. But does it consume our lives and our thoughts today? No, of course not. It can't. If it did, how would we be able to function or live?

Did Katrina change us forever? It had to. It was a disaster of a kind never before seen in the United States. But was it a negative change? Overall, no, it wasn't. We in New Orleans are stronger, better prepared and more attentive than we ever were before. It highlighted our deficiencies, and we stepped up and fixed them to create better preparedness, better institutes and better structures. In many respects, we have an awareness and strength that didn't exist before the storm. Calling on that tried and true literary device, Katrina may have flooded our city, but it washed away the veil of denial, baptized us into a new life, and cleansed and refreshed our community, allowing us to develop grassroots efforts to do for ourselves and improve the city that we all love and call home.

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'I recall going over the High Rise and seeing total darkness on the other side. I knew that a city was there but could not see it.'

Wayne Backes, Louisiana State University Health Sciences Center New Orleans

As an institution, we lost three major resources — personnel, laboratory samples and time.

After the storm passed through New Orleans, there was about six to seven feet of water surrounding LSU Health Sciences Center. All power to the research buildings was lost for about three months. Adding in the summer heat, the building temperatures rose to about 100 degrees. This was not good for the biological samples. It was about 10 days before we were able to send small groups of faculty and staff into the research buildings to recover samples (with National Guard escorts). Most samples in freezers, with the exception of DNA and some antibodies, were lost. There were a lot of samples in Dewars scattered throughout the research buildings. The smaller ones were carried down the stairs, placed onto National Guard trucks and taken to Baton Rouge. The larger ones could not be moved, so liquid nitrogen was brought in and carried up the stairs — in 100-degree temperatures — to top-off the larger Dewars.

After about three weeks, the flood water was pumped out of the city; however, most people were not allowed to return. About six to eight weeks after the hurricane, faculty were allowed to return to the research buildings to recover computers and take them to alternate sites where they could salvage their research operations. Again, there was no power in the buildings, so it was hot, and numerous rodents of varying sizes had taken up residence there.

Many of the scientists relocated to their colleagues' labs throughout the country in the interim. By late December, the first of the research buildings had power and could be occupied; however, there was no Internet, and phone service was minimal. All of the research buildings were reopened by mid-March. After the research buildings reopened, scientists slowly migrated back to New Orleans; however, some relocated permanently.

Once the research building reopened, the real recovery began. Our scientists needed to re-establish cell lines; try to salvage constructs; and

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replace antibodies, purified proteins and numerous other resources. Many clinical and animal tissue samples were lost.

The time to recovery depended on the investigator, but the average was probably about one and a half to two years for recovery of seminormal research activity. For my lab, it was about a year and a half. But we had a lot of help from the scientific community. The National Institutes of Health provided a one-year, full-cost extension of active research grants, which was essential for many of us maintaining our research programs. ASBMB members in the affected area also were provided grants to help offset some of our unexpected costs. This support was very much appreciated.

After 10 years, the scientific community has recovered. Many new faculty have been recruited to replace faculty losses immediately after the storm. The biggest concerns are now similar to those of everyone else — lack of NIH support due to the tight budget environment, recruiting and retaining faculty and staff, and so forth.

I tend not to think too much about Katrina. It was a painful experience. Ultimately, the reminders come back every August. Will there be another storm? Will it hit New Orleans? There was about a 40-year span between Katrina and the previous major storm (Betsy in 1963). Hopefully, it will be at least another 40 years.

There are a lot of thoughts that enter my mind when I think about Katrina. One is getting used to waiting. Everything — I mean everything — took longer after the storm. The Internet, when it was finally available, was slower. Going to the store took longer. There were not enough employees to maintain full staffing, so stores would only be open for two to three hours per day. Everyone went shopping for supplies at the same time — 10 minutes to get your items and then 90 minutes in a line to pay for them.

Gasoline was also difficult to get. Without power, the pumps didn't work, so you needed to travel to an area where there was power.

And the traffic! Traveling by car was an experience in patience. There was a bridge on I-10 that was destroyed during the storm, so there was a detour that lasted a few months before a temporary bridge was constructed. Traveling east from New Orleans was fine for about 25 miles. Then you got to wait for about three hours to get across Lake Pontchartrain. Traveling to Baton Rouge was no picnic either. So much of New Orleans relocated to Baton Rouge that a two- to three-hour wait was common in either direction.

Another memory is the darkness. When traveling east from New Orleans, there is a bridge called the High Rise. It crosses the industrial canal and goes to East New Orleans. This area was under water for at least a month, and all the electrical substations were damaged. So there was no power in East New Orleans. When traveling into East New Orleans at night, I recall going over the High Rise and seeing total darkness on the other side. I knew that a city was there but could not see it. Power to that area was not restored for at least six months.

One last thought is the variety of insects that encroached on the city. Within two weeks of the storm, there were species of insects that I had never seen. New plants began to grow, probably seeded by the floodwaters. It was amazing to see how quickly civilization can devolve and be overtaken by nature.

KEN EHRLICH

Melanie Ehrlich comforts Haruka Tsumagari, the wife of one of her postdocs, in the days after the storm.

'I never was politically active before'

Melanie Ehrlich, Tulane University Health Sciences Center

I never was politically active before (Hurricane Katrina). Destruction of my home from floodwaters due to faulty levee construction and incredulity at how poorly organized the $10 billion Road Home Program for homeowner victims was from its inception led me to found the nonprofit Citizens' Road Home Action Team. (CHAT was active from 2006 to 2010.)

Using my science-based analytical and oratorical skills in dealing with the top officials of the United States Department of Housing and Urban Development-financed, state-run program, other members of CHAT and I secured more equitable rule-making and implementation benefiting many thousands of the applicants.

CHAT was mentioned in more than 50 newspaper articles, including three mentions in the New York Times, and featured numerous times on TV to advocate for logical rules. Still, the Road Home was a very unfair program, but CHAT made it appreciably less so.

IRIS LINDBERG, FROM HER DISASTER PREPAREDNESS PRESENTATION FOR SCIENTISTS: THELINDBERGLAB.COM/RESOURCES

Mold obscures labels on retrieved bacterial stocks.

'Institutions need to involve scientists more in disaster planning'

Iris Lindberg, University of Maryland Medical Center (formerly of Louisiana State University Health Sciences Center New Orleans)

The most prominent memory I have of Katrina is the visit to New Orleans that Mike Jazwinski, Bronya Keats and I made from Baton Rouge to rescue our lab materials three weeks after Katrina, after the National Guard had evacuated the city for Hurricane Rita. As we drove down Claiborne Avenue toward LSUHSC in the only car on the road, we did not see a single person or animal — nothing else moving but us. We were in an empty city, surrounded by wind-wrecked signs and tree debris, and passed an empty boat stranded on the median strip. It was and will remain the most surreal experience of my life.

I lost everything but my Dewars and my plasmids: 10,000 frozen tissue samples, milligrams of purified protein intended for crystallography, and knockout mice that are no longer on this earth.

What I really missed in the next six months was new data: There was, of course, none coming in. Most (principal investigators) are data junkies, and not getting any new data for so long was tough! Interviewing for 11 jobs all across the country between November 2005 and March 2007 was also pretty stressful.

I still have not regrown all of the plasmids. We are growing them as needed. I think Katrina set me back about two years of profitable research time. I was very grateful for the extra support I received from the National Institute on Drug Abuse.

I think people need to realize that disasters involving power outages are much more common than they think, and they should have valuable materials backed up off site. I now provide an external hard drive for backup of all lab computers, as I had to carry seven desktop computers down seven flights of stairs in 90-degree heat! I also think institutions need to involve scientists more in disaster planning. There was no need for me to lose my mice. Firstly, there were people in the building who could have carried a few cages to upper levels when the building started to flood. It didn't happen that rapidly. Secondly, we were told the mice had all drowned when the top level of mice were still alive and I could have rescued them when I went in to get my stuff a few weeks afterwards. Lastly, these very valuable remaining live mice were then sacrificed by LSUHSC because they had fur mites — a purely cosmetic disorder. There was no need to sacrifice them. Basically, many decisions were taken by people who should have asked the scientists involved, which compounded the losses … A lesson I learned is that no one cares about your stuff more than you do.

Katrina changed my life and hopefully taught all research institutions that they must include a business-continuity plan for researchers in disaster planning. We think about the hurricane a lot. It was actually the beginning of a 10-year period of stress for New Orleans scientists, both those who stayed and those who moved. First some of us lost our labs, then came the housing bubble … and this was then followed by the collapse in NIH funding … I am sure the last decade of heightened cortisol levels has shortened my lifespan.

However, I have very much enjoyed my new research environment in Baltimore in the last eight years. I just wish I could have moved here under less stressful circumstances!

'The following year, there were more undergraduates enrolled at Tulane than before Katrina'

Larry Byers, Tulane University

Being on the high ground of the campus — about four feet above sea level — means our part of Uptown, along with the French Quarter, was among the 20 percent of the city, which has an average elevation of seven feet below sea level, that did not flood. However, the basement, where the stockroom is, was flooded by groundwater.

Our building did not suffer severely right after Katrina. There was very little wind damage. Most of the damage was due to about five months without power. Aside from replacing stockroom reagents, most of the remediation expense was mold removal.

The chemistry department did not lose any faculty, but the administration cut staff support by 20 percent to 30 percent, and this still has not been restored.

The fall 2005 academic semester, which was just about to begin, could not take place, but the spring semester of 2006 took place, and the fall courses were offered then and in the summer. The following year, there were more undergraduates enrolled at Tulane than before Katrina.

Fishing in life and the lab

By Lynn Mirigian

Fishing is synonymous with my childhood. My first memory is of gleefully picking up earthworms from my driveway after a heavy rain and poking their wriggling bodies one by one into a bait bucket. At the age of 4, fishing was not yet an option, but bait collecting was a prime pastime. I hunted down worms, crawdads and other crawling things to put in the bait bucket or in the Polly Pocket clamshell purse I used as a tackle box. I received my first Disney princess rod and reel as a birthday gift from my parents with the sense of anticipation, joy and responsibility typically reserved for a first pet.

I grew up in rural Indiana and spent all of my summers, first as a child in pigtails, then as a teenager in ponytails and finally as a young adult with wavy hair, with a fishing pole in my hand. As I watched the bobber float up and down, fishing showed me what it was to be calm. Working on my jigging technique engrossed me. It taught me patience when it seemed like all of the fish had gone on vacation away from my hook. Little did I know then that fishing would be great training for my journey through science and my current job as a postdoctoral researcher.

Here are some lessons I've learned.

Proper bait is key

Just like fish reject old, worn-out crickets, regardless of how superb the fishing technique, cells don't respond to an ancient, undated tube of cytokines found in the back of the 4 °C fridge no matter how many times I repeat the experiment.

Know the target

I know catfish are partial to slow-moving, smelly bait. So if a fish fry is at stake, I need to have a juicy earthworm bobbing at the end of my hook. With hundreds of successes and failures at capturing collagen recorded in my lab notebook, I now know collagen does not favor warm temperatures and shields itself from capture by cozying up with DNA. But the protein is attracted by low pH and agitation.

Enjoy the cold drink and tales of triumph and woe

Stopping by Dairy Queen at the end of the day was one of my favorite parts of childhood fishing adventures. Sitting in a faded red booth, slurping down a double blueberry milkshake, my dad and I recapped the glories, laughed at the mistakes and commiserated over the fish that got away. Without that same easy camaraderie with lab mates and an enormous $8 bottle of pinot grigio, forging through science would be tough.

It's important to teach others

"Da-ad, it's in a tree again!" My dad heard those words at least five times an hour when he first began to take me fishing. But each time, he would patiently rescue my hook, and we'd move to a new spot where, once again, he'd show me how to sidearm cast under trees. But through this effort, he passed the love of fishing from one generation to the next. This cycle also occurs in the lab. My graduate-school supervisor patiently set aside large chunks of his day not only to rescue my haywire experiments but also to instill a love of discovery of the unknown. As I mature as a scientist, I look forward to teaching students just as I was taught.

Mirigian's favorite pan-fried fish with rice dinner was just moments away.

Living creatures deserve respect

In that split second after a fish takes the bait, it is the fisherperson's responsibility to recognize a fish has been caught and to set the hook. Wait too long, and the fish could swallow the hook or get it caught in its gills and be hurt unnecessarily. Whether I'm handling a fish or a laboratory mouse that must be sacrificed, I do my best to prevent suffering. The gut check that accompanies each procedure, even when I know the animal is to be used for food or to benefit human health, never goes away.

Lynn Mirigian (mirigianls@mail.nih.gov) is a postdoc at the National Institutes of Health studying disordered proteins and a communications/outreach intern with ASBMB.

Nature or nurture?

By Mariana Figuera–Losada

What was the tipping point that put my younger self on a path to a career in science? Was it the hours I spent as a child reading books about space exploration or the immune system, playing exotic adventure and strategy video games, or solving puzzles? Was it watching educational programs on public television about the wonders of the universe, the beauty and toughness of the African savannah, or the mysteries of the oceans?

Perhaps it was the long stories that my mom, who was a teacher and a psychologist, told me about lost pre-Columbian civilizations, their amazing cultures and their demise. Maybe it was my uncle, the marine biologist, who poured some intellect fertilizer into my head while we fantasized about the mysteries of the Bermuda Triangle, survival in the jungle or how to come up with brand-new sports games. At the time, these games felt like the most fun games ever invented, but now they only seem like awkward variants of baseball, my uncle's favorite sport.

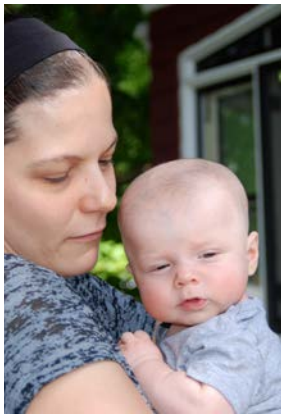
Maybe it was just the flow of knowledge following a steep gradient from my mom's and her friends' minds to mine. Those friends, an ever-expanding group of teachers, physicians, biologists, sociologists and psychologists, would spend endless hours on somebody's porch or at the beach talking about everything under the sun. Eavesdropping on their conversations was always a treat for me. It didn't matter whether they were talking about the latest medical advances, the best cuts of meat for a barbecue, or world politics or social justice. Whether I could understand their discussions was also beside the point. What mattered most was that I was there and part of something I perceived to be exciting and extraordinary.

For all I know, I even may have had a genetic predisposition to become an experimentalist. Family stories make reference to my great-grandmother Mimi, who was a sort of shaman in the little town hidden in the low mountains of northeastern Venezuela where my mom was born. Mimi was the healer to seek out when health troubles struck. Since access to modern medicine was a journey of hours in those years, her healing powers and recipes for special concoctions were said to cure relatives and friends of all sorts of afflictions.

The writer and her mother

Great-grandmother Mimi

It may not be a single reason but a combination of factors that shaped me. Whatever those factors are, I am glad that I decided to take this journey and that I never have stopped exploring, asking questions, and feeling the joy of discovery and learning in daily life. Biochemistry became my path, and studying proteins' functions turned out to be my passion. It is hard to believe I ever could get tired of peeking into the amazing lives of proteins. Learning what they do and how they do it is like going on an expedition to a faraway, exotic place with no map to show the way; if you are lucky, a few tales told by those that came before guide your first, hesitant steps.



The writer with her son

Now I believe it is my turn to pass the torch. There is a new member of my family, a little one with insatiable curiosity. I cannot wait to share with him the stories that made me dream when I was little as well as the ones that amaze me these days. I hope he shares my hunger for knowledge and my need to see the magic of the universe and the unbelievable beauty of life and nature. I will try to tickle his inquisitive mind with fantastic questions and encourage him to explore and to learn. He won't have to become a scientist to be able to enjoy exploring, but I want to make the process fun for him. I want him to love what we do together and to grow up to live his life doing what he loves most, whatever that turns out to be.

Mariana Figuera–Losada (fmariana@hotmail.com) is an associate scientist at Albert Einstein College of Medicine in the Bronx.

Pursuing dragons and damsels with Hal White

By Martina Efeyini

Harold White III, a professor of chemistry and biochemistry at the University of Delaware, recently won the 2015 Educator of the Year in Higher Education award from the Delaware BioScience Association. White, who runs the Howard Hughes Medical Institute Undergraduate Science Education Program at the university, was also the winner of the 2014 Award for Exemplary Contributions to Education from the American Society for Biochemistry and Molecular Biology.

White earned his bachelor's degree at the Pennsylvania State University and his doctorate in biochemistry at Brandeis University. He was a National Science Foundation postdoctoral chemistry fellow at Harvard University. In 1971, he became a faculty member at the University of Delaware, where he has done protein chemistry research and taught chemistry and biochemistry and where he developed a strong interest in using problem-based learning in his biochemistry courses.

The painted skimmer, an uncommon dragonfly, is about 1.7 inches long.

Harold White III

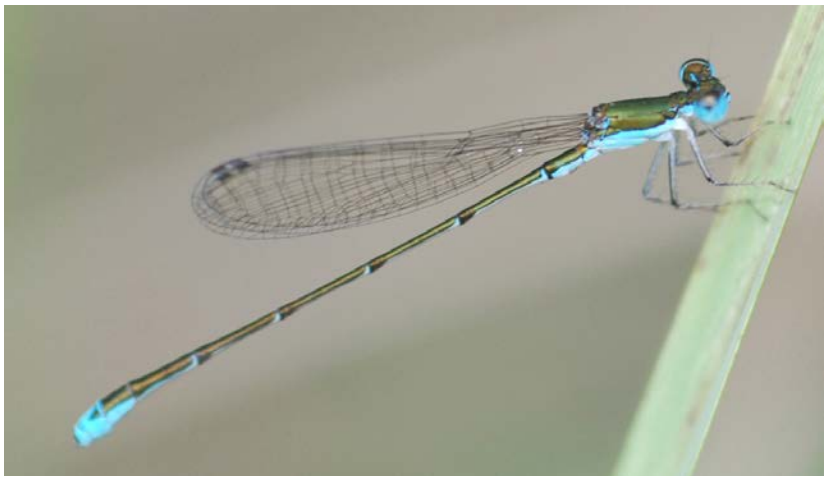
Beyond the classroom and laboratory, White likes to find, observe and photograph dragonflies and damselflies (members of the carnivorous Odonata order of insects) whenever and wherever he can. Dragonflies and damselflies have large eyes, short antennas and four large wings. Dragonflies are usually larger, more robust and stronger fliers than the smaller and more delicate damselflies. White developed an interest in these insects in high school. In college, he tried to merge his interests in dragonflies and biochemistry with an undergraduate research project studying isoenzymes of glycerol-3-phosphate dehydrogenase. Without realizing the significance at the time, he observed a huge increase in the activity of that enzyme during metamorphosis in dragonflies. While that research never was published, it significantly influenced his graduate career.

For many years, he and his family spent their summer vacations in Maine on Mount Desert Island and in its vicinity, where many northern species of odonates live. In 2011, he published, "Natural History of Delmarva Dragonflies and Damselflies: Essays of a Lifetime Observer," a book that reveals his passion for these insects.

Our conversation has been edited for length and clarity.

What sparked your interest in science?

I have been interested in nature activities since as early as I can remember. My interest in dragonflies and damselflies started when I was in junior high school. I was thinking of majoring in entomology in college when a geologist who also had an interest in dragonflies told me, "Whatever you do, don't major in entomology. Keep it a hobby. In college, major in the most difficult thing you enjoy." That advice might not be good for every budding entomologist, but it worked well for me. When I applied to college at Penn State and had to choose a major, I knew I liked chemistry and biology, so I checked the box marked "biochemistry," even though I was not sure what it was.



The Southern sprite is a tiny damselfly found in the swamps of the Southeastern U.S.

How did you get interested in dragonflies and damselflies?

My earliest interest in odonates was kindled by George and Alice Beatty, biologists who lived near me in central Pennsylvania. We met one summer evening in 1957 when they stopped for an ice cream at a frozen custard stand where I and a friend, armed with nets, were catching sphinx moths and silk moths around the lights. The Beattys were willing to help us as emerging entomologists. They transferred my interests from Lepidoptera (moths and butterflies), a usual interest of youngsters, to their primary interest, Odonata. One day in 1959, I saw an Anax longipes, a large, rare, brightly colored dragonfly that was notoriously difficult to catch. George Beatty challenged me to catch it and offered $10 for a specimen. A week later, after many failed attempts, I caught it!

Where do you like to go to observe dragonflies and damselflies?

I observe dragonflies wherever they are. That is part of my enjoyment, because different species have different habitat preferences. Thus, I revel in wading in a swift-flowing, boulder-strewn mountain stream as much as slogging knee-deep in a steamy bog surrounded by deer flies. Sitting by a farm pond watching many of our more common dragonflies flying around is enjoyable, but I most enjoy the search for rare and elusive species in places few people go.

What inspired you to write your book on Odonata of the Delmarva Peninsula?

I originally was approached by two people from the Delaware Nature Society to write a book about dragonflies of Delmarva, a defined area I knew well. In contrast with when I started observing dragonflies, there were now many field guides to help with identification. Writing yet another identification book was not my goal. Instead, I wanted a book that had an eclectic mix of information. I wanted to include stories using each of the more than 120 species found on the Delmarva Peninsula as a point of departure. The table of contents is unique in that the two-page entry for each species is referenced in three ways — by the scientific name, by the common name and by a catchy title. I have a mix: Some are stories sharing my experiences, and some relate to history and descriptions of dragonflies, and some are about their biology and behavior. I wanted this book to be of interest to both amateurs and experts.

What can the reader expect to learn from reading your book?

I think of my book as having the potential for reading enjoyment — with vignettes about dragonflies that can be read in small doses or cover-to-cover, perhaps even as bedtime reading. I have some more formal information about Odonata in the book but did not present it in the structure of a field guide or a textbook. In addition, there are many tidbits in my book that would not be found in other books about dragonflies and damselflies. Biochemical topics are mentioned infrequently.

One of my daughters, an elementary-school teacher, thought that the book could be the point of departure for teaching biology using examples students could observe and explore. In the book, I suggest science projects that some enterprising students might work on.

What have you gained from this hobby?

Being a scientist requires commitment and willingness to devote time, energy and productive thinking into one's work. Hopefully most scientists consider their work as having some elements of enjoyment, but having something quite different that one enjoys – be it music, sports, photography, woodworking, travel, family, gardening or whatever – is important to refresh one's mind and keep things in perspective.

Martina Efeyini (mefeyini@gmail.com) is a toxicologist and freelance writer. Read her blog at mademoisellescientist.worpress.com. She also writes for the National Society of Black Engineers and ScientistaFoundation.com

ACDC: What's in the name?

By Eleftherios P. Diamandis

Having a distinct name like Eleftherios gives you a lot of advantages. People never ask you to spell your name, and they remember it without much trouble.

Ha! If only!

When I make restaurant reservations, I simplify things by going with the name Elvis. Nobody has ever asked me to spell it, and I get a smile in return. When people ask me for the name of my research laboratory, I reply, "the ACDC lab."

The usual response is, "I've heard that name before. Is it a band from the '70s?"

But of course it is. And the follow-up question is always, "Does your lab's name have anything to do with the band?"

Well, it does and it doesn't. The name was chosen many years ago for two reasons: to celebrate one of my all-time favorite rock bands, AC/DC, and to outline the scope of my research laboratory — ACDC stands for Advanced Centre for Detection of Cancer.

I have tried repeatedly to reach out to AC/DC and let them know about the research laboratory that shares their name and is devoted to fighting cancer, but with no success. In fact, not only is the lab named after them, but to celebrate the music of AC/DC, we formed a rock band within the lab with me representing Angus Young (lead guitarist and music composer) and my graduate students playing the other members. We created a poster and shot a video of the AC/DC song "Chase the Ace."

Until recently, I thought naming a research lab after a rock band was rather unique. That changed when, in 2014, I met my friend and fellow physician and scientist Steven Boyages from Australia. Boyages revealed that he'd created a digital communications company and named it "Red Zeppelin" to celebrate the legendary rock band Led Zeppelin. The name is meant to connote inspiration, and capture the sense of imagination and innovation the band represents.

Eleftherios Diamandis and graduate students in character for their "Chase the Ace" video: http://y2u.be/UTKvs-zvdus.

Eleftherios P. Diamandis (ediamandis@mtsinai.on.ca) is the biochemist-in-chief for the Laboratory Medicine Program at the University Health Network and head of the clinical biochemistry division at Mount Sinai Hospital in Toronto, Canada. He also is the division head of clinical biochemistry at the laboratory medicine and pathobiology department at the University of Toronto. Diamandis is a fanatical music lover. Apart from rock, he also listens to Greek folk, classical and other types of music, but he dislikes rap (which he suggests should be called "crap").

Resolving major issues with major selection

By Kristian Teichert

Jordan Soucy and Emily Breviglia had similar experiences choosing their undergraduate majors. Both rising juniors at the University of Massachusetts, Amherst, Soucy and Breviglia selected their majors in their freshman year but changed them before the year was out. The change for Soucy was dramatic: from chemical engineering to kinesiology. Breviglia's switch from communications disorders to psychology was more of a fine-tuning. But both changes, it turns out, were fairly typical. According to the National Center for Education Statistics, about 80 percent of students change their major at least once before graduation.

College major selection is an important process. Choosing the wrong major can result in additional stress and financial burdens, which can be debilitating for some. A number of factors contribute to students choosing a major they'll later reject. These include practical concerns like students' income expectations and career opportunities, ignorance of how the major aligns with their interests, and a lack of familiarity with their major of choice. Programs designed to expose students to their chosen field of study can mitigate the latter two factors.

Learning Unlimited is an organization that aims to expand educational opportunities for high-school students while providing college students with teaching and leadership opportunities. In 2013, with a group of friends, I opened an LU chapter at Northeastern University called the Northeastern Program for Teaching by Undergraduates, or NEPTUN. NEPTUN, much like other LU programs, brought high-school students to the college campus to take classes designed and taught by Northeastern students. Over the past two years, we have run three programs and taught a variety of classes ranging from "Introduction to Rocketry" to "Power, Wealth and Happiness." Soucy and Breviglia both agree that programs like these would have been helpful in their major-selection process. Asked what would have helped her make the right decision about her major at the start, Soucy said, "A program in high school."

Each year, NEPTUN runs two programs, Splash and Waterfall. Splash is a one-day event in the spring where students take classes designed to introduce them to a new topic that they would be unfamiliar with otherwise. On average, there are 34 unique classes taught per NEPTUN Splash program. Waterfall is a multi-week program run in the fall to foster a deeper understanding of topics than can be offered in the Splash program. Last fall, 30 classes were taught during Waterfall. Past students involved in NEPTUN programs claimed that they enjoyed the "intro to new topics" and considered it a "fun place to try new things."

Each NEPTUN program is designed to accommodate 200 or more students, and generally we have had a large number of sign-ups, achieving or nearing our goals. But attendance has been an issue. Only about half of the people who sign up actually attend the programs. We attribute the low turnout to a combination of issues: low student interest, low commitment on the part of the student and competing extracurricular activities. In previous programs, no-shows who contacted us said that events, such as track meets, class projects and exams, interfered with their attendance. But they still voiced a desire to attend. We think organizers could strengthen student commitment by charging a nominal fee, fostering a level of investment on the part of the student.

We've also found it is difficult for organizers to choose a date for the event that works for all schools in the area. With the sheer number of schools participating, this can be a nearly impossible feat. This year, to combat the issue of the schools' conflicting extracurricular activities, we are designing a new, alternative outreach program to bring the college students to high schools. By working directly with each high school, organizers can settle on a date that will allow for the most student engagement. College students across disciplines and universities, such as Soucy and Breviglia, will be recruited to design lessons focused on their respective majors. This program will begin during the fall at Methuen High School in Methuen, Massachusetts. Ideally, this program, or others like it, will expand into a network that can accommodate multiple high schools.

Kristian Teichert (teichert.k@husky.neu.edu) is a biochemistry student at Northeastern University.

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Upcoming ASBMB events and deadlines

AUG

Aug. 17: Abstract deadline for ASBMB Science Communication and Outreach Career Symposium, San Antonio, Texas

SEPT

Sept. 1: Registration deadline for ASBMB Science Communication and Outreach Career Symposium, San Antonio, Texas
Sept. 10: Oral abstract deadline for ASBMB Special Symposium Kinases and Pseudokinases: Spines, Scaffolds and Molecular Switches, San Diego, California
Sept. 17–20: ASBMB Special Symposium: Membrane-Anchored Serine Proteases, Potomac, Maryland
Sept. 18–19: ASBMB Science Communication and Outreach Career Symposium, San Antonio, Texas
Sept. 22: Early registration deadline for ASBMB Special Symposium Kinases and Pseudokinases: Spines, Scaffolds and Molecular Switches, San Diego, California
Sept. 27–30: 14th Human Proteome Organization World Congress (HUPO 2015), Vancouver, Canada, Molecular & Cellular Proteomics booth #413

OCT

Oct. 14: Poster abstract deadline for ASBMB Special Symposium Kinases and Pseudokinases: Spines, Scaffolds and Molecular Switches, San Diego, California
Oct. 27: Registration deadline for ASBMB Special Symposium Kinases and Pseudokinases: Spines, Scaffolds and Molecular Switches, San Diego, California
Oct. 29–31: Society for Advancement of Hispanics/Chicanos and Native Americans in Science (SACNAS) National Conference, Washington, D.C.

NOV

Nov. 5: Abstract submission deadline for ASBMB 2016 Annual Meeting, San Diego, California
Nov. 12: Travel award application deadline for the 2016 Annual Meeting, San Diego, California
Nov. 11–14: Annual Biomedical Research Conference for Minority Students (ABRCMS), booth #900, Seattle, Washington

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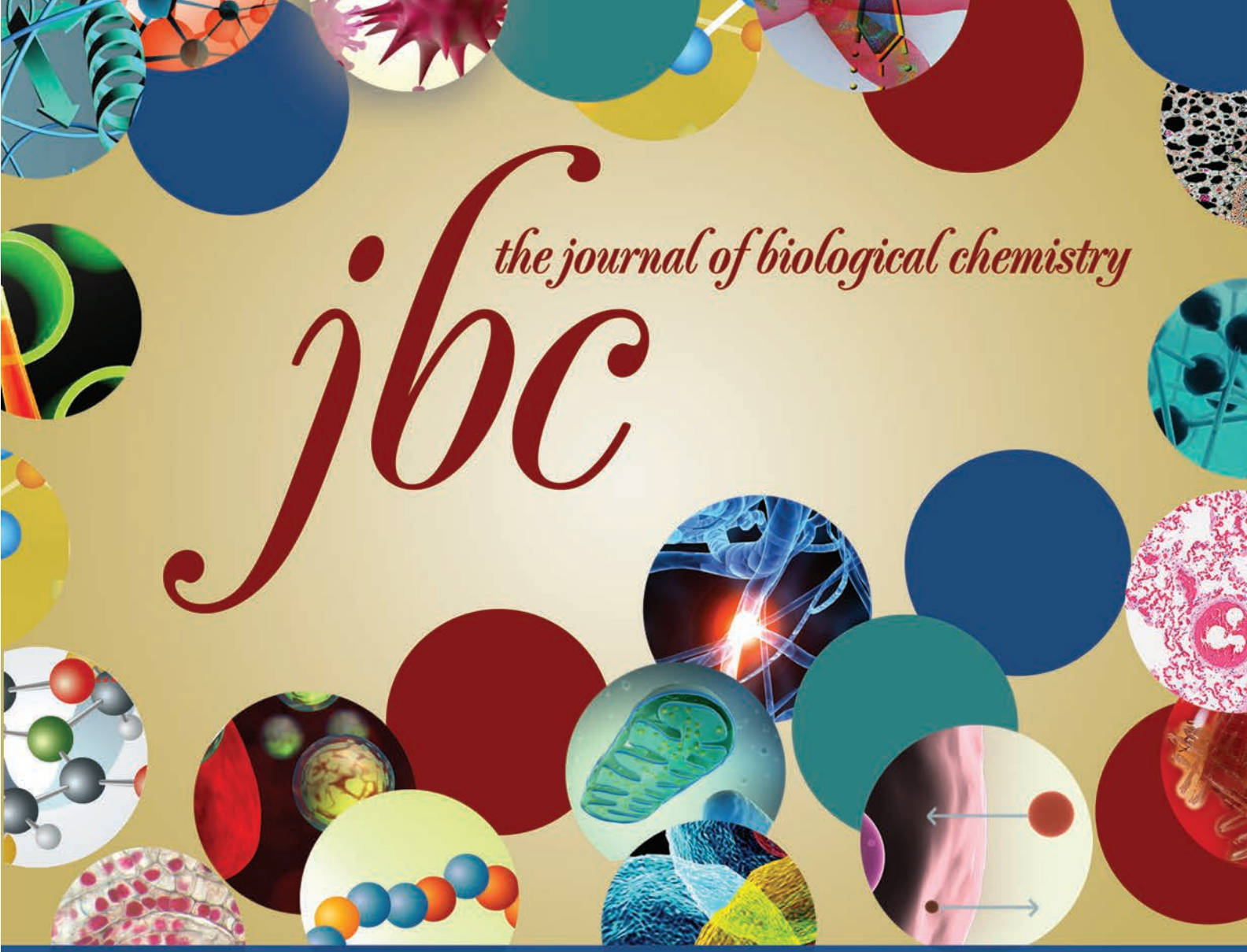

The Journal of Biological Chemistry's editors are pleased to announce that 21 papers have won Best of 2014 designations. The Best of 2014 manuscripts were selected from the more than 3,100 papers published last year. One Best of 2014 paper was chosen from each of the journal's Affinity Groups for its excellence and potential impact on the field.

These 21 papers are free to all.
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JARED P. RUTTER, UNIVERSITY OF UTAH, HHMI
PETER WALTER, UNIVERSITY OF CALIFORNIA, SAN FRANCISCO, HHMI
XIAOWEI ZHUANG, HARVARD UNIVERSITY, HHMI

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