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ASBMB TODAY

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

GOING GLOBAL WITH GENOMICS

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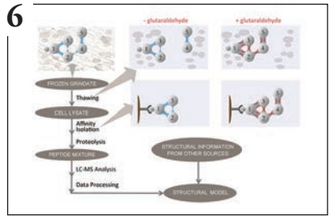
NEWS



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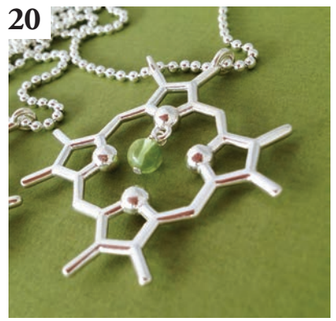

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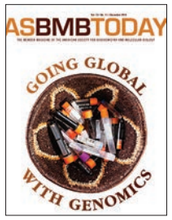
Researchers at the Smithsonian National Museum of Natural History want to advance the genomics of as many life forms on Earth as possible. But first they need to figure out the small details that will make or break the effort.

Image courtesy of James Di Loreto, Smithsonian



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ASBMBTODAY
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Time machine

By Steven McKnight

This is the story of a spectacular triumph of biochemistry. The story builds upon the foundation of more than four decades of research on circadian rhythm.

Centuries ago, the French botanist Jean-Jacques d'Ortous de Mairan considered how it might be that the leaves of acacia trees zipper up at night and then open at dawn for maximal capture of sunlight. The most sensible interpretation, at least for a simple-thinking person like me, would have been that the earliest rays of sunlight might trigger the leaves to open up to optimize photosynthesis.

No, in the complete absence of sunlight, the leaves of the acacia tree opened right at dawn, giving evidence that the plant has a built-in clock (1). This internal timing device allows the plant to anticipate when the sun should be coming up. In hindsight, the advantage of anticipation is obvious.

Insight into the nature of the regulatory system controlling circadian rhythm got a huge boost from fruit fly genetics a bit more than 40 years ago. In an unusually inspired series of experiments, Ron Konopka and the late Seymour Benzer found mutations that cause fruit flies to have a longer than normal period of circadian rhythm, a shorter than normal period, or no circadian rhythm at all. Remarkably, all of these mutations mapped to the exact same gene — the fly period gene (2).

Beautiful, beautiful genetics — yes. But advances toward mechanism had to wait decades until the period gene could be cloned. This was achieved independently by Mike Rosbash and Jeff Hall (3) and Mike Young (4). How cool it was when these scientists showed that expression of the period gene was itself rhythmic over a 24-hour period.

Author's note

I've decided it's prudent to take a break from the debate about the quality of reviewers on National Institutes of Health study sections. The American Society for Biochemistry and Molecular Biology governing council met in mid-November with Richard Nakamura, director of the NIH's Center for Scientific Review. The discussion was enlightening, and the data presented will inform my future columns on this topic.

In the meantime, I encourage you to take a quick poll on the ASBMB Today website about the current state of our NIH peer-review system. Visit www.asbmb.org/asbmbtoday to participate in the poll.

Two decades of research in the lab of Joe Takahashi enhanced the understanding of how things fit together. Takahashi took exactly the same approach as Benzer and Konopka — forward genetics. Instead of fruit flies, Takahashi was sufficiently bold to use chemical mutagenesis and forward genetics with mice as his experimental species. Like Benzer and Konopka, Takahashi found his gene — Clock — wherein a specific ENU-induced mutation resulted in a lengthened circadian period (5). Like Young, Rosbash and Hall, Takahashi painstakingly chased down his Clock gene by positional cloning (6, 7).

Unlike his predecessors, however, Takahashi got lucky. Upon sequencing the Clock gene, he quickly recognized that it encoded a transcription factor – it had a distinct bHLH DNA binding domain. That discovery represented a critical, missing piece of the puzzle. In short order, Takahashi and others established that the genes controlling circadian rhythm specify the parts list for a negative transcription feedback cycle such that the pathway could be understood in clear and simple terms (8).

Perhaps the coolest piece of the circadian rhythm puzzle came from studies of the single-celled marine microbe Synechococcus elongates — a cyanobacterium. Susan Golden, Carl Johnson, Takao Kondo and others used forward genetics to discover cyanobacterial variants with altered circadian periods. In a particularly beautiful series of experiments, they showed that short or long period variants were at a fitness disadvantage relative to wild-type strains when grown under a 12-hour-to-12-hour light-to-dark cycle. Amazingly, variants with a long period — such as 28 hours — out-competed the wild-type strain when grown under a 15-hour-to-15-hour light-to-dark cycle (9).

These experiments demonstrated the importance of circadian timekeeping for biological fitness of cyanobacteria. Among the many mutants discovered to affect timekeeping in cyanobacteria, the most prevalent class fell into the kaiA, kaiB and kaiC genes. The products of these three genes organize into a complex centered with a KaiC hexamer having the approximate ratio of KaiA:KaiB:KaiC of 1:1:4. The KaiC hexamer has both autophosphorylation and autodephosphorylation activities, with KaiA enhancing autophosphorylation and KaiB attenuating the stimulatory effect of KaiA.

In a spectacular, two-page paper published in 2005, Kondo and colleagues showed that this Kai complex undergoes rhythmic changes in phosphorylation with a period of 24 hours (10). In other words, a complex reassembled from recombinant proteins has all of the properties of a biochemical clock — a virtual time machine. Complexes composed of mutated Kai variants known to have a short period in living cells displayed a short oscillatory period in the test tube, and complexes composed of long-period variant polypeptides displayed a long oscillatory period.

That the reconstituted, recombinant Kai complex has all of the working parts necessary to create an isolated and fully accurate biochemical clock represents a breathtaking discovery. This, my friends, is the beauty of biochemistry. The field needed genetics to open the door, but it was hardcore biochemistry that showed us the precise workings of the Kai time machine. What a triumph of science!

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Wanted: lab pranks

Have you ever pranked a colleague in the lab? Have you been the victim of a (hopefully harmless) prank? Send us your story for a special feature in April. Email asbmbtoday@asbmb.org.

Take the ASBMB Today readership survey

We value your opinion. Put your email address in the form for the final question to enter our drawing for $20 Amazon gift cards. https://www.surveymonkey.com/s/2014ASBMBToday

The policy year in review

Notable changes that affected scientists in 2014

By Chris Pickett

By all accounts, 2014 was an active year in science policy. While Congress had only a modest effect on science policy during the past year, federal agencies made important changes that will affect scientists from all disciplines. Here are some science-policy highlights from 2014.

National Institutes of Health

The NIH made significant policy changes in a variety of areas. Efforts to improve the reproducibility of preclinical research moved forward with important changes to data and methods reporting in research papers. The agency also issued several grants to improve diversity in the biomedical research workforce through university collaborations and mentoring networks. The NIH and individual institutes also addressed important issues such as workforce training, funding people instead of projects and the sex of research animals used in experiments, among many others.

Arguably the most notable change in NIH policy in 2014 was to allow unlimited grant application submissions. In 2009, the NIH instituted a policy that grant applications could be submitted only twice, cutting back from the three-submissions policy that had been in place for some time. However, earlier this year, the NIH reversed course and now allows unlimited submissions. If an application is rejected after the first submission, principal investigators allowed to submit a response to the reviews during the second submission. However, a failed second submission will not prevent the PI from resubmitting the same grant application during a subsequent cycle. The results of this new policy will play out in 2015.

National Science Foundation

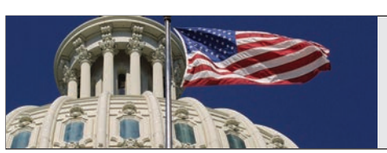
France Córdova became the director of the NSF this year, while James Olds took over at the Biological Sciences Directorate. However, the NSF story that dominated 2014 was about the Republicans on the U.S. House Science, Space and Technology committee continuing to press the agency over the release of confidential merit-review materials. The representatives accuse the agency of using scarce taxpayer dollars to fund frivolous science, and they want to review the confidential materials concerning the grant application reviews. Córdova has resisted releasing these materials, saying that doing so would damage the merit-review system. This debate does not appear to be losing any steam and will continue into 2015.

Congress

The midterm elections that resulted in Republicans taking control of the U.S. Senate dominated this year's political headlines. But when it comes to science policy, we won't see the effects of this until 2015. There was quite a bit of talk on the campaign trail about what the government should do with regard to the Ebola outbreak in West Africa. However, it remains to be seen if Congress will take any action.

The most notable Congressional action this year with regard to science was taken by U.S. Reps. Fred Upton, R-Mich., and Diana DeGette, D-Colo., of the U.S. House Energy and Commerce committee. They launched the 21st Century Cures initiative, a bipartisan effort to pass legislation that removes bureaucratic roadblocks to discoveries of drugs and technologies. The committee held several roundtable events and hearings addressing various topics concerning basic research, drug development, clinical trials and data sharing. We expect 21st Century Cures legislation to be introduced at the beginning of 2015. After such an eventful 2014, we expect nothing less in 2015!

Chris Pickett (cpickett@asbmb.org) is a policy analyst at ASBMB.



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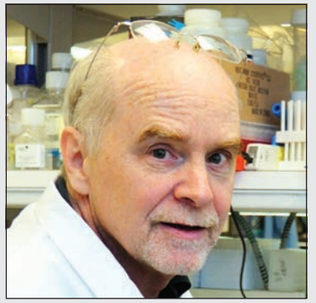
Three members elected to Institute of Medicine

ELLIOT L. CHAIKOF
Harvard Medical School and Beth Israel Deaconess Medical Center

GERARD KARSENTY
Columbia University



JOHN JOSEPH O'SHEA JR.
National Institute of Arthritis and Musculoskeletal and Skin Diseases

The Institute of Medicine in October elected 70 new members and 10 foreign associates. Three members of the American Society for Biochemistry and Molecular Biology were among those chosen by active members at the IOM's annual meeting. Election to IOM is one of the highest honors for those in the health and medicine fields.

Benovic, Catterall to give ASPET talks

BENOVIC

CATTERALL

Jeffrey L. Benovic of Thomas Jefferson University and William A. Catterall of the University of Washington will give lectures at the annual meeting of the American Society for Pharmacology and Experimental Therapeutics in the spring in Boston. Benovic won the Julius Axelrod Award in Pharmacology. His talk will be titled "Arresting developments in receptor signaling." Catterall will give the Norman Weiner Lecture. His talk will be titled "Structural basis for function and pharmacology of voltage-gated sodium and calcium channels." ASPET's annual meeting will be held alongside ASBMB's at the Experimental Biology 2015 conference in March.

College proud to claim alumnus Kozak

Leslie P. Kozak, who earned his undergraduate degree in 1964 at St. John Fisher College in Rochester, N.Y., was one of five alumni inducted this year into the college's Science and Technology Hall of Fame. A professor at the Institute of Animal Reproduction and Food Research of the Polish Academy of Sciences, Kozak initially attended college part time to accommodate his professional hockey career. In the early 1960s, he played in the National Hockey League for the Toronto Maple Leafs. He went on to earn in 1969 a Ph.D. in biochemistry from the University of Notre Dame and has spent the years since as a researcher. "Something laid down in that gentle and nurturing time at Fisher provided the background, which, together with the competitive drive associated with becoming a professional hockey player, ignited my infatuation with scientific discovery, and I have never looked back," Kozak said.

Halpert appointed dean at UConn

HALPERT

James Halpert is now dean of the University of Connecticut School of Pharmacy. Before being appointed in June, Halpert was a professor and the associate dean for scientific affairs at the University of California, San Diego. Before that, he was chairman of the University of Texas Medical Branch's pharmacology and toxicology department and held various other leadership positions. Halpert's research focuses on the structure and function of cytochromes P450. He is an American Association for the Advancement of Science fellow and a past editor of the journal Drug Metabolism and Disposition.

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Protein, you can't hide anymore!

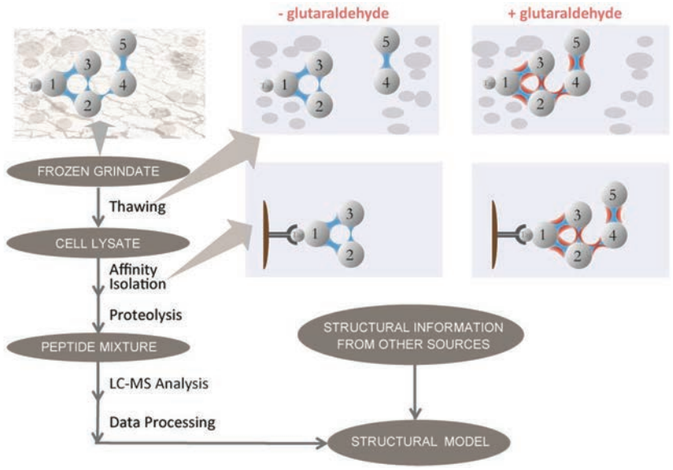
An improved method for the detection of protein-protein interactions

By Alok Upadhyay

A recent report published in the journal **Molecular & Cellular Proteomics** by scientists from The Rockefeller University details an improved method for detecting protein–protein interactions in a cell's natural environment. In this method, dubbed stabilized affinity capture mass spectroscopy, or SAC-MS, the authors combined commonly used techniques and standardized a procedure to affinity-capture proteins and subsequently identify them by mass spectrometry.

Protein–protein interactions are required in essentially all biological activities. A tremendous amount of research is being done to understand these interactions and their relationship to human diseases. A number of experimental techniques exist to isolate and identify these interactions, including isolation of protein complexes using specific antibodies (collectively termed affinity capture). Although traditional affinity-capture methods are used widely and have aided in scientific discoveries, they suffer from major shortcomings, such as inability to capture weak or transient protein interactors, and are unable to differentiate proximal (direct binding) from distant or indirect associations.

Brian Chait, who led the research project, describes this methodology as a "step forward in protein interaction studies in a cell's native environment." He added: "This technique allows us to capture and identify specifically associated proteins that may not have been feasible — such as transient and/or weak interactors, interactions that undergo rapid exchange, or even those that do not survive the normal biochemical isolation conditions used in conventional protein complex isolation methods."



The stabilized affinity capture mass spectrometry (SAC-MS) pipeline for targeted determination of specific protein–protein interactions and proximities in cellular milieu.

The SAC-MS technique has three steps:

1) flash-freezing samples in liquid nitrogen to preserve the native cellular environment and molecular interactions, followed by fracturing samples at -80°C into microchunks;

2) glutaraldehyde treatment to stabilize protein–protein interactions via crosslinking; and

3) affinity capture of associated proteins (see figure).

The affinity-captured complex then is subjected to mass spectroscopy to identify individual components.

The salient feature of this method, which sets it apart from other methods, is the use of sub-stoichiometric amounts of glutaraldehyde with respect to reactive amino acid residues in the protein. "This low molar ratio is optimized for stabilization of native interactions, efficient (affinity) isolation, and minimal interference with MS readout," the authors wrote.

The authors validated the SAC-MS approach by studying two different protein complexes: the nuclear pore complex and the minichromosome maintenance complex. Their findings suggest that they have identified transient interactors, distinguished false positives from real interactors, and deciphered direct and indirect associations along with improved yields of many protein components of the complexes with SAC-MS.

Alok Upadhyay (alok7930@gmail.com) is a postdoctoral associate at Fox Chase Cancer Center. His major research area is Notch signaling regulation during cell fate decisions and neural crest stem cell development. Follow him on Twitter at www.twitter.com/alok7667.

Englund writes about his 'passion for parasites'

By Angela Hopp

"I knew nothing, and had thought nothing, about parasites until 1971," writes Paul Englund in the **Journal of Biological Chemistry**. "In fact, if you had asked me before then, I might have commented that parasites were rather disgusting."

Englund, professor emeritus at the Johns Hopkins University School of Medicine, infuses his recent "Reflections" article with a dash of wit and a notable helping of self-awareness.

ENGLUND

He describes how he first stumbled upon the intriguing world of parasitology — by reading a paper about a parasite found in lizards — and ended up spending the next four decades unraveling the intricacies of kinetoplast DNA replication in trypanosomatids, which cause a handful of devastating human diseases in tropical areas.

Read about Englund's scientific journey at www.jbc.org/content/by/section/Reflections.

Angela Hopp (ahopp@asbmb.org) is editor of ASBMB Today.

How enzymes came to be

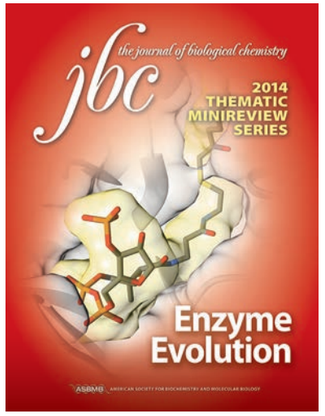
By Maggie Kuo

Consider the decarboxylation of orotidine 5′-phosphate reaction. This reaction is essential for the synthesis of DNA. Without the corresponding enzyme, the uncatalyzed reaction would take millions of years to complete. With the enzyme, the reaction happens in milliseconds. The **Journal of Biological Chemistry's** recent thematic minireview series focuses on how enzymes acquire and optimize their traits for such efficiency.

If the reactions necessary for life occur so slowly, how could an enzyme even begin to evolve from its ancestral form? In the first review of the series, Richard Wolfenden of the University of North Carolina at Chapel Hill discusses how temperature changes as the Earth developed encouraged the evolutionary process. Recent studies demonstrated that very slow reactions, like some in the body, are sensitive to temperature, supporting the idea that the very warm temperatures of primordial Earth would have accelerated their rates dramatically.

Other studies have shown that the extent to which artificial catalysts enhance the reaction rate increases as temperature decreases. If early enzymes behaved like this, Wolfenden contends, as the Earth cooled, the rate enhancement from the enzymes would have increased, compensating for the decrease in the reaction rate itself. Studies also have reported that the rate of genetic mutations is sensitive to temperature. The generation of genetic variants might have been extremely prolific at the early stages of the evolutionary process.

What interactions change as an enzyme evolves? In the second review, Judith P. Klinman of the University of California, Berkeley, and Amnon Kohen of the University of Iowa present examples of how protein dynamics and the chemical reaction being catalyzed influence enzyme evolution. For dihydrofolate reductase, residues directly affecting the reaction step were shown to evolve together, although the functions of residues that coevolved were not necessarily part of the chemical reaction coordinate. The chronological order of mutations also is important, as some mutations in higher organisms can support the chemical step only if earlier mutations have occurred. Studies in two highly related alcohol dehydrogenases that function at extremely different temperatures showed how protein dynamics can increase the



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efficiency of the catalyzed reaction by creating active site configurations with highly specific internuclear distance and charge, illustrating one way proteins can adapt to different environmental conditions.

What structures and functions did an enzyme acquire at each evolutionary step? In the third review, Charles W. Carter Jr. of the University of North Carolina at Chapel Hill describes how Urzymes can be used to find these evolutionary intermediates. The Urzyme of an enzyme is created by cutting away portions of the enzyme that are not conserved in all members of its superfamily. What remains is the part that provides the catalytic activity, the core of the enzyme. While the Urzyme has somewhat reduced catalytic activity, it has lost much of its specificity. Carter references studies that demonstrate that adding protein domains can confer specificity and that these domains influence specificity through their synergy, or epistasis, suggesting how specificity and function developed as enzymes evolved.

Enzymes in the same superfamily share a common partial reaction or chemical capability. However, the reactions that enzymes within the same superfamily catalyze can vary widely. In the fourth review, Shoshana D. Brown and Patricia C. Babbitt of the University of California, San Francisco, explore how this divergent evolution occurs. Variations in the active site and other features can generate diversity while conserving common traits. The specific variation differs by superfamily. In the two dinucleotide binding domains flavoprotein, or tDBDF, superfamily, the organization of cofactors within the active site are physically and chemically constrained to limit how they are used, while changing the protein-protein interactions allows different reactions to occur. In the nucleophilic attack, 6-bladed beta-propeller, or N6P superfamily, the active sites and the reactions catalyzed vary dramatically between the subgroups. However, all the subgroups initiate their reactions by the same strategy.

Many enzymes accept a number of substrates to catalyze a chemical reaction. In the final review, Debra Dunaway–Mariano of the University of New Mexico and Karen N. Allen and colleagues of Boston University discuss how a cell capitalizes on this promiscuity and how substrate ambiguity can occur. Substrate-ambiguous enzymes carry out other cellular functions, such as removing toxic metabolites and balancing metabolite pools. Substrate ambiguity can be promoted by varying the size of the active site and increasing the number of locations that can contribute binding energy through domain insertion.

Maggie Kuo (mkuo@asbmb.org) is an intern at ASBMB Today and a Ph.D. candidate in biomedical engineering at Johns Hopkins University.

Metalloproteins and their metals

JBC thematic minireview series on metals in biology continues

By Umesh D. Wankhade

Metal ions are essential for the function of more than one-third of all proteins. Many enzyme-aided processes, such as nutrient absorption and excretion, require certain metal ions at optimum concentrations both inside and outside of the cells. The **Journal of Biological Chemistry** recently published the sixth installment of an ongoing series about the role of metals in biochemistry and human health. This year's "Metals in Biology" series, coordinated by JBC Associate Editor F. Peter Guengerich of Vanderbilt University, features five review articles that describe metal homeostasis in terms of enzyme selectivity and affinity for certain metals and the consequences of the wrong metal attaching to an enzyme during a reaction known as mismetallation.

In the first minireview, a group of authors led by Nigel Robinson from Durham University in the U.K. discusses enzymes' metallation selectivity processes and the implications of metal deficiency. Under deficient conditions, enzymes compete for metal ions in buffered metal pools inside the cells. As an example, the authors discuss the competition between Zn^{2+} and Mg^{2+} and Fe^{2+} and Mn^{2+} in the context of metal-delivery systems in metal homeostasis.

In the second minireview, JoAnne Stubbe from the Massachusetts Institute of Technology and co-authors describe the competition between Fe^{2+} and Mn^{2+} for ribonucleotide reductase. They discuss how organisms use either one or both of these metals in this enzyme and how perturbed environmental and genetic conditions cause mismetallation.

In the third minireview, John Helmann from Cornell University reviews the key factors regulating Fe^{2+} and Mn^{2+} homeostasis in the model organism Bacillus subtilis. The Gram-positive bacterium provides a model for the regulation of Fe^{2+} and Mn^{2+} homeostasis that involves three regulatory proteins, Fur, MntR and PerR, to sense the intracellular levels of Fe^{2+} and Mn^{2+} and the ratio between them.

The fourth minireview, by James Imlay from University of Illinois at Urbana–Champaign, discusses how oxidative stress causes mismetallation. Using E. coli as an example, he explains how oxidation of Fe^{2+} by partially reduced O_2 species perturbs the competition between Fe^{2+}, Zn^{2+} and Mn^{2+}.

The fifth minireview, by Crysten Blaby–Haas at the University of California, Los Angeles, delves into the role of metal transporters in storage organelles for loading and unloading the metal. Along with animal systems, yeast- and plant-based models have contributed to our understanding of vacuoles and related organelles as mediators of metal homeostasis.

Umesh D. Wankhade (udvets@gmail.com) is a postdoctoral fellow at the National Institute of Health's diabetes, endocrinology and obesity branch.

In case you missed it

RACCA

We hope you enjoy this excerpt from a Journal of Biological Chemistry Paper of the Week author profile as much as we did.

"Although I have received previous awards for various poster and oral presentations at CWRU, I take particular pride in winning the department's legendary Stall–Pewis Award for excellence in the field of blooper biochemistry. My award-winning miscues in the laboratory have, therefore, become part of a legacy of bloopers shared by such late legends as professors Harland Wood and Richard Hanson. (Corresponding author Michael Weiss) and I dedicate this present recognition to their memory."

– **Joseph Racca**, a graduate student at Case Western Reserve University School of Medicine and the first author of the JBC Paper of the Week titled "Structure-function relationships in human testis-determining factor SRY: An aromatic buttress underlies the specific DNA-bending surface of an HMG box."

Investigating the link between noncoding RNAs and alcoholic liver disease

By Jen McGlaughon

Alcoholic liver disease is a term that describes a wide range of damage caused by the overconsumption of alcohol, including fatty liver, cirrhosis, hepatitis and increased risk of hepatocellular carcinoma. Due to the variety of factors that likely influence alcoholic liver disease (both genetic and environmental), it is difficult to define the precise mechanisms by which alcohol induces liver damage.

Recent studies have implicated microRNAs (called miRNAs for short) in the regulation of hepatic cell proliferation and survival during alcoholic liver injury via their ability to switch off specific target genes. Authors of a recent article in the **Journal of Biological Chemistry** investigated the precise mechanisms by which miRNAs contribute to cellular responses in alcoholic liver disease.

Heather Francis, Gianfranco Alpini and Fanyin Meng of the Central Texas Veterans Health Care System and collaborators in China began by identifying the miRNAs that were differentially overexpressed in livers from mice that were fed ethanol compared with controls. They found that 0.8 percent of known miRNAs in the mouse liver were upregulated in the ethanol-fed group. Of those, the most upreglated miRNA was miR-21.

Upon in vitro overexpression of

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miR-21, cell survival was increased in three different cell types from human liver, indicating a possible role for miR-21 in regulating the survival of hepatic cells in alcoholic liver disease. Indeed, the authors found that miR-21, which they determined is regulated by IL-6/Stat3 signaling, regulates cell survival by targeting two well-characterized genes involved in the apoptotic pathway, FASLG and DR5.

Although IL-6/Stat3 signaling has been implicated previously in alcoholic liver disease, this is the first known linkage to alcohol-dependent miRNA expression. The identification of other noncoding RNAs and their targets involved in alcoholic liver disease may provide key insights into the development of improved diagnosis and novel therapeutic approaches for treating patients.

Jen McGlaughon (jla254@cornell.edu) is a graduate student in the molecular biology and genetics department at Cornell University.

Niacin and triglycerides

By Mary L. Chang

Vitamin B_3, also known as niacin, is used alone and with other medications to decrease blood triglyceride levels and prevent the progression of atherosclerosis. However, the mechanisms by which niacin affects these lipid levels is not yet fully understood. A study in the December issue of the **Journal of Lipid Research** presents important findings about the activity of a common niacin receptor.

The intramembranous G-protein–coupled receptor GPR109A/HCA2 readily binds niacin and mediates many of its effects. The receptor is expressed predominantly in adipose tissue and immune cells such as macrophages, specialized white blood cells that engulf and digest foreign particles. Previous research has shown niacin treatment does not affect lipid levels in mice lacking this receptor. It also has shown that triglyceride accumulation occurs when the normal innate immune response activates macrophages.

In the JLR study, a research team led by Kenneth R. Feingold at the University of California, San Francisco, treated mouse cells with lipopolysaccharide, a component of Gram-negative bacteria's outer membranes. The treatment activated macrophages, which increased expression of the receptor.

The researchers then targeted the receptor with small interfering RNA, or siRNAs. That decreased the receptor's expression. Also, they saw a small but statistically significant increase in triglyceride accumulation in macrophages in cells with targeted siRNA.

Feingold, a JLR associate editor, explains: "If one inhibits the increase in GPR109A/HCA2 that is induced by inflammation, the ability of the macrophages to accumulate lipid is increased. This indicates that the increase in GPR109A/HCA2 is playing a role in preventing or decreasing the increase in lipids in macrophages that would typically occur with immune activation."

The finding that increased expression and activation of this receptor with niacin or other ligands can inhibit feedback is novel and may inform researchers studying diabetes and atherosclerosis, common diseases with roots in inflammation.

Mary L. Chang (mchang@asbmb.org) is publications manager for ASBMB.

ASBMB journal articles optimized for the Web

The American Society for Biochemistry and Molecular Biology is piloting a new article-reading tool on its three journal websites. Called Lens, the tool allows a website visitor to view figures, legends, references and other parts of an article alongside the text and with backward and forward linking.

ASBMB is one of six publishers on the Highwire platform that are piloting Lens, an open-source tool introduced originally by the journal eLife. Visit the online versions of the Journal of Biological Chemistry (www.jbc.org), Journal of Lipid Research (www.jlr.org) and Molecular & Cellular Proteomics (www.mcponline.org) to test it out.

Money, sex and cell tracking

By Samarpita Sengupta

BRAIN awards

A wearable scanner to image the human brain in motion. Lasers to guide nerve-cell firing. Radio waves to stimulate brain circuits. DNA barcodes to identify complex circuits. No, these are not items from the latest sci-fi thriller! They are among the 58 projects funded by the National Institutes of Health as part of the Brain Research through Advancing Innovative Neurotechnologies, or BRAIN, initiative. In 2013, President Obama launched the BRAIN initiative to bridge the gap between the technologies available for neuroscience research and the areas of research most consequential to our understanding of this organ. In late September, the NIH announced the issuance of $46 million in grants, the first wave of funding, to more than 100 researchers all over the U.S. and abroad. These awards are the first round of awards in a 12-year plan aimed at developing tools and technologies that will help dissect and demystify complex neural circuits with the hope that understanding how the brain works will help decipher therapies to treat a wide variety of neurological disorders.

The X factor

Have you ever looked at a plate of cells and wondered whether they had two X chromosomes or one? Would a male cell respond differently to your experiment than a female cell? In a commentary in the journal Nature over the summer, Janine Austin Clayton, the NIH associate director for women's health research, and NIH Director Francis S. Collins wrote that there is a paucity of experiments designed to analyze the effects of sex. There are known effects of sex on several disease states, such as multiple sclerosis, Parkinson's and schizophrenia. Also, for example, stress affects males and females differently, and males are more prone to substance abuse. However, more often than not, these differences are neglected in basic science research. To help bridge the gap, the NIH announced supplemental funding of $10.1 million that will go toward building a "body of sex-based knowledge, informing the understanding of health." "By making strategic investments that incorporate sex into existing funded studies, we are paving the way for researchers to better understand when sex matters in their research," said James M. Anderson, director of the Division of Program Coordination, Planning and Strategic Initiatives, which oversees the NIH Common Fund.

May the best stalker win!

Calling all wannabe cell stalkers! The NIH has a challenge for you: The NIH Single-Cell Analysis Program, or SCAP, is calling for innovators to look at a single cell in a mixed population of cells and develop novel tools and techniques to analyze and track a single cell in situ over time. Cellular heterogeneity, now widely accepted, can affect the function of an entire population of cells. Methods to identify dynamic changes in the cell can derive information about the health of the cell and the population, allowing researchers to develop diagnostic and therapeutic modalities to treat human diseases. The Follow the Cell challenge is a two-phase competition. In phase I, contestants submit theoretical solutions. Entries are due by Dec. 15. After doing an initial round of screening, a three-judge panel will review the submissions and award up to six prizes totaling $100,000 by March 16. Phase II will involve real data showing proof of principle from the phase I entries. These are due by March 30, 2017, and up to two winning solutions will win prizes totaling $400,000. The phase II winners will be announced July 31, 2017. Happy stalking!

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Upcoming ASBMB events and deadlines

JANUARY

Jan. 21: 2015 ASBMB annual meeting late-breaking abstract deadline

FEBRUARY

Feb. 2: 2015 ASBMB annual meeting discounted registration deadline

Feb. 6: Accreditation webinar

Feb. 23: 2015 ASBMB annual meeting housing deadline

IMAGE COURTESY OF JAMES DI LORETO, SMITHSONIAN

Going global with genomics

Researchers at the Smithsonian National Museum of Natural History want to advance the genomics of as many life forms on earth as possible. But first they need to figure out the small details that will make or break the effort

By Rajendrani Mukhopadhyay

A taxidermied elephant greeted visitors with a raised trunk at the main entrance of the Smithsonian National Museum of Natural History in Washington, D.C. It was a Monday morning on a regular workweek, but there was a busy hum of visitors clicking photos and getting their bearings. Up on the third floor, where the sounds of traipsing visitors dissipated, Jonathan Coddington, the museum's associate director of science, laid out his grand vision for the museum's Global Genome Initiative, which aims to accelerate genomic study of up to 50 percent of eukaryotic life forms on Earth.

"As a museum, we're doing collection-based research," he told me as we got comfortable at a pine-colored table in his office. Coddington, who looked like a college professor in his black blazer, khakis and glasses, said that in the 21st century, that means the research has to embrace genomics in addition to the classical physical morphology work that has dominated natural history studies for centuries.

The Global Genome Initiative did not adopt the word "global" hastily. There are somewhere between 160,000 and 200,000 genera on Earth (all living things are ranked into categories, from family to genus to species). "We want to collect genome-quality tissues of half the genera of life on Earth," said Coddington, adding that the collection will be made available to researchers.

IMAGE COURTESY OF THE SMITHSONIAN INSTITUTION
Smithsonian Rotunda

The biorepository will hold 5 million tissue samples. By the end of 2015, museum researchers hope to have genome-quality tissues from 500 families.

For the grand plans to become achievements, the scientists involved first have to figure out some details that sound rather mundane but are essential for the success of the endeavor. For example: Which tubes

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are the best for collecting the tissue samples that will provide the DNA for sequencing?

Tubes and other troubles

Coddington flicked through an assortment of screw-cap, 2-milliliter tubes in a woven basket on the table. He pulled out an inch-long white tube. This tube, he said, is the current candidate for tissue collection. But the problem with the tube – the problem, in fact, with all of the tubes in the basket – is that "none of them is warranted by the manufacturers for liquid phase nitrogen," he said.

"We spent almost as much time preparing labels as we did preparing birds."

– CARLA DOVE

Freezing samples in liquid nitrogen is the gold standard for tissue preservation in the field. But the caps pop off 2 percent of the tubes selected by the Smithsonian researchers when they are dropped into liquid nitrogen Dewar flasks in the field. When setting up a biorepository of 5 million tissue samples, we're talking about 100,000 lost caps.

And that's only one of the problems. Another is actually getting a hold of liquid nitrogen. On a recent trip to Costa Rica, Coddington said, he found only one town that sold the stuff. Another museum scientist, Carla Dove, had worse luck in the Republic of Djibouti this summer. There was no liquid nitrogen to be found in the entire country. "When you start thinking about industrial-scale biodiversity genomics, all the problems that attend to you in the field ramp up," noted Coddington.

So the 80 or so scientists at the museum who are doing the genomic analyses have to think about how to preserve tissue during field collections without liquid nitrogen. The method has to be cheap and easy. They have to make sure whatever preservative is used doesn't degrade the DNA to the point that it can't be used for genomic analysis.

During her trip to Djibouti, Dove, a petite woman with a bright smile, saved her samples in ethanol, dimethyl sulfoxide and sodium dodecyl sulfate.

But what constitutes genomic-quality DNA from samples subjected to the trials and tribulations of travel? Coddington said that with the sequencing instruments they have now, such as the ones made by Pacific Biosciences and Life Technologies, their working definition of "genome-quality DNA" is having 50 percent of the DNA at lengths of 9 kilobases or larger.

Then there is the headache of keeping track of boxes of 2-milliliter tubes with various tissue samples during collection and analysis.

As head of the Feather Identification Lab at the museum, Dove made the trip to Djibouti at the behest of the U.S. Navy. She was to inventory the biological diversity on Camp Lemonnier, which is being expanded. Dove's interest lies in obtaining bird DNA sequences to help identify those involved in midair collisions with aircraft.

While there, Dove and her team collected samples from 430 vertebrates, including a series of birds. Dove did specimen preparation on dead birds, as is her normal routine, but she also collected tissues from the birds for the genome initiative and popped them into the tubes with the different preservatives. She discovered that just making all the sticky labels for the tubes and making sure they were cross-referenced back to the correct birds was labor intensive. "We spent almost as much time preparing labels as we did preparing birds," she said.

But it looks like the scientists are getting closer to coming up with tissue-collection protocols that will work on the global scale. On the first floor of the museum, molecular biologists in the glistening white Laboratory of Analytic Biology, which many visitors don't even realize exists within the museum, were busy analyzing the quality of the DNA in the tissue samples Dove brought back from Djibouti.

From the white bands on an agarose gel under ultraviolet light, it was obvious that all the samples in the different preservatives gave good-quality DNA. The news thrilled Dove, who was desperate to know how the tissues fared. "We don't have to carry those heavy nitrogen tanks all the time!" she exclaimed. But her excitement was squelched by LAB biologists, who prefer to work with the gold standard of frozen tissues.

Ramping up

While looking at one of the gels, Coddington emphasized how important it was for the Smithsonian scientists to work out the kinks in sample collection and analysis. As the scale of the Global Genome Initiative expands, the museum scientists don't intend to get bogged down with analyzing tissues from 100,000 different genera. They intend to farm out much of the sequencing. "We're not going to turn into the Broad Institute and spend all our time sequencing," said Coddington. Because the tissue collection and sequencing will happen all over the world, Coddington and his team want to be certain that they arm their collaborators with sample collection and analysis protocols that are rock-solidly reliable and easy to do.

Coddington, a spider expert himself, has great hopes for the biodiversity collection. Only about 1,000 eukaryotic genomes have been

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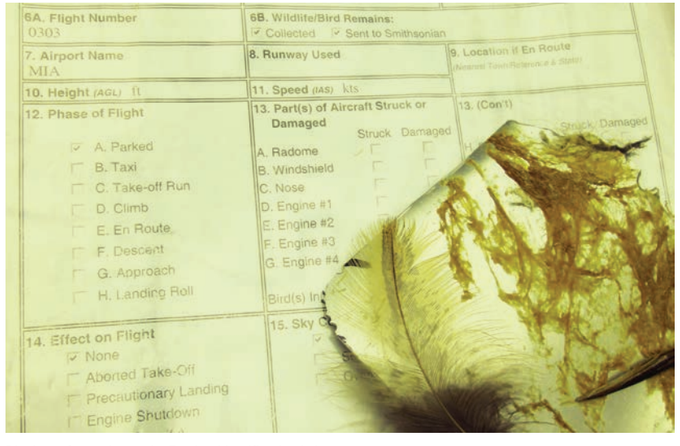

Displays of samples at the Feather Identification Lab. IMAGES COURTESY OF RAJENDRANI MUKHOPADHYAY

Laboratories of Analytical Biology

IMAGE COURTESY OF DONALD E. HURLBERT, JAMES DI LORETO AND BRITTANY M. HANCE, SMITHSONIAN

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sequenced to date, and Coddington pointed out that scientists haven't paid close attention to phenotypes. Take the cow genome, he said. The DNA came from "a bull named Dominico. Nobody seems to know what happened to Dominico. In most cases, there is no actual physical voucher for the phenotype," he said.

"But something, somewhere on Earth, is breaking those rules, and you wonder why."

– JONATHAN CODDINGTON

Coddington explained that because Dominico's sperm was used for sequencing, genomics researchers did not record what Dominico even looked like. Was he a brown bull or a black bull? But that's where he says natural history museums like the Smithsonian come to the rescue – because they excel at cataloging the morphologies. As Coddington noted, "We're all about phenotypes."

The project isn't simply about creating a catalog of genomes. The collection will become an essential tool to understand biodiversity. "It will enable higher-quality, finer-grain, more reliable environmental monitoring in important ecosystems," said Coddington. "It will be important for climate change." He also talked about the great likelihood of commercially important natural products emerging from the project as scientists discover new species in their quest to sequence them.

The initiative also will be a basic researcher's goldmine for understanding life itself. Coddington rattled off oddball facts: Sharks don't get cancer; there is a jellyfish that is immortal; and there is a marine worm that can regenerate an entire organ from a tiny cube of tissue. "For humans and similar organisms, there are absolutely ironclad rules of biology," Coddington mused. "But something, somewhere on Earth, is breaking those rules, and you wonder why."

For now, he and his team need to figure out how best to get tissues from about 100,000 genera, evaluate the DNA in each, and make the data available for scientists of today and tomorrow. "We're in the forever business," said Coddington. "Some of our collections are 200 years old. When we say we're going to keep something, we mean it."

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DEFYING STEREOTYPES:

‘Science and art mix so beautifully together’

As a partner and program director of Neuehouse, Michelle Grey gets to straddle the worlds of art and science

By Rajendrani Mukhopadhyay and Geoffrey Hunt

Just a block away from Madison Square Park in Manhattan sits a place called Neuehouse. Part office space, part gallery, part boutique hotel and restaurant, the venue describes itself as a “series of spaces, experiences and amenities especially suited to ambitious innovators.”

It’s the kind of place where a fashion designer will sit next to an architect at a work table and an inventor can hope to find business partners over coffee in the lounge. To boost the creative and entrepreneurial vibe of the place further, the monthly programming schedule features celebrities from across the cultural and scientific spectrum.

How does science find a place in this milieu? Enter Michelle Grey, a business partner at Neuehouse who serves as director of programming.

“With a science background, science is a huge love of mine,” says Grey. At Neuehouse, Grey aims to develop initiatives that bring together science with the arts into one synergistic experience for the Neuehouse patrons. “The arts can be an inspiration for scientists, and scientists can be (the) inspiration for many things that are happening in the arts,” she says. “I’m really excited to introduce science to the creative set and to see where they can meet creatively.”

Creativity is Grey’s major passion, something that she has channeled into all of her disparate endeavors through the years, from science to fashion to media. It hasn’t always been easy. Although she earned an undergraduate degree in genetics with an honors year in immunology and microbiology, Grey knew she didn’t want to be a researcher. Both her sisters are scientists, and she knew from their experiences that a life at the bench wasn’t her cup of tea. Instead, she says was more intrigued by the art and craft of telling stories about science “in a fun and entertaining way to the general public.”

That interest first led her to journalism. She became a writer and presenter for a now-defunct TV show in England called “Einstein TV.” She then moved back to her native Australia and contributed science pieces to radio programs, TV shows and lifestyle magazines before launching Yen, a magazine that carried “heavy-hitting articles on science, world politics and socioeconomics but also had a heavy fashion proposition.” As Grey says, “Smart girls like fashion too.”

In undertaking these different ventures, Grey had to overcome stereotypes of what is expected of those in different professions, especially for women in science. Science “felt very elitist when I was studying,” laments Grey, who also modeled at one point. “People don’t take you as seriously if you don’t fit that stereotype.”

Though Grey was more comfortable in the worlds of arts and fashion, her curiosity about science didn’t diminish. She says she strives to balance her interests in both domains. For much of her career, it’s been a struggle, Grey admits, “of where can I express my creativity, be heavily involved in the artistic and creative community but also have a cursory understanding and knowledge of the sciences.”

That’s what makes her current role so exciting. At Neuehouse, Grey seems to have hit the perfect balance between the two worlds of science and art, getting a particular thrill out of bringing them together in interesting ways.

Take, for example, a recent event that featured a discussion between physicist Brian Greene and Ellie Mannette, the inventor of the steel drum, about the physics of sound waves. Or Speed Science, a collaboration with the Science and Entertainment Exchange in which “seven scientists in seven different conference rooms talked for seven minutes about the most exciting part of their research,” according to Grey. The seven scientists later regrouped in one of Neuehouse’s amphitheaters for a roundtable discussion moderated by filmmaker Scott Burns, who has directed “Contagion,” “The Bourne Ultimatum” and “Side-Effects.” “That was a really amazing combination, having together scientists and a filmmaker,” says Grey.

From her vantage point, Grey sees what can happen when scientists and artists emerge from their silos and begin to collaborate. Indeed, she finds that there is a common thread that ties together scientists and artists. “The main character trait is always a huge curiosity of life and a passion for what they are doing,” explains Grey. “I think the crux of any successful person in science or in the arts is a real curiosity.”

IMAGE COURTESY OF MANOLO CAMPION

Passion for communicating science has taken Michelle Grey from the lab to programming director at the Neuehouse creative work space.


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DEFYING STEREOTYPES:

Put a smile around your neck

Raven Hanna makes molecular jewelry, bringing out the art in science

By Geoffrey Hunt and Rajendrani Mukhopadhyay

For Raven Hanna, the motivation to launch a science-themed jewelry company came from a dark place.

While coping with an "emotionally exhausting" relationship breakup, Hanna, a molecular biophysicist by training, was browsing sleepily through a book on neurotransmitters, trying to understand the science behind her emotional state. She stumbled upon a passage on serotonin. Hanna, who describes the molecule as being "symbolic of happiness," had an epiphany: This molecule "would make a pretty necklace," she recalls thinking.

When an Internet search for such an item came up empty, Hanna took matters into her own hands, enlisting a local jeweler to make a silver sterling pendant in the shape of serotonin.

Inspired by that experience, in the mid-2000s, Hanna launched her one-woman science-themed jewelry company, Made With Molecules. Blending her scientific background with her natural creativity, Hanna produces pieces for people who, like her during that painful period, are looking for physical representations of their feelings. "People see their molecules as a personal symbol," she says.

Strangely enough, jewelry never appealed to Hanna growing up. "I have not had a huge interest in jewelry until I started this," she says. Instead, she was a dedicated scientist, first getting her Ph.D. from Yale University in 2000 and then completing a postdoctoral stint at the University of California, Berkeley. But she was getting restless in the lab. "It was around the end of my postdoc that I was thinking more about how to communicate science to people who don't realize that science is really cool," says Hanna, who decided to act on her newfound interest by enrolling in a science writing program at the University of California, Santa Cruz.

Hanna still wasn't sure about where her passions would take her career until she was approached in a Gap store by a teenager who inquired about her serotonin necklace. "I suddenly found myself giving a science lesson," she says. That interaction crystallized for Hanna the realization that "I really wanted to communicate science through art."

Hanna chooses her designs carefully, focusing on molecules that could be "really interesting and also could be pretty as jewelry," she explains. Examples include a neurotransmitter bracelet, a chlorophyll/heme necklace that incorporates semiprecious stones and nucleotide earrings. Ever the scientist, Hanna includes a small card with each of the 5,000 pieces of jewelry that she produces annually to help explain the underlying chemistry and functionality of the molecule.

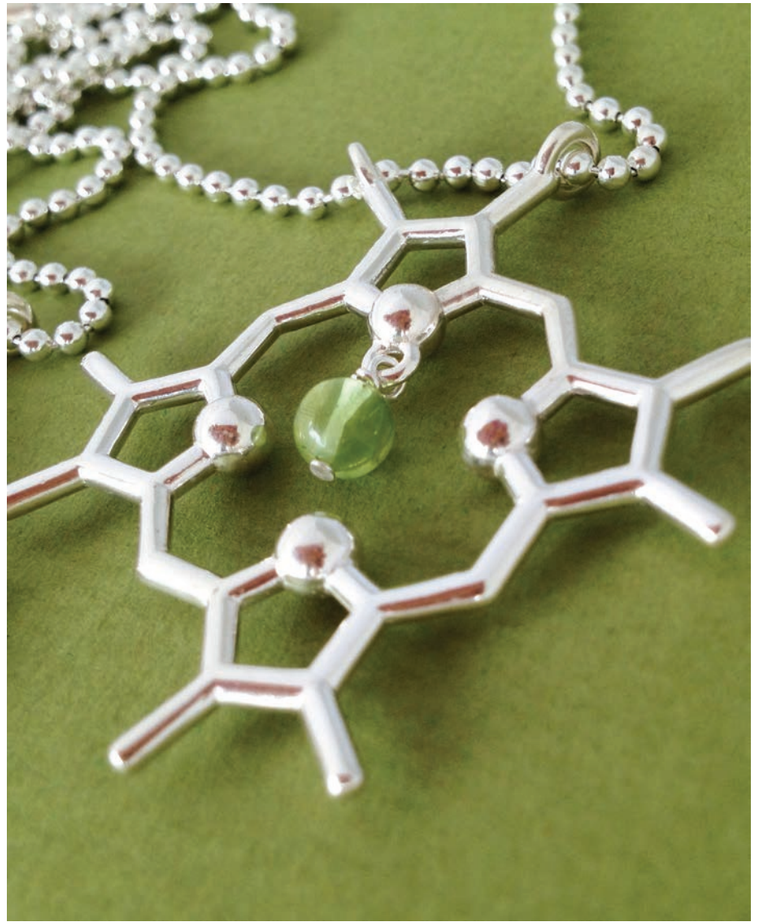
Artist Raven Hanna uses her chemistry background to inspire her jewelry creations, which are found at www.madewithmolecules.com.

Hanna says she makes sure that the pieces retain their scientific accuracy, admitting that she is constantly asking herself, "Have I watered down the science behind the jewelry too much?" Ensuring that her work appeals to both scientists and non-scientists is important to Hanna. "I really wanted my stuff to be aesthetic enough to appeal to people who aren't necessarily attracted to the very geeky science stuff," she says.

Of course, those who are attracted to the geeky science stuff make up a significant proportion of Hanna's customer base. Her first major showing at an American Chemical Society meeting was an enormous hit. "It was so amazing to me that people really love the stuff they work on, to the point where it's not work. Their chemical is a member of the family," she says. After that meeting, Hanna was inundated with requests from scientists asking her to make "whatever their favorite molecule was."

The most challenging part of being a professional jeweler, she says, has been adjusting to the business side of things, such as having to learn how to file taxes as a business owner. The creative aspect of her business, however, comes naturally. "I have to say that a lot of skills that I use doing this are things that I've enjoyed doing my whole life," she says. "When I was doing science, I felt there was a huge value on creativity that was respected and honored." Hanna says a "love of experimentation and the willingness to observe results in an objective way" are, in her view, critical aspects of both artistry and science.

As for jettisoning her life at the bench in favor of one in the studio, Hanna admits having certain regrets. "I miss growing bacteria so much," she says with a laugh. However, the repetitive nature of scientific experimentation and validation was not for her. "At that point, it's not fun anymore," she says. "It's work."



IMAGES COURTESY OF RAVEN HANNA

One of Hanna's pieces is a chlorophyll necklace.

While Hanna is comfortable with her choice, she occasionally runs into people who wonder, "What does my mother think about how I'm not doing science anymore?" she says.

Thankfully, Hanna, who is now living in Hawaii, knows that her current career is making an impact. She says her customers are "looking for symbols in their life and none of the traditional symbols really appeal to them." It therefore shouldn't be surprising that they would turn to a nontraditionalist like Hanna to help them express themselves. That serotonin necklace around her neck is now more appropriate than ever.

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Using active-learning approaches in a lecture hall

By Elizabeth Sandquist

Active learning has emerged as an effective pedagogy in the science, technology, engineering and math disciplines. Active-learning approaches engage students through activities or discussions rather than having them listen passively in a lecture environment. In an active-learning classroom, students learn critical thinking, teamwork and problem-solving skills.

Recently, a meta-analysis of 225 studies showed that active-learning approaches improved student performance on exams or concept inventories and reduced failure rates compared with traditional lectures (1). Furthermore, active-learning interventions are especially effective for black and first-generation students (2). In the widely promoted 2009 American Association for the Advancement of Science report "Vision and Change In Undergraduate Education: A Call to Action" (3), in numerous reports by the National Research Council (4), and in the American Society for Biochemistry and Molecular Biology report to the Teagle Foundation (5), active-learning approaches are recommended in the STEM disciplines.

As a teacher, you may be interested in using active-learning approaches in your classroom but find yourself trapped in a lecture bowl. These rooms are designed for traditional lecture and are not conducive to discussions among students or interactions between students and teachers. Some universities have alternative classrooms featuring group seating

and extensive technology to facilitate discussion, but not every teacher is so lucky as to have access to those. Many academic institutions do not have alternative classrooms, and resistance to active-learning approaches can be strong in some departments. Additionally, you may not feel ready to overhaul your course and may want to test out just a few techniques. Here are some strategies you can use to engage students without the need for alternative classroom space or extensive technology.

Think, pair and share

In this activity, each student completes a short assignment based on the day's lecture. Upon completion, students trade assignments with those seated next to them and comment on each other's work. The assignments are then returned to the students, who are allowed time to review the suggestions. The teacher then may call on a few pairs of students to summarize their findings.

This activity provides instant feedback for students at any point during class, allowing them to evaluate their own learning. In addition, students improve their communication skills and get a different perspective on the topic at hand. The final discussion by the instructor clarifies any misconceptions and summarizes the major points to be learned.

Simple quiz

In this quiz, the instructor asks a yes/no question to the class. All students respond with thumbs up or thumbs down, and a discussion of the correct answer led by the teacher follows. This quiz can be enhanced by the use of clickers, allowing for more complex questions. It can be used at the start of class to assess previous knowledge or throughout to monitor student comprehension.

This paperless quiz allows the instructor to determine the class's mastery of a topic in a single glance. It also avoids the stress many students feel when speaking in front of a large class. This instant feedback allows instructors to accommodate the intellectual needs of students, correct misunderstandings and reinforce concepts in real time. Students benefit from the simple quiz as gaps in their understanding are revealed, indicating where to focus their studies.

Quick paper

The instructor asks participants to take two to three minutes during class to write about a topic or a question the teacher has asked. The prompt may be used at the start of class to focus students' thoughts on the content of the day or later on to reinforce important concepts.

This activity also may be used to encourage student reflection on past and current knowledge, encouraging a transition to higher levels of learning. Instructors also may use the exercise to solidify student understanding of difficult or critical concepts or to bring class to a close, summarizing major points.

Case studies

The teacher gives pairs of students a scenario that applies concepts discussed in the lecture. Question design encourages students to make connections between the information learned and the provided situation. Student pairs may be called upon to share their work with the class or a nearby group. This flexible activity can be short, with only a few questions, or extended for a full session.

By applying their knowledge to a new situation, students achieve higher-ordered learning. In addition, group work challenges students to improve their teamwork and communication skills.

Note check

In this activity, a student shares his or her lecture notes with a partner or small group. This activity may be used to summarize the end of a lecture and confirm student comprehension of a lesson. Students also may use each other's notes to create or answer problems.

The note-check technique is a rapid way to ensure students have caught the main points of the lecture. Additionally, it encourages students to look at the concepts from a different perspective. By answering or generating questions together, they transition to higher-level learning.

Doing problems together

Many students benefit from working out problems with the instructor. The teacher leads the class through a problem but stops for student participation now and then rather than completing the whole problem on his or her own.

This technique allows students to see a problem completed step by step and promotes student engagement by requiring participation to solve the problem.

Undergraduate teaching assistants

Teaching assistants can be of great help when implementing active-learning techniques. Especially in large classes, teaching assistants can monitor students during group activities and create more one-on-one interactions. Undergrads who have completed the course already can provide useful suggestions to their peers on strategies for success in the class as well as testing out potential class activities.

By implementing these strategies, among others (6, 7), teachers can promote active learning in a traditional lecture setting. Techniques that use small-group work, reflection and peer critique enhance student engagement in a class that otherwise promotes passive learning.

The use of active-learning techniques, even in small amounts, has been proved to improve student performance in the STEM disciplines. Though you may be trapped in a lecture bowl, with these simple strategies, you can escape and create a class of engaged learners.

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Like water in a desert

By Andrew D. Hollenbach and Kristen L. Eckstrand

Despite recent legal and societal advances, patients who identify as lesbian, gay, bisexual and transgender still face significant disparities in health care. Individuals who are born with differences of sex development, those who are transgender and gender-nonconforming individuals often face even greater difficulties obtaining compassionate, patient-centered care. Reducing the health disparities affecting these communities requires an interdisciplinary approach, beginning with ensuring a competent, sensitive and welcoming health-care workforce.

For the past two years, we had the honor and privilege of serving on a committee dedicated to improving the education of the next generation of physicians in caring for patients who may be LGBT, gender nonconforming or born with DSD: the Association of American Medical Colleges Advisory Committee on Sexual Orientation, Gender Identity and Sex Development (1). Our initial charge was to develop learning competencies for medical educators and institutions to guide the advancement of medical curricula to provide high-quality, patient-centered care for these populations. However, we quickly realized that learning competencies alone are insufficient to produce the desired change in medical curricula. Medical institutions need to ensure the effectiveness of curricula and promote a climate that supports, values and includes people who are LGBT, gender nonconforming and/or born with DSD at all levels.

On Nov. 11, the committee released the culmination of these efforts in the publication "Instituting Curricular and Institutional Climate Changes to Improve Health Care for Individuals Who Are LGBT, Gender Nonconforming, or Born with DSD: A Resource for Medical Educators" (www.aamc.org/publications). This book has three goals:

1) to help educate the reader about people who may be LGBT, gender nonconforming or born with DSD and how academic medicine can support these populations;

2) to instruct medical schools on the importance of evaluating their cultural climates and on how to implement curricular changes as they relate to people within these populations; and

3) to provide a framework to facilitate and assess the effectiveness of new curricula.

This book achieves these goals by detailing the history of disparities faced by these populations, by providing the learning competencies that all medical students should achieve, and by explaining how to integrate and evaluate the effectiveness of the curriculum. The publication also discusses how to assess institutional climate to identify the barriers to curricular reform and the role of trauma and resiliency in the health of these individuals. To highlight national leaders, the book lists institutions that are implementing these curricula into their educational programs.

At this point, you, as a reader of ASBMB Today, are probably asking yourself, "If this book targets health-care professionals, how does this relate to me, a basic scientist?" If this is your question, we instead suggest asking, "How can a basic scientist support this work?" The answers are numerous. If you work in a medical institution, then part of your job is to teach medical students and to develop curricula. The book targets a wide audience including teaching faculty and basic scientists.

Also, chances are someone you know is LGBT, gender nonconforming or born with a DSD — although you may not know that about him or her. On any team, team members play a valuable role in ensuring the well-being of their peers. Whether it is supporting inclusive nondiscrimination policies, demanding inclusive health-care benefits or even inquiring about what you can do to make a colleague feel more welcome, your actions can help create a supportive climate.

Regardless of where you are employed or your role, you can be that agent of change.

Change can be frustratingly slow, but any level of change is important. Remember that it has taken centuries for marriage equality to become a reality, yet this one change has impacted millions. Smaller changes frequently become the impetus for larger changes, and the actions of a person at one institution may spark someone else to initiate a similar process at another institution, thereby leading to true, sustainable health-system change.

The book is the first and only comprehensive, evidence-based curriculum and institutional climate guide from an academic health association to address the health disparities of these unique populations. For the many individuals who have advocated for such change with few resources and for those individuals who have been marginalized and ignored for so long, the publication fills a striking need, much like water in a desert.

We hope that the publication will initiate much-needed change across the health-care professions. With dedication and perseverance by all people involved in health-care education, including basic scientists, our work can grow and truly transform medical education and improve health-care delivery and outcomes for any population facing health-care disparities as a result of implicit or explicit prejudice.

What you'll find inside the book

1. History – laying the foundation for inclusion and equality:
- Historically, people who are LGBT, gender nonconforming and/or born with DSD face discrimination.
- Discrimination leads to challenges when these populations interact with the health-care system, which translates into significant health disparities.

2. The role of medical education in eliminating these disparities:
- Increase awareness and knowledge of health disparities and risks for patients in these populations.
- Train students to provide high-quality, patient-centered care.
- Inspire students to be advocates for change.
- Promote resilience in and foster positive health outcomes for patients in these populations.

3. A detailed list of competency objectives to improve health care for patients in these populations

4. How to integrate competencies into medical school curricula:
- Encourage trainees, faculty members or administrators to serve as champions for change.
- Identify barriers and implement strategies to incorporate change.
- Integrate competencies across all years of education and learning modalities.

5. Clinical scenarios relating to these populations with discussion points for experiential learning

6. Assess and evaluate the curricular initiatives:
- Assess the learners to evaluate the effectiveness of the curricular changes.
- Evaluate the effects of curricular changes on institutional environment.

Andrew D. Hollenbach is an associate professor in the genetics department at the Louisiana State University Health Sciences Center. He is a member of the Association of American Medical Colleges' Sexual Orientation, Gender Identity and Sexual Development Patient Care Advisory Panel and the lead editor of the recent publication. Kristen L. Eckstrand is an M.D. candidate at Vanderbilt University, chair of the Association of American Medical Colleges' Sexual Orientation, Gender Identity and Sexual Development Patient Care Advisory Panel and co-editor of the recent publication. She is vice president of the Gay and Lesbian Medical Association: Health Professionals Advancing LGBT Equality and a member of the American Medical Association Advisory Committee on Lesbian, Gay, Bisexual and Transgender Issues.

REFERENCE

1. https://www.aamc.org/initiatives/diversity/portfolios/330894/lgbt-patientcare-project.html

Science to a beat

Sparking interest with wows and hip-hop moves

By Maggie Kuo

The Dancing Scientist is decked out like a rock star in a bejeweled lab coat and Bono-like lab glasses. He is on the set of ABC's TV show "The View," standing by glass containers of purple cabbage juice. The show's host pours lemon juice into the first container. The Dancing Scientist stirs the mixture, and the deep purple color of the cabbage juice fades to a brilliant pink. The studio audience "aahs" in surprise. "So this is an acid-base indicator," he explains. "It's telling us that the lemon juice is acidic." At the end of the segment, the Dancing Scientist remarks, "Red cabbage juice has some amazing effects." As he takes a sip of the liquid, techno music begins playing, and he slides into a slick hip-hop dance routine. The audience goes wild.

The Dancing Scientist is a science-outreach persona who dazzles his audience with classic chemistry and physics demonstrations while explaining the science behind them. While he can be seen on TV shows like "The View" and "The Today Show," he does mostly school programs, performing for students from kindergarten to high school. He sets the demonstrations to upbeat music, makes them interactive and performs some while dancing to engage and inspire kids to be enthusiastic about science.

In between shows, the Dancing Scientist is Jeffrey Vinokur, a Ph.D. student in biochemistry at the University of California, Los Angeles. Vinokur redesigns enzymes to produce biofuels and commodity chemicals. He solves the structures of enzymes using X-ray crystallography and figures out how to mutate them to make useful chemicals instead of the metabolites that they normally produce.

Coming together

Growing up, Vinokur was extremely enthusiastic about science. He built a lab for himself, equipped with goggles, gas mask, gloves and fans for ventilation. In his homemade lab, he did "really dangerous, stupid things," he recalls. For instance, he ran electricity from a car battery through molten sodium hydroxide, which he sourced from drain opener, to make sodium metal. "I was just that into science," he says. In high school, Vinokur did research at Rutgers University and Pennsylvania State University. He went to the University of Wisconsin-Madison for college and continued doing research there.

Vinokur's passion for lively demonstrations stems from the teachers he had along the way. He had a chemistry teacher in high school who did "every demonstration in the book," he says. As an undergraduate at the University of Wisconsin–Madison, he saw the demonstrations again performed by his chemistry professors and noticed that his classmates were amazed. Vinokur realized that if his fellow classmates had not witnessed the wonders of chemistry as he had before college, students with even less access certainly had not.

"Their experience with chemistry is big vocabulary words, abstract concepts and this dense textbook. That never got anybody into science. When you get into science, it's because you see all that amazing stuff — flash, bang, fizz — and then you go to the textbook interested in figuring out why. But you wouldn't care why if you've never seen the amazing stuff."

Jeffrey Vinokur performs his Dancing Scientist shows at elementary schools.

IMAGES COURTESY OF JEFFREY VINOKUR

IMAGE COURTESY OF LOU ROCCO/ABC

Jeffrey Vinokur shows how coffee creamer can catch on fire when puffed into the air over a flame with Whoopi Goldberg on ABC's "The View."

The idea to do the Dancing Scientist act came to Vinokur five years ago while he was an undergraduate. "We'll call it a case of convergent evolution," he says. Vinokur was part of an outreach group that went to libraries and elementary schools to do science-education activities. He was also an avid hip-hop dancer and posted videos of his routines on YouTube. His videos became so popular that they caught the attention of the producers of "America's Got Talent," and Vinokur was invited to audition for the show.

His audition with just the dancing did not take him far, but the next year, Vinokur went back to the producers and pitched an idea to combine dancing and science. The routine would be "crazy," he promised, and they would "never have seen anything like it." The producers were intrigued and invited him back to perform the act. Until that point, the Dancing Scientist was a vague idea, but now, with the producers' interest, Vinokur set out to make the Dancing Scientist real. He recruited the chemistry lecture demonstrator at his university and developed the science in the lab. He then took the demonstrations back to his dorm room and put them together with music to make them an act.

Leading a double life

Neither of his roles — Dancing Scientist or graduate researcher — are side activities. They are full-time commitments. When the Dancing Scientist is performing on TV, Vinokur works sunup to far past sundown for several days before and after the show. On a day when the Dancing Scientist has a school performance, Vinokur does the show in the morning and then returns to the lab in the early afternoon and works late into the evening. Vinokur averages two school shows a week and regularly appears on TV.

Jim Bowie, a professor of chemistry and biochemistry well-known for his work in protein crystallography and studying notoriously difficult membrane proteins, is Vinokur's adviser. Bowie sees Vinokur's zeal for outreach as a rare gift among scientists and is happy to support Vinokur's outreach efforts. He is impressed by Vinokur's success in handling the demands of both the Dancing Scientist and the graduate researcher.

"Jeff seems to have energy to burn and has an unusual ability to compartmentalize," Bowie says. "For example, he sent me a revised draft of his latest paper the night before he appeared on the 'Today Show!' If you think about all the logistics of organizing a wild science demonstration before millions of viewers, I think it would be hard for most of us to pull our attention away from it to focus on something else." Vinokur says that

CONTINUED ON PAGE 28

IMAGE COURTESY OF JEFFREY VINOKUR

Jeffrey Vinokur demonstrates the hydrophobic properties of water repellent with a white shoe and red wine with Kathie Lee Gifford and Hoda Kotb on NBC's "The Today Show."

CONTINUED FROM PAGE 27

Bowie's support and flexibility have allowed him to pursue both of his passions.

Vinokur's career in science is already promising. Only in his second year of graduate school, he has two publications and a third one on the way. He is a National Science Foundation fellow and a trainee in the University of California, Los Angeles, Chemistry–Biology Interface Training Program funded by the National Institutes of Health.

While Vinokur loves performing his shows for kids, his outreach is also a business that handsomely complements the stipend he receives as a graduate student. A 50-minute school show runs $995, and two shows back-to-back, which most schools book, go for $1,595. His TV segments pay less. For appearing on a one-hour national talk show, he receives $1,094, while news programs do not pay at all. Vinokur says he mainly does TV shows for publicity and to bring science to a larger audience. TV appearances drive school bookings and also train him for a career in hosting science TV shows, which he hopes to do after completing his Ph.D.

When graduation comes, Vinokur will be at a crossroads in his career. Does he pursue his passion for outreach, or does he pursue his passion for research? Ideally, he wants to do both. He cites Carl Sagan and Bill Nye as his models. Sagan was an astronomer who made significant contributions to planetary science but is known by the public for the 1980 TV series he narrated and co-wrote, "Cosmos." Nye was a mechanical engineer at Boeing before he became known as Bill Nye the Science Guy.

Vinokur dreams of having a dual career in which he is a professor running his own lab and teaching university classes while occasionally hosting TV shows that engage the public in science. A career like this would demand even more time than his commitments now, and he wonders if he can do both well.

But right now, being the Dancing Scientist in the morning and the graduate researcher in the afternoon is "such a great day," Vinokur says. "I went in and did science for 500 kids, potentially impacted their lives. Then I was back in the lab, doing my research. It's perfect."

Maggie Kuo (mkuo@asbmb.org) is an intern at ASBMB Today and a Ph.D. candidate in biomedical engineering at Johns Hopkins University.

The Dancing Scientist's tips for doing outreach for kids

Keep it simple. Most kids don't have dedicated science classes until around age 10. They are blown away by disappearing ink, instant snow (polyacrylamide) and pulling a tablecloth out from underneath plates. These are easy, cheap and highly portable. Leave the complicated chemistry for the research lab.

Focus on fun. It's more useful to spark curiosity and create a memorable experience than to focus on teaching vocabulary words and concepts. They have full-time teachers for that. Spark their interest so when they have science class they will be more interested. That is goal No. 1.

Maintain control with a quiet symbol. The kids undoubtedly will get very excited. To prevent chaos, teach them a simple clap sequence or a special hand symbol. It's corny but works like magic. When you make the symbol, they will get absolutely silent. Have them practice with you.

Join a group. That's how I got into it — with the student group at the University of Wisconsin. They already were going to libraries and things. They trained me one day — here's your script, here's what you do, here's how you don't get hurt. And you go the library and do the presentation.

Keep at it! No matter who you are, your first time is not going to be outstanding. Mine sure wasn't. You just learn it and improve. The key here is you're really making an impact; you really are making a difference. When these kids see this stuff, they're really impressed. You leave a mark on them.

How to write a teaching philosophy statement when you don't have a lot of classroom experience (or even if you do)

By Joseph Provost

Asking for a statement of teaching philosophy from candidates who haven't taught very much is kind of crazy, but the document is a standard requirement for an application package in academia. Having recently taken a new position and having written my second teaching statement after 16 years, I realize how difficult it is for someone to write his or her first teaching philosophy.

My first teaching statement, written when I was a postdoc, was clumsy and superficial, filled with declarative, unsupported statements. I wrote that I wanted to reach out to students without indicating how I would do that. I wrote about how I wanted to involve students as partners in learning but didn't seriously address a method or approach to do so. I should have shown that this is a vocation, and I should have communicated that I have a passion for teaching and need to share this with students.

During my career, I've read hundreds of teaching philosophy statements, and many of the applicants have made the same mistakes I did. While most scientists are trained to think about research and have honed their curricula vita and research statements to be inventive, inviting and impressive, most are not prepared to create an inspirational teaching philosophy.

Here are some tips for those of you writing your first teaching philosophy statements:

Identify a strong thread

Consider taking the same approach you would take with a research statement: Find an overarching theme. Think of the statement as a development plan and not a chronology of your time as a teaching assistant. What kind of professor do you want to be? Keep your statement student centered. A hiring committee will want a candidate who can articulate a distinctive vision that implies passion for teaching.

Be fairly specific

How will you engage students, create interesting and challenging courses, and maintain rigor in the classroom while maintaining student motivation? Writing about your need to push students is good and expected, but how will you do it? Will you assess your learning outcomes?

Include teaching laboratories

Look at the opportunities you will have to teach various labs. Can you find examples of other programs to emulate? There are many examples that use different pedagogies in the teaching laboratory that you can include in your statement. Imagine if you were to create a new lab on your own. Look at the literature to see what concepts and skills should be included in such a lab. Use these references to discuss how you might create, for example, a research- or inquiry-based biochemistry laboratory.

Emphasize your experience

A hiring committee will want to know about your experience, but don't make a laundry list of what you did as a teaching assistant. Use specific experiences to emphasize your successes and how you overcame challenges. You might think of a specific example of how you mentored a student or a positive moment as a TA. This will help demonstrate your motivation to teach. If your teaching experience is limited, focus on what you want to do, your observations of what works and how you want to emulate strong professors. Remember that most applicants have been teaching assistants, and don't linger on that experience.

Think like a scholar

This is particularly important for applications to primarily undergraduate institutions. What kinds of pedagogical approaches have you used or will you consider using in class? You may not have used POGIL (process-oriented guided inquiry learning) or know much about flipped classrooms or even have an idea about David Lopatto's assessment of learning gains by research, but you can certainly read about them and then write out your plan to use them. Explore the current literature. Would you ever consider creating an experiment or research proposal without reading critical literature? What would you think of someone who wrote about a research project that was based on what they experienced as a student or thought of off the top of their head? Such a research proposal would be considered nonsensical and not based on current scientific understanding and quickly ignored. The same can be said for a teaching statement that isn't informed by current literature and teaching approaches.

Most importantly, show your passion

The reason we teach is to mentor, help students realize their potential, help students grow and share our knowledge. Bring these elements to your document. Highlight that teaching is an important part of your career and that you are more than a promising researcher. Don't forget that teaching happens in the classroom, in the halls and your office, and, very important, in your research laboratory. I can't split my passion for teaching and research. In fact, they are often the very same thing. If you can communicate this in your teaching statement, you will be in good shape.

Know the learning outcomes

The American Society for Biochemistry and Molecular Biology and other organizations offer many resources you can use in your teaching philosophy statement. Don't be afraid to mention such organizations as part of your plans. These are the sorts of comments that show your understanding of teaching and indicate to the committee you are as serious about your teaching as you are about research and other aspects of your career.

- The ASBMB Undergraduate Affiliate Network has information on its website (www.asbmb.org/UAN) and its blog (substrate.asbmb.org/).
- The ASBMB accreditation program (www.asbmb.org/accreditation/) has the foundational principles of a biochemistry program and education.
- Other organizations, including the Council on Undergraduate Research, Project Kaleidoscope, and the American Association for the Advancement of Science, also offer information.

Read the literature

Here are three good journals that cover current teaching methods:

- Biochemistry and Molecular Biology Education
- Journal of Chemical Education
- Cell Biology Education—A Journal of Life Science Education

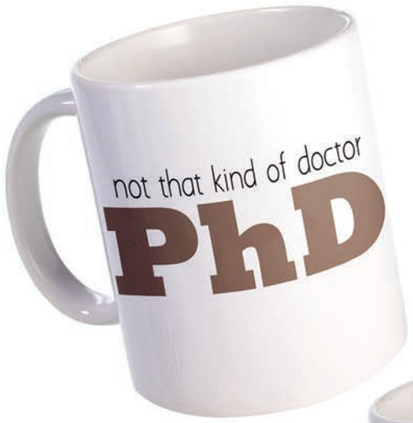
Fundamental elements of a strong teaching statement

- Keep the statement personal and a reflection of who you are.
- Show your interest in and passion for teaching.
- Keep your philosophy focused on students.
- Include your teaching history.
- Include how you would use a couple of techniques to engage students and perhaps even an example (such as POGIL to teach cooperativity, case-based learning to teach kinetics or a flipped classroom to approach a difficult topic).
- Use the education literature to talk about teaching effectiveness and take a scholarly approach to your teaching. Don't make a laundry list of pedagogies.
- Consider writing about building programs and majors.
- Assessment of teaching effectiveness and student learning are important and often overlooked concepts that will get attention.
- Think about learning objectives and outcomes.
- Teaching laboratories are important. Find examples (from your observations and reading of the literature) that you may want to emulate or develop.

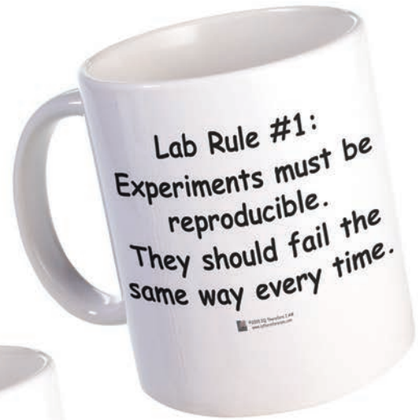
Joseph Provost (josephprovost@sandiego.edu) is a professor at the University of San Diego chemistry and biochemistry department and a member of the ASBMB Education and Professional Development Committee.

Mugs for scientists

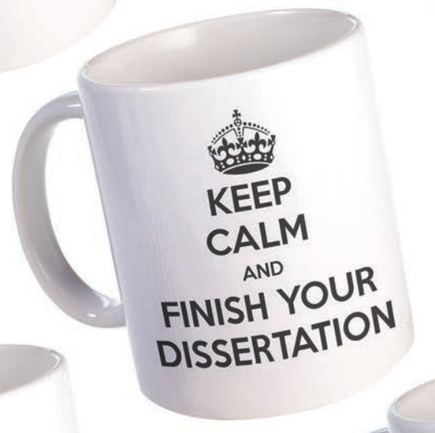
By Chris Pickett, Maggie Kuo & Rajendrani Mukhopadhyay



Useful for the bench scientist constantly being asked to diagnose friends' and family members' illnesses.



Failure to comply with the mug may extend time to dissertation.



For those oscillating between anxious and frustrated, here's a mug to urge you to keep your eye on the prize.

Every situation has a silver lining.

Remember: What goes around, comes around.

Visit Cafepress.com and the Cafe Press store on Amazon.com to purchase these mugs and more. IMAGES COURTESY OF CAFE PRESS

The giving list: supporting science with annual donations

By Donna Kridelbaugh

Fundraising campaigns – from ice bucket challenges to pink cleats on the football field –have been all the craze lately, saturating our social media feeds and news headlines.

While it's refreshing to see people pitching in to support groups that return a portion of funds to biomedical research, these donation fads can quickly fizzle out. Plus, many nonprofit research and science-education programs rely on consistent, year-round donations.

I use the end of the year as a mental reminder to plan my annual giving list comprised of worthy science and education causes. Also, I have transitioned to making donations in lieu of giving materialistic holiday gifts to maximize my donation potential and promote a philanthropic culture.

If you care about grassroots science initiatives or supporting young scientists, you too can adopt a year-end tradition and include science on your annual giving list.

Contribute to your alumni associations and university foundations

State funding for public colleges and universities continues to decline across the nation. At one of my alma maters, the University of Illinois at Urbana–Champaign, direct state support has decreased from 50 percent in 1987 to 11.9 percent in 2014.

Dick Norton, a regional director with the University of Illinois Foundation, explains the vital role of alumni support in continuing university operations: "In FY14, alumni were the second-largest source of donors to the University of Illinois. They designated $35.8 million for student support. That funding helps defray some of the educational debt that now saddles students."

Norton adds, "The burden of debt frequently has repercussions on students' future employment, dictating when and where they work. There are many financial ways for alumni donors to support students at their alma mater. Endowed scholarships, for example, can provide student assistance in perpetuity."

When I graduated from college, I made a promise to contribute to the Chemistry Alumni Scholarship fund that supported me during my undergraduate days. I now give annually to that scholarship fund. Plus, I am a contributing member to the alumni association at my former graduate school institution.

In addition to supporting students, active involvement with alumni associations provides endless benefits. Alumni connections are strong and provide an important networking avenue, while many alumni associations offer career-development resources to support you throughout your lifetime.

Get involved with citizen science projects

If you are strapped for cash, you can volunteer with citizen science projects to help speed up research, provide valuable data and interpret data sets. SciStarter features a collection of more than 850 projects open to the public. Darlene Cavalier, founder of SciStarter and Science Cheerleader, explains, "There is something for everyone: bird lovers, armchair astronomers, nature enthusiasts, concerned citizens, pet owners, DIYers and hobbyists." Projects range from playing online games to tracking wildlife in your backyard.

Cavalier says she sees an advantage for scientists to be involved with citizen science projects, especially for projects in need of community leaders or that require data interpretation. She also said she has observed the emergence of new a project type where the public directly provides input on science policy issues (e.g., Informing NASA's Asteroid Initiative).

Donate funds to nonprofit science organizations and crowdfunding projects

Nonprofit research and education centers depend on private donors to sustain their operations. I make a yearly contribution to Discover Life in America, a nonprofit that runs citizen science projects in the Great Smoky Mountains National Park. DLiA is on a mission to identify all the living species in the national park to inform biodiversity and conservation efforts.

Todd Witcher, executive director

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of DLiA, emphasizes the importance of leveraging private donations for general operating support. "This is the most difficult line item to find funding for," he says, "and generally private donations are not restricted or designated for specific projects." Unrestricted funds can be used for day-to-day needs, including staff wages and to keep the lights on.

Funds also may be raised directly from the public for specific research projects via crowdfunding platforms like IndieGoGo, Experiment and Petridish. You can back a number of innovative research projects or support local education initiatives, such as the neighborhood biohacker space.

Help buy needed STEM education materials for K–12 classrooms

Thousands of inspiring K–12 classroom teachers seek funds on DonorsChoose.org to purchase equipment and supplies. Teachers work with limited budgets and thus turn to private funding for student-enrichment opportunities.

For example, special education teacher Shani Cutler is raising funds for a classroom microscope via her crowdfunding project called The Unseen World. If her funding goal is met, Cutler says, the microscope will enhance her classroom: "The unseen world of cells and cellular structure is a vital part of a student's understanding of the parts of a whole concept — mineral composition, symbiotic organisms, microcopy and so many more. A microscope is an essential part of any successful scientific journey."

Cutler adds, "When students have access to hands-on manipulatives and tools for science, technology, engineering and mathematics, it feeds to their natural curiosities about the world around them. When they are interested, they are more likely to go beyond the textbook and explore possible fields in the STEM areas that they may have not considered."

Instead of holiday gifts this year, you can donate to a classroom in honor of friends and family or buy DonorsChoose.org gift cards so that recipients can pick out their own projects to fund.

Support the professional development of a young scientist

Membership fees for professional societies add up quickly, especially for early-career scientists who are in career transitions. Think about purchasing a professional membership or donating funds toward travel to a science conference for a young scientist in your life. A prepaid money card with a note that the money is to be used to support their awesome science is a good way to give, too.

Author's note: In the U.S., charitable contributions can be deducted on federal income taxes when itemizing deductions on a tax return. Consult a tax professional for details.

Donna Kridelbaugh (@science_mentor) is a communications consultant and founder of ScienceMentor.Me. Her mission is to create an online field guide to self-mentoring in science careers. She offers writing, editing and marketing services for early-career professionals who are ready to advance their career to the next level. Learn more at http://sciencementor.me/.

Give to ASBMB to support emerging scientists and their teachers

When you make a gift to the ASBMB, you make it possible for emerging scientists and their teachers to attend the annual meeting. Our travel award program supports undergraduate and graduate students, postdoctoral fellows and teachers of undergraduates. Travel award winners present their research, learn about projects by others, explore career options and expand their professional networks.

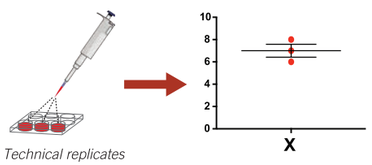
Donate when you renew your membership or contact ASBMB Executive Director Barbara Gordon at bgordon@asbmb.org.

HEY, RESEARCHER! LEAVE THOSE BARS ALONE!

Good practices for reporting numerical and statistical results

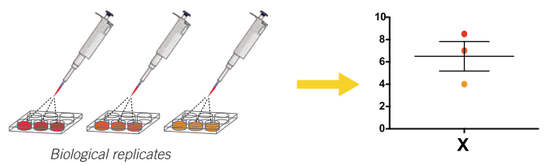
1. **Show error bars for independent (biological) replicates only, not technical replicates from a single experiment.**

NO



Technical replicates

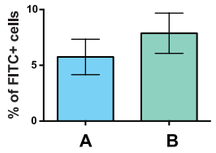
YES



Biological replicates

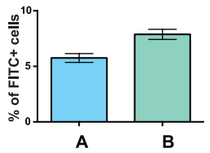
2. **Know when to use standard deviation (s.d.) or standard error or the mean (s.e.m.)[1].**

SD



(Same data plotted)

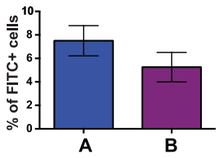
SEM



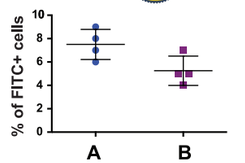
[1] Standard deviation (s.d.) measures the variability or spread of the data in one group. Standard error of the mean (s.e.m.) is an estimate of the variability of the means based on the sample size. The larger the sample size, the smaller the standard error.

3. **When including error bars in a graph, explain what the bars represent (s.d. or s.e.m.)[1] and state the number of independent data points (n) shown in the graph. Consider showing all data points in the graph if n is less than 5.**

NO



YES



Error bars represent s.d. (n=4)

4. **Use the statistical test most appropriate to evaluate your data, and include the name of the statistical test used to generate the P values. State the threshold for significance (alpha), and report the actual P values in the figure legend.**

NO

P < 0.05

YES

(Example) Statistical significance was determined by Student's *t* test. A P value < 0.05 was considered statistically significant. P = 0.023

ASBMB
American Society for Biochemistry and Molecular Biology

2015 CALLS FOR SUBMISSIONS

HOBBIES

We know that a life in science can be grueling. We also know that some of you have very interesting or unusual ways of blowing off steam or finding your Zen. We would like to feature your essays, poems, artwork or multimedia reflecting on scientists' pastimes. We welcome all creative interpretations of the theme. You could send us a photo of you shooting hoops or jumping out of an airplane. You could send us a video of you jamming with your band. You could send us a poem about a childhood hobby or otherwise abandoned escapes. You could write about a hobby enjoyed by someone else — perhaps a figure in science history or one of your mentors. And you could send us a rant about how you don't have time for such frivolity.

GENERATIONS

This collection of essays, poems and artwork will explore generations in a very loosely defined way. You might have come from a family of scientists. You might have insights about parenting while doing science. You might have something to say about generations of cell lines or scientific lines of inquiry. You might have a story to tell about a line of researchers mentored by one scientist. Interpret the theme as you will. It is not a boundary but rather a springboard for the making of meaning.

DEADLINES FOR HOBBIES AND GENERATIONS: Dec. 31, 2014.

FORMAT: We'll print some; others, we will post online. Some might appear both in print and online.

SUBMISSIONS: Email (to asbmbtoday@asbmb.org) your manuscripts as Word documents, static images as JPEG or TIFF files (the higher the resolution the better), audio as mp3 or mp4 files, and videos in something like QuickTime, Vimeo or YouTube. Please indicate to which series you are submitting in your email subject line.

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BOSTON

March 28 – April 1

PLENARY SPEAKERS


C. David Allis, *The Rockefeller University*


Bonnie Bassler, *Princeton University*


Zhijian James Chen, *University of Texas–Southwestern Medical Center*


Rachel Klevit, *University of Washington*


Ian Wilson, *The Scripps Research Institute*

LATE-BREAKING DEADLINE

January 21

DISCOUNTED REGISTRATION DEADLINE

February 2

HOUSING DEADLINE

February 23

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