EDITORIAL

by Todd Weaver, Ph.D., University of Wisconsin La Crosse

Welcome to the Winter 2013 issue of Enzymatic! I am a professor at UW-La Crosse in the Department of Chemistry and Biochemistry and am excited to offer my services to the ASBMB-UAN community as the newest chief editor for Enzymatic. In this issue you will find student contributions covering deep-sea research, the Annual Bay Area Science Festival, and becoming a scientist. Emerson Khost from Marymount Manhattan College (MMC) describes his summer research experience in the lab of Richard Sheryll from the American Museum of Natural History where he progresses from the laboratory to a deep-sea extremophilic bacteria sampling cruise aboard the R.V. Endeavor. Amanda Carbajal from San Francisco State University (SFSU) provides a review of the Bay Area Science Festival Discovery Days held at AT&T Park in San Francisco. ASBMB-UAN chapters from SFSU and San Jose State University represented ASBMB-UAN at the event. Alice Trye provides a personal reflection about her transition from a new first year student at MMC to an undergraduate scientist.
including being awarded a prestigious Jeannette K. Watson Fellowship. Additional contributions by James Hazzard (University of Arizona), Raj Mukhopadhyay (ASBMB) and yours truly describe their involvement with high school students, career in science writing, and using JBC to integrate enzyme kinetics and metabolism, respectively. This issue also provides reviews on an animation involving photosynthesis coupled ATP synthesis from McGraw-Hill and the book *Power Unseen: How Microbes Rule the World* by Bernard Dixon. If you are interested in contributing to the spring *Enzymatic* please feel free to contact me with your ideas (tweaver@uwlnx.edu).

Molecules in Motion: Animated Movie Reviews

**Review of Photosynthetic Electron Transport and ATP Synthesis**
Animator: McGraw Hill
Reviewer: Kristen Benner, University of Michigan Dearborn


You can choose to view the animation in two ways, with or without narration. I chose to experience the animation via audio narration and was glad that the narrator spoke clearly and concisely. The drawings were vibrant and depicted a phospholipid bi-layer with the correct alignment of non-polar tails towards the center and polar heads on the perimeters. I especially appreciated the use of arrows that illustrated the pathways of various molecules and ions throughout the phospholipid bi-layer. Different portions of the diagram were labeled, such as the stroma and thylakoid, which otherwise might have proved difficult to spell. The labels also allowed viewers to better orient themselves inside the plant cell. The narrator described the events in detail without overly complicating the materials. This animation is appropriate for high school biology students or students taking introductory-level biology courses in college.
A beautiful day for science

by Amanda Carbajal, San Francisco State University

November 3, 2012 was a rare, beautiful fall Saturday in San Francisco and AT&T Park was buzzing with excitement and enthusiasm where people of all ages and background gathered to attend Bay Area Science Festival Discovery Days (BASF).

BASF Discovery Days featured a variety of representatives including those from scientific institutions, northern California schools and science clubs, such as the UAN groups from San Francisco State University (SFSU) and San Jose State University (SJSU). These groups provided the guests with an array of fun, colorful and interactive booths on a broad spectrum of scientific topics. There were booths on astronomy, technology, gravity, engineering, life sciences and biology. Food, souvenir carts, mini shows and games also spread throughout the stadium. Last year, over 21,000 people attended this event and this year visitors came from the United States, Germany, the Netherlands, and Switzerland!

The SFSU-UAN, led by Dr. Teaster Baird, Jr. joined the SJSU-UAN and presented a booth that described the basics of DNA base-pairing using redvines (phosphodiester backbone) and colored marshmallows (purines and pyrimidines).

Our booth had heavy traffic all day from children, ranging in age from preschool to high school. Parents and relatives listened and watched their children build double helices, while we explained how DNA encodes information. Many parents approached to ask questions and the kids posed with their DNA “models”. A local middle school teacher even asked the SFSU UAN to pay a visit to their school to present this very same presentation.

Thanks to the SJSU UAN chapter’s support and participation, our booth was a great success and we all had a great time sharing our knowledge and teaching kids a little about biology. Everyone is already looking forward to doing this again next year.
JBC IN THE CLASSROOM: Making connections between enzyme kinetics and fundamental metabolism

by Todd Weaver, Ph.D., University of Wisconsin La Crosse

JBC in the Classroom is a recurring series published in Enzymatic as well as on the JBC website under Teaching Tools.

Background
Many core biochemistry and molecular biology curricula encompass a two-semester biochemistry course sequence. Typically, the first semester biochemistry course is highly centric covering the relationship between protein structure and function, including exposure to enzyme kinetics and mechanism. The second semester often covers a myriad of metabolic pathways and typically these pathways are discussed in an integrated fashion with some emphasis placed upon coordinated regulation. However, there may be little to no evidentiary connection made between these first and second semester courses. Most importantly, there may be little connection made between fundamental enzyme kinetics and the regulation of cellular metabolism and bioenergetics. To illustrate the interconnected nature of enzymes and metabolism, primary literature can be introduced into the second semester course. In this example, both junior/senior level biochemistry and biology majors populate this second semester biochemistry course. The pre-requisites for this course are two semesters of general and organic chemistry, as well as one semester of biochemistry.

Integrative Manuscript
Fundamental metabolism as taught in some biochemistry courses covers carbohydrate, lipid, and amino acid associated pathways and cycles.

However, there are few concrete descriptions of molecular communication between these integrated schemes that can be linked to bioenergetics. An article by Wang et. al. (JBC 285: 10408 – 10414) provides a good example of the molecular communication between mitochondrial MDH, a Kreb’s Cycle enzyme, and cytochrome bc1 complex, a part of the electron transport system (ETS). The article addresses three important student-learning outcomes: (1) enhancing scientific literacy, (2) understanding the integrative nature of metabolism and bioenergetics and (3) understanding the cellular importance of enzyme kinetic parameters ($K_m$, $V_{max}$). Two of the more important figures from the manuscript have been illustrated to the left. In Figure 1, the investigators illustrated molecular communication between MDH and cytochrome bc1 via co-immunoprecipitation followed by SDS-PAGE and Western Blot analysis. These pull-down experiments illustrated a basic molecular interaction between MDH and bc1. In Figure 2, the investigators also reported unidirectional cytochrome...
bc1 activation of MDH by monitoring MDH activity in both the malate -> OAA and OAA -> malate directions. The authors illustrate a clear activation of MDH in the OAA -> malate direction.

Most students will have been exposed to many of the Experimental Procedures covered in this manuscript during the laboratory component of a first semester biochemistry course. Techniques covered in the Wang et al. manuscript include protein purification, enzyme kinetics and inhibition, SDS-PAGE, and Western Blot. Thus, many of the results have been obtained using techniques familiar to most first year biochemistry students. The Experimental Procedures also exposed the students to surface plasmon resonance (SPR) and site specific protein cross-linking. These techniques were new to most of the students in this course and thus, expanded their scientific knowledge. In order to facilitate the interpretation of the results, these techniques were discussed before the students had read the article.

Ultimately, the authors conclude the interaction between bc1 and MDH provides a mechanism to down regulate ATP production during times of intracellular high-energy status. More specifically, a specific bc1-MDH association activates MDH to catalyze the conversion of OAA -> malate. The decreased intracellular need for ATP stimulates bc1 directed MDH activation toward the formation of malate, a reversal of the classic Kreb’s Cycle. Stimulation of the MDH reverse reaction would lower intra-mitochondrial levels of NADH and slow the progression through Complex I of electron transport leading to decreased H+ gradient and ATP production. Many biochemistry courses will cover the integration between Kreb’s Cycle and ETS starting from the condensation of OAA and acetyl-CoA into citrate. The manuscript by Wang et al. provides an intracellular enzyme-mediated regulation at the final step of the Kreb’s Cycle.

By integrating current primary literature in this course, students have become exposed to a regulatory mechanism whereby protein-protein interactions between energetically connected partners coordinates an intracellular bioenergetics response to slow the production of ATP via decreased production of OAA, citrate and reduced co-enzymes NADH and FADH2. Thus, the regulation interconnects the Kreb’s Cycle, Electron Transport and Oxidative Phosphorylation.

Presentation and Assessment
As a portion of the assessment strategy, groups of students presented the figures and tables to the rest of the class. First, students were placed into JBC Discussion Groups using an on-line course management system. Each group was then assigned a figure or table to present to the rest of the class. The group presentation accounted for 40% of this assignment. The roles for each student member are listed below.

**Student 1:** (a) present the preparation of the samples, (b) explain the technique/instrument employed to collect the data, (c) explain what information this type of experimental technique might provide

**Student 2:** (a) provide a clear explanation of the samples used during the experiments, (b) explain how the samples were treated, (c) make sure to define the abbreviations used by the authors in the figure or table, (d) discuss the controls and their importance to the results

**Student 3:** (a) provide a clear synthesis of the results in relation to the overall hypothesis, (b) explain why these experiments are important to the article, (c) whether or not other samples should have been included in the experiment, (d) were all control samples included during the experimental procedure

**All students:** (a) discuss how the data being presented support the main hypothesis, (b) provide a major outcome statement from this figure/table, (c) suggest any improvement of the data presentation
Prior to the student group presentations, each student must have addressed the guiding questions below. Each student was required to upload his or her responses to these questions to an on-line course management Dropbox. This portion accounted for 60% of their final grade and having this assignment due prior to the group discussions was critical in maintaining an interactive classroom during the group presentations.

**Guiding questions:**
1. What is the context of the paper?
2. What work by others is critical to the paper? (What major finding or idea are they trying to expand upon)
3. Identify three critical background articles cited in the paper and how has each of these articles helped frame the experimental design within this article?
4. Summarize the big picture aspect of this work.
5. What is the central hypothesis of being tested?
6. Identify the preparative experiments.
7. What are the critical/qualitative/quantitative experiments that test the author’s hypothesis?
8. What do you deem as the most important figure in the paper? Explain and support your selection in relation to the hypothesis.
9. What are the major conclusions reached by the author’s?
10. What evidence (figures or tables) are the major conclusions based on?
11. Discuss each figure and table in regard to: (a) controls used, (b) results obtained, (c) relationship to hypothesis.
12. What is the next logical step suggested by the authors?
13. What additional experiments do these results suggest to you?

This JBC-based in class assignment was selected to illustrate the close connection between enzymes and the control of metabolism, topics typically taught separately within biochemistry curriculum. The article by Wang et al. provided a succinct integration of enzyme kinetics and intracellular bioenergetics. In addition to helping students make the connection between two important biochemistry concepts, the incorporation of primary literature into the biochemistry curriculum also enhanced student scientific literacy.
CAREERS IN SCIENCE - An interview with Rajendrani Mukhopadhyay

Dr. Mukhopadhyay is the senior science writer for ASBMB today and has been at ASBMB since 2011 and she holds a Ph.D. in biochemistry from Johns Hopkins University.

Dr. Mukhopadhyay, how did you get involved in science and eventually decide to become a scientist?

I grew up mostly in the Middle East and had gone through the British education system. In that system, at the age of 16, you pick 3 or 4 subjects to focus on for your “Advanced Levels” program. These 3 or 4 subjects are supposed to reflect what you’re going to do later in life professionally. I was torn. I excelled in chemistry, biology, English and French, and loved history. I wanted to be a writer but with my grades in school, science also was a viable option. I knew I wanted to be able to financially support myself as an adult. Through movies and books, it appeared to me that writers lived in garrets with only candlelight for warmth and scientists appeared to be a better-fed lot. So much to the utter dismay of my English teacher, I picked chemistry, biology, physics and French (I really wanted to read Voltaire’s “Candide” in its original language) for my A-levels and focused on becoming a scientist. I did well in my A-levels and got admission into McGill University in Montreal, Canada, with full scholarship. I opted for the biochemistry program because it involved both chemistry and biology.

McGill’s undergraduate biochemistry program is rigorous and tough. Lectures, labs and homework ate up my time. But like with my A-level courses, it mostly involved learning numbers, rules and concepts. I had the ability to absorb large bodies of material and churn them out at exam time. Even the lab courses expected me to follow protocols and come up with predetermined answers. So I did well and passed through McGill’s program with honors. But I had very little hands-on experience in an actual laboratory setting working on an actual scientific problem.

Did you always know that you wanted to get a PhD?

The Ph.D. became obvious to me toward the end of my second year at McGill. It seemed to me there were three options after getting a bachelor’s degree in biochemistry: Apply for medical school, be a laboratory technician or get a Ph.D. I never harbored any ambitions for medicine so that was not an avenue for me. I hesitated to be a technician because I knew within a year or two I would back at my present situation of wondering “What next?” At the time that I was trying to figure out what to do, Canada was going through a recession. There wasn’t much funding for graduate school. You had to see if an individual principal investigator could support you for the duration of your Ph.D. Also, the programs were designed as 3-year programs where you started right away working on a thesis project. I didn’t have any confidence that I knew enough about the different areas of biomedical research to decide on what I wanted to focus for a graduate thesis project.

I looked to the south and found the U.S. was in a better financial shape and actually supporting students in their quest for a Ph.D. I got into the biochemistry, cellular and molecular biology program at Johns Hopkins University based at the university’s medical campus in Baltimore. The most important aspect of the program was that it was 5 years long, with the first year dedicated to courses in different aspects of molecular biology, biochemistry, biophysics.
and genetics and three lab rotations to explore different kinds of research. It was exactly what I was looking for.

**Did you the typical path of training and preparation to become an academic scientist? At what point, or what experience(s) did you have that made you realize that you didn’t want to do bench science anymore?**

My lab rotations helped me chose to do atomic force microscopy in the laboratory of Jan Hoh for my graduate thesis work. I loved the images taken by AFM and I enjoyed working with the microscope’s parts to get those images. Jan’s lab was also different from most of the labs in the Hopkins medical campus in that he pulled together a scientifically diverse group that consisted of physicists, chemical engineers, computational biologists and folks like me with a molecular biology/biochemistry background. Lab meetings were early training for me as a science writer to learn to talk about science without devolving into jargon!

But my Ph.D. training was the first time I was in the laboratory on my own without an undergraduate teaching assistant hovering in the background and a tested protocol in front of me. Much to my alarm, I discovered that experimental design wasn’t intuitive for me. I lacked the instinct and the manual dexterity for experiments. I also lacked the patience needed for research. It was painful to learn there was no such thing as instant gratification in science.

Even more alarming, many of my peers seemed to be more at ease in the laboratory setting. I realized that there was no way I could compete against them when it came to academic or industry research positions after graduation.

All together, I grew miserable and scared. I realized that after all this time, I didn’t have what it took to excel in research. All my dreams of following in the footsteps of Marie Curie, James Watson and Francis Crick became obviously naïve. As a 16-year-old, I had set my sights on being a scientist. Now, seven years later, it was horrifying to realize that I may have set off on the wrong path. I needed a Plan B, but I didn’t have one.

**Was it difficult to commit to the decision to leave bench science?**

My misery and fright steadily increased through the second and third year of graduate school and I knew I had to find a way out of academic science. But in my time, the other careers in science were not publicized much and, indeed, a number of faculty members in my program openly discouraged them. Jan was not one of them and told me on more than one occasion that there were other careers outside of academia that were just as good. But I didn’t know where to find information about these other options, and I grew increasingly paralyzed with fear and a sense of failure.

**After you decided that you didn’t want to follow the more traditional path, what “path less traveled” did you take?**

The lucky break came from my then-boyfriend (now spouse) who, seeing my utter misery, told me to do something that would give me a break from science. I had heard of the Odyssey Program at Hopkins that does adult education programs. Recalling my love for English and French, I enrolled in a creative writing class that was held on Tuesday evenings. On the first day of class, the instructor told us to write about our first names. As I set pen to paper and started to describe how my father gave me the name, which means “The Queen of Queens” in Sanskrit, I felt a huge weight lift off my shoulders. This is what I wanted to do for the rest of my life. I wanted to write.
The realization rejuvenated me. But I needed to be practical. Even though I wanted to make a living by writing, I knew that my fiction writing wasn’t good enough to bring in paychecks. I did have this extensive training in science. It wasn’t that I hated science. I loved learning about science in a big-picture way. I just couldn’t be bothered to know what was the buffer pH and at which temperatures the measurements were taken! So I started to ask faculty members if there was a career that combined science and writing. The chair of the department, William Agnew, immediately told me if that I knew how to communicate the excitement of science to people who were not scientists, there was a career for me.

Bill went on to be an important mentor who helped me get my first clips in Hopkins Medical News magazine. The editor of the magazine at the time, Edith Nichols, and the senior science writer, Marjorie Centofanti, quickly taught me the ropes of writing for a nontechnical audience.

Once I knew I wanted to pursue science writing, I asked every faculty member I met if they knew a science writer. That’s how I got introduced to Joanna Downer who was then at the Hopkins medical school’s media office and is now at Duke University. Joanna and Marjorie helped me get into the National Association of Science Writers so I could see what science writers talked about every day and also get job alerts to see what the requirements were to break into the field.

When I was in my fourth year, Hopkins launched its Professional Development Office at the medical campus, which became an important resource for me as well as the Science Careers website. I began to realize that there were many people with extensive scientific training who opted for careers in areas such as science policy, law, communications and management consulting. It was reassuring to know that I wasn’t a failure for not continuing on in academic research and that I could do something worthwhile with my scientific training.

With the support and help of people like Bill, Marjorie, Joanna, and Jan, by the time I was in my fifth year of graduate school, I was set on the path of a career in science writing. I had already devoted the evenings, after I had finished up in the laboratory, to build up my portfolio of clips. By the time I graduated with my Ph.D., I had written several columns for Hopkins Medical News magazine, an article for the Science Careers website, a couple of columns for the Hopkins Graduate Student Newsletter, and a creative nonfiction piece in a magazine. With that portfolio and my resume, I landed my first job as a science writer and reporter at the American Chemical Society right after graduation. I’ve never looked back.

Incidentally, I met up with my high-school English teacher, Shane Heslin, shortly after starting the ACS job. When he heard that I was writing for a living, he said with a huge grin, “I told you so!”

Could you give our readers an idea of what your current job involves?

Deadlines drive my life as a science writer. I write posts for the blog, Wild Types, as well as stories for ASBMB Today. Every post and story has a deadline by which it has to written and be ready for publication. By the time of the deadline for each story, I need to research a topic, interview the appropriate scientists working in that field, transcribe the interviews, write a draft of the story, which will be revised several times, and fact-check it. I also work on the Journal of Biological Chemistry in writing up the Paper of the Week summaries and editing
titles to eliminate jargon. All this means I have to be very organized with my time and make sure nothing falls behind. So every day, I set time aside for different activities: making phone calls, transcribing interviews, revising pieces I have in development, searching the scientific literature and social media outlets, like Twitter and Reddit, for new story ideas, and helping with the layout of stories heading out the door for publication. As you can tell, if I do get a quiet moment, I wonder, “What am I forgetting?”

Does any of the training or education that you received help you in your current career path, i.e., can someone without a PhD do what you do?

There are stellar science writers out there who don’t have a Ph.D., and some who don’t even have a science degree. A good science writer is someone who is curious and loves to tell stories. A science writer is also not afraid to go after topics about which he or she initially has very little knowledge. I have written about the 1976 Viking mission to Mars, art analysis, performance-enhancing drugs taken by cheating athletes and the biofuels industry. These are all topics that I didn’t know much about going in. So a strong sense of curiosity, the ability to ask the right questions, and being able to frame all the information into a story that takes readers on a journey are the only requisites for science writing.

For me, though, I do feel the Ph.D. training helped me be the writer I am today. As a graduate student, I had to learn not to be intimidated by the unknown (being a good student in high school and college gave me the unfortunate mentality that it was a sign of weakness to not know something). Being in an academic research environment for 5 years showed me how scientists think (shades of grey, not black-and-white!). That has been invaluable for me when framing my interview questions for stories. I also learned that the single “Eureka!” moment in rare in science and that a single publication represents years of a student’s or postdoctoral fellow’s work. I respect that and always keep it at the back of my mind.

But you don’t have to go through a Ph.D. training program to learn these things. Just chatting long enough with scientists will teach you these same principles. I will never advocate going through a Ph.D. program if you know early on that you want to become a science writer. There are other avenues, such as science writing master’s programs and internships. But if you are like me and you discover in the midst of a Ph.D. program that it’s not a good fit, you can turn around that experiment gone awry for your favor.

What advice would you give to undergraduates who may know that they like science, and may want a career in science, but don’t yet know exactly what they want to do once they graduate?

Talk to graduate students, postdocs, faculty members, family members, friends, neighbors, anybody willing to hear you out. You never know who knows what and may turn you in a direction you had never imagined existed. And stop occasionally to critically think about what you are doing and how you see it steering your future. I wish I had done that earlier in my education and saved myself a lot of heartache.
UPRRP chapter engages in science, outreach and fun

by Emir Aviles-Pagan, University of Puerto Rico-Rio Piedras

In the words of the great Ralph Waldo Emerson, “men love to wonder, and that is the seed of science.” In this case, however, it wasn’t men that were wondering, but kids! Many children were inspired to wonder at the latest science demonstration given by the ASBMB UAN at the University of Puerto Rico-Rio Piedras (UPRRP).

The demonstration was part of the Un Rayito de Sol en tu Habitacion’s (the direct translation into English being “A Ray of Sunshine in your Room”) Annual Christmas Event that took place this past December in the city of San Juan, Puerto Rico. This non-profit organization works with the San Jorge Children’s Hospital to bring recreation and emotional support to pediatric cancer patients. The event itself is the culmination of the year’s activities and it focuses on giving the kids a joyful day filled with all sort of fun events.

More than fifty volunteers participated in the event, amongst whom were several members of the UAN chapter at UPRRP. “Do you see that? That’s DNA!” said Edwin Rosado-Olivieri, Chapter Vice President, as he showed one of the kids the DNA that he had just extracted from a strawberry. Many children were engaged in crushing a strawberry and using common household materials to extract its DNA. The demonstration also consisted of an oral explanation of DNA and its biological importance while the extraction was in process. For many of the children, this was their first time hearing the term DNA and witnessing its extraction.

The day was as much a fun for the kids as it was for the UPRRP chapter members. Apart from teaching science, members got to let out their inner child and play games with the kids. The commitment of our UAN members to science outreach and education went hand-in-hand with a little fun.

2013 UAN CALENDAR

January 25, 2013
• Last day to sign up for the 17th Annual Undergraduate Student Research Poster Competition (invitation only)

January 31, 2013
• Last day to nominate students for the ASBMB National Biochemistry and Molecular Biology Honor Society.
• Last day to sign up as a volunteer judge for the 17th Annual Undergraduate Student Research Poster Competition

February 8, 2013
• Last day to designate UAN Non-Competitive Travel Award Recipients to the 2013 ASBMB Annual Meeting.

March 15, 2013
• Deadline to submit applications for the UAN Outstanding Chapter Award.

April 20-24, 2013
• 2013 ASBMB Annual Meeting, Boston, Mass.

May 17, 2013
• Last day to submit applications for the Undergraduate Research Award.

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My journey to becoming a scientist
by Alice Trye, Marymount Manhattan College

As a freshman, I came to Marymount Manhattan College (MMC) with the mindset that a major in biology would help me reach my goal of entering medical school. As the school year went on, I worked hard to achieve high grades and learn as much as possible. I was soon offered a work-study job as the receptionist for the Natural Sciences department at MMC and worked under the supervision of Dr. Ann Aguanno, a biology professor at MMC. Dr. Aguanno immediately encouraged me to join MMC’s UAN chapter and after seeing my commitment to school and the chapter’s activities, Dr. Aguanno offered me a probationary semester in her research laboratory where she and her team study the role of cylin-dependent kinase 5 (CDK5) in the development of mammalian tissues. Without any prior experience, I had never considered research as something I would find interesting. However, I was excited to learn more about the research in her lab, so accepted her offer knowing it would be a great learning opportunity.

Working with Dr. Aguanno has been a life-changing experience. She pushes me to ask questions and to think critically, not only in the research lab but also in the courses I am currently enrolled in. Having a great mentor is crucial at any stage of one’s career, and I realize how lucky I am to have found such an amazing mentor in Dr. Aguanno. For students who have not found a mentor within their institution, I recommend approaching professors with whom they have good relationships and asking if their research projects need assistance. It will demonstrate your readiness and willingness to work and scientists love to discuss their research with those interested. If research opportunities are not available at your school, be sure to look for research opportunities at nearby institutions or medical centers. The ASBMB also has a great web tool to help undergraduates locate summer internships around the country (www.asbmb.org/summerresearch). When selecting an internship, make sure you are interested in the research topic, so that you will look forward to the amount of time you will have to dedicate to lab.

Dr. Aguanno was the first person I went to for advice and a recommendation letter when I found out about the Jeannette K. Watson Fellowship, a competitive fellowship for promising undergraduates that provides leadership and cultural seminars along with paid internships for three consecutive summers. After an arduous application process and a number of interviews, I was one of the fifteen students chosen for this prestigious award. My first internship last summer took place at the Beth Israel Cancer Center in New York City where I worked with clinical trials and shadowed several physicians. When the summer was over, I was ready to get back in the lab because I realized how important research is before clinical trials can take place.

I have started my own research focusing on how CDK5 regulates insulin secretion in the acinar cell line, AR42J. I will be attending Experimental Biology 2013 and cannot wait to share my findings. Being a part of the UAN has shown me how important it is to step out of my comfort zone and try something I never thought I would. Research was not on my radar when I started college, and now I am working on my own project. I have also decided not to pursue medical school, and am looking into combined M.D./Ph.D. programs. Although my journey to becoming a scientist is only just beginning, I am confident that research will lead me down the right path.
BOOK REVIEW: Power Unseen: How Microbes Rule the World

by Katherine Bricceno, Ph.D. Candidate, The George Washington University

Bernard Dixon's collection of short articles details the influence of microbes on our world. Some of these articles originally appeared in Dixon's columns for British newspapers and journals, and are grouped into five sections, named for the roles the microbes play in our world. For example, the section named The Destroyers includes stories about the Plasmodium species that cause malaria. Since many of the stories appeared as columns, they are of similar length. The downside to this format is that an article detailing the discovery of acetone-producing bacteria is similar in length to one about the Black Plague. The reader may find the latter more interesting and prefer a more detailed account of the far-reaching effects of Yersinia pestis on the European population.

In addition to describing a given microbe, Dixon uses the articles to introduce prominent scientists, like Charles Darwin and explain concepts such as antibiotic resistance. These quick lessons in Biology 101 make the book appropriate for lay readers and early science students. More experienced scientists will be interested in stories covering topics like establishment of GeneCards, a database of human genes under development at the Weizmann Institute of Science.

As the book was originally published in 1994, it risks being dated, especially given the pace of scientific discovery. However, microbes continue to appear in the news headlines. The recent reemergence and subsequent outbreak of cholera in Haiti makes the book's historical accounts of cholera epidemics quite timely. In addition, the final section of the book addresses microbes that continue to influence human development. Several articles describe the use of bacteria to clean ecosystems, a process termed bioremediation. Following the 2010 oil spill from the Deepwater Horizon, an article describing how a “microbial consortia” mitigated the damaging effects of previous oil spills into open waters is of particular relevance. In the same article, Dixon also explains the benefits and drawbacks of different approaches to bioremediation.

Throughout the book, Dixon's writing does not merely explain the influence of microbes in our world, it also advances his view of how we should respond. One article begins with a description of tuberculosis and the improvements in sanitation and medicine that successfully combated the disease. He further explains how the disease has reemerged in drug-resistant forms and the various challenges facing physicians, public health officials and countries. After this discussion, Dixon cautions against ignoring diseases we believe are conquered and advocates for continued research on their pathogenicity.

With a mixture of historical perspective, biological relevance and public policy, Power Unseen is an interesting read for scientists at all stages of their career. The clear explanations of scientific concepts and behind-the-scenes descriptions of scientific research combine to hold the reader’s attention. The articles often draw from historical events and large-scale epidemiological studies, but remain relevant and accessible. Microbes continue to facilitate our progress and yet burden us with disease; this book offers snapshots of the influence of both on our modern world.

University of Arizona scholars continue to visit Tucson high school

by Angela Schlegel, Shiana Ferng, Jose Quiroz, and James T. Hazzard, Ph.D., University of Arizona

One of the joys of being a faculty adviser for a UAN chapter is working closely with undergraduates to establish beneficial and viable outreach activities. An exciting activity in which our Chapter has been engaged in since spring 2011 is the Visiting Scholars Program (VSP), first described in the Winter 2012 Enzymatic. In this article we would like to provide an update on the VSP program.

The VSP is designed to give the University of Arizona (UA) students an opportunity to visit Tucson area high school biology and chemistry classes where they discuss their research (a mandatory requirement for all of the B.S. Biochemistry majors at our institution) and engage the high school students in a dialogue about the college experience. Typically, two UA students visit the same high school class, one being responsible for delivering a presentation about their work, the other taking photographs and helping to answer questions concerning life as an undergraduate. The inspiration for VSP came primarily from two observations. First, since the inception of our annual undergraduate research conference (BECUR), a number of high school students have presented very sophisticated posters describing their research, which is often being done on UA campus. Secondly, for a number of years our Department hosted a one-day event in which high school students from across Arizona were invited to a series of presentations and visits to research laboratories on campus. Participating in this event led me to suspect that high school students were reluctant to ask questions concerning how to prepare for and survive college in front of older faculty members such as myself (my suspicions were also strengthened by seeing the inhibitory effects of the “cool” factor in two teenage granddaughters). Dutifully taking a scientific approach to this “problem”, we developed a working hypothesis that the high school students would be much more willing to openly engage in conversations with UA students due to their closer proximity in age. Fortunately, as we show below, going against the trend one often hears about in science classes, not all hypotheses are disproven!

Beginning this fall, Angela Schlegel and Shiana Ferng assumed leadership roles for Visiting Scholars, markedly increasing the number of high schools and classes visited relative to previous years. The following are reflections from members who are participating in the VSP.

Angela Schlegel

Part of my motivation for choosing to pursue a career in science comes from the opportunities I had to conduct lab experiments at UA through my high school’s Research Methods program. I personally benefited from the mentorship by both the UA students and faculty. The VSP allows me to give back to my community by serving as a mentor to local high school students. Through the VSP, students at local schools get to see first-hand that Tucson natives such as myself achieve success in science and learn that such programs are within their reach as well.

Shiana Ferng

As a University High School’ alumnus, it was a pleasure for me to return and share with current students the opportunities that
research has opened up to me. Angela and I were both impressed by the San Miguel High School’s vision for their students as future college graduates and also by their strong support system for the kids in terms of building character and work ethic (described in the Winter 2011 Enzymatic).

Joey Quiroz

The VSP is designed to encourage high school students towards science and higher education. Our program aims to visit numerous high schools in the Tucson area, including those with large populations of underrepresented minorities in science. While visiting Flowing Wells High School, which has a diverse student body and a large Hispanic student population, I asked each student what their plans were after college; the majority of the students answered construction, salesman, or undecided. Not one of the students was interested in or even knew about careers in science. Fortunately, when my question and answer session ended, a young man came up to thank me and said, “I didn’t know there was so much one could do in science.”

As a faculty adviser, a major concern for this outreach activity is its future viability. Therefore, we are transforming this “volunteer” activity into a formal class for which students can receive academic credit (always a good “carrot”). Our model for this transition is the outstanding outreach program established by Dr. Hannah Alexander at the University of Missouri called Science and Me (scienceandme.org), which was featured in A-Today (Dec. 2011). We will continue to engage Tucson area high school students many of whom will be the first in their families to attend college. Additionally, calling upon the diverse nature of research in which our biochemistry students are engaged, we will shift the focus of our talks away from the specific details of the students’ research (which often exceed the high school students level of comprehension) to topics of more general public interest, especially those related to the biomedical sciences. We also plan to enlist the UA’s Office of Instruction and Assessment to assist future students in effective public speaking practices and the design of more sophisticated assessment tools.

As we continue to refine and develop our outreach activities, we are confident that Visiting Scholars is a worthy program that benefits not only the target audience (high school students), but also the undergraduates, helping them improve their organizational, leadership and communication skills.
Science in the deep sea: An unforgettable summer on the R.V. Endeavor

by Emerson Khost, Marymount Manhattan College

I have been conducting research with my advisor, Dr. Ann Aguanno, for about three years on the protein known as cyclin dependent kinase 5 and its role in the developing mammalian nervous system and pancreas. The experience has piqued my interest in academic research, and I have been on the lookout for opportunities to work on more projects. Near the beginning of the previous summer, I started looking for a summer program that pertained to my interest in astrobiology. I was having little luck, and had resigned myself to a summer of playing video games in my pajamas when Dr. Aguanno brought some good news. One of her former colleagues, Dr. Richard Sheryll at the American Museum of Natural History, had contacted her asking for students interested in helping with a project cultivating deep-sea extremophilic bacteria. He and several other collaborators at Wood’s Hole Oceanographic Institute would be retrieving the organisms using a new sampling probe developed by Dr. Sheryll known as the Deep Ocean Benthic Sampler (DOBS) on a research cruise in August. Dr. Aguanno and I said we would be happy to help.

The goal of the DOBS was to retrieve samples at their native pressures and keep them at pressure for subsequent growth. DOBS is the first probe of its kind that would allow for the isolation of bacteria that require high pressures for growth (known as barophiles), as well as prevent the change in gene expression that is believed to occur following depressurization. Deep-sea organisms have unusual metabolisms, and are often studied for their pharmacological potential as well as their ecological importance. Our part of the project would be to cultivate the organisms at atmospheric pressure on a wide range of growth substrates to encourage the production of alternate secondary metabolites. To prepare for this, our lab first established growth protocols using model organisms related to species reported in the literature. Due to the diversity of species that we might encounter in the retrieved samples, we chose a range of model species with varying biochemistries to identify growth conditions that could support general growth. While I was experienced in culturing animal cells, I had relatively little experience working with bacteria, so it was exciting to learn a new skill set via a crash-course from Dr. Aguanno on microbial growth and aseptic technique.

In addition to cultivating the organisms, I was recruited by Dr. Sheryll to help prepare the DOBS for the trip, which consisted of a lot of last-minute modifications in the sweltering attic at the museum. Upon demonstrating my superior wrench-handling skills, I was invited to participate in the cruise itself, which lasted three weeks at sea on the R.V. Endeavor off the coast of Rhode Island. This was my first experience with field research, and it was very exciting to see how scientists deal with unforeseen complications. The entire pharmacy of anti-nausea compounds that I had brought with me proved unnecessary, and I thoroughly enjoyed the everyday rhythm of life on a ship.

The summer research experience and interaction with the other scientists helped me narrow down my own research focus to molecular evolution. While deep-sea organism ecology and biochemistry is fascinating, my interests lie in learning how these organisms have evolved to thrive under such extreme environments, and what processes drive the formation of these specialized species.
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