On the Right Path

As the end of the calendar year approaches, it is a natural time to reflect on what we have accomplished this past year and what opportunities will engage us in the year ahead. It is my hope that readers of this issue of Discoveries will share our pride and conclude that the Department of Biochemistry & Cellular and Molecular Biology (BCMB) is on the right path as our talented and dedicated faculty make steady progress in advancing our research and continue to seek opportunities to enhance the instruction and mentoring of our students. In this issue, we feature two examples of outstanding BCMB students, Jordan Roach, an undergraduate working in the laboratory of Engin Serpersu, and Randy Lacey, a graduate student and doctoral candidate working in the laboratory of Associate professor of BCMB Brad Binder. Both students are natives of Tennessee, and we hope you enjoy reading about their exciting work at the forefront of Molecular and Cellular Biology.

An academic department's success depends on the quality of faculty it attracts and retains. BCMB is excelling at attracting and recruiting the very best young scientists in the Molecular and Cellular Biosciences who are performing research at the cutting edge of their discipline. In this issue of our newsletter, we feature assistant professor Josh Bembenek, an outstanding cell biologist who joined the faculty in 2012. He was the recipient this year of a prestigious five-year R01 grant award from the National Institutes of Health to support his groundbreaking research in cell division and development.

As we look ahead, the department's future is brightened by the recent groundbreaking of the Kenneth and Blaire Mossman Building that will house the BCMB faculty labs, core labs, classrooms and office space that presently reside in the Walters Life Sciences Building. While many of us remember Walters fondly as the home of BCMB, we are excited about the Mossman building which is a modern state-of-the-art facility. It will feature two floors of dedicated teaching classrooms and laboratories—designed for flexibility to accommodate the needs of different disciplines and to promote and accommodate the newest teaching pedagogies, such as hands-on active learning, interactive “peer-to-peer” group discussions, and the use of technology as instructional tools. Faculty research labs in the building will be constructed in an open laboratory format to promote increased interaction and collaboration between the various research groups within the department. The building will feature a modern vivarium as well as a dedicated computational laboratory to support the research and teaching of four internationally renowned computational biologists/biophysicists in the faculty. This science teaching and research facility represents a step change in infrastructure, a strategic priority in UT’s journey towards the top 25.

DAN ROBERTS
Professor and Head

pg. 2&3 Focus on New Faculty: Josh Bembenek
pg. 4 Cancer Community Scholars of UT
pg. 5 Graduate Research: Randy Lacey
pg. 6 Undergraduate Research: Jordan Roach
pg. 7 Tyler Duke Scholarship
Josh Bembenek
joined the faculty in August of 2012 after completing a bachelor’s degree at Texas A&M University, a doctorate at Southwestern Medical Center, and three postdoctoral fellowships. Among his several publications, the most recent is in Science—a collaboration with Eric Betzig, the recipient of the 2014 Nobel Prize in Chemistry. Last spring he received a prestigious five-year R01 grant award from the National Institutes of Health.

What motivated you to pursue career in science?

JB: My dad, a biochemist, had a great influence on me, and I became interested in science early on. I recall in elementary school being completely amazed by the discovery of how many feet of intestine were inside the human body. In ninth grade, a great science teacher explained how speakers work and how a CD is read by a laser, and I realized that I was fascinated about understanding how things work. I gravitated toward the life sciences.

I went to college at Texas A&M mainly because I was accepted and the tuition was reasonable. When I first started college I didn’t realize that one’s own motivation dictates one’s future more than the name of the college where the degree is earned. Texas A&M was a good place to learn this lesson because the opportunity to learn was there, but it was up to the student to figure it out. The large university environment didn’t provide for a lot of individualized attention. Despite my lack of confidence, I developed an independent approach that served me well. I had to pay for my education and consequently had a job while in college. I also worked in a laboratory doing research, but the time I could work there was limited by my other classes and my job outside of school. However, the time challenges notwithstanding, I realized that I really enjoyed the problem-solving associated with doing research in the laboratory. I knew that I wanted to go on to graduate school.

Once I started graduate school I remember feeling that the intellectual environment was exactly where my brain had belonged my whole life. While in graduate school I developed my own research problem that I have pursued independently ever since.

Can you describe the path that led you to your current research area?

JB: My area of research focus came about because I joined a cell cycle lab partly out of interest and partly out of necessity. While working on my thesis, it became clear that the protein I had been characterizing primarily using hard-core in vitro biochemical assays was regulated in the cell by spatial restrictions. I began using microscopy to investigate how the cell regulated this pathway and became completely engaged in cell biology and imaging. I literally chose a postdoc position based on looking at the most recent high profile papers and trying to decide which organism lent itself to the most impressive images, which narrowed me down to the Drosophila oocyte or C. elegans. Given that C. elegans had a robust community of investigators looking at cell division pathways, I ended up interviewing in labs using this model system. When I went to John White’s lab at UW Madison, I knew where I wanted to be. This was a lab which was a normal biology lab filled with students and a second microscopy lab filled with computer scientists, engineers and advanced imaging equipment like a multiphoton—an environment in which I could thrive.
Any advice you would offer to undergraduate and graduate students?

JB: My first piece of advice to undergraduate students is to be proactive. This is especially true if they have the opportunity to work in a laboratory. In class you are told what you need to know and there is a clear path to knowing it: study and memory. In the lab, no one can tell you what you need to know, success requires innovation, creativity and hard work. These same skills apply to both finding a lab to work in and a project to work on, as well as the day to day work of participating in research.

If I were to offer advice to graduate students it would be to be flexible. You can learn how to do science anywhere, so the primary consideration would be that you feel there are promising prospects in the lab you choose and that you fit into the environment well. Obviously, it is important to have some interest in the research, but unless you are already committed to a specific field, your interests are likely to change as you mature as a scientist. And this is one of the most rewarding parts of science: you can never predict exactly what answers you will find in the lab and often your career path can have unexpected turns despite the most well-laid plans, which can end up being better than you would have imagined. My advice to any postdocs looking for jobs is to be persistent. It took me four job searches to find what I wanted. Most people probably give up before then. What discriminates me from others isn’t necessarily the smarts or how good I am, but the fact that I am persistent and tenacious.

What do you like most about your job at UT?

JB: I most like offering what I’ve learned to students in the lab and the classroom. After working in science for many years I am comfortable knowing how to approach new questions and performing experiments in the lab. Helping students understand the exciting aspects of science and helping them achieve their own goals is more rewarding than continuing to do it myself and hopefully will inspire the next generation of scientists and biomedical related professionals.

What are the biggest challenges?

JB: The hardest part is the transition from being a postdoc to a Project Investigator (PI). As a post doc I knew how to do experiments really well, but my training had not prepared me to be a PI running a lab. While we all know in general that running a lab is different than running the experiments, there are many skills that are quite different for success in the two, so learning new skills for the new job is essential and not easy after many years being primarily focused on getting experiments to work.
The Cancer Community of Scholars (CCoS) is a forum for UT faculty interested in cancer research. The CCoS currently includes faculty from several UT colleges including Arts and Sciences, Engineering, Nursing, Social Work, Communications, and Education Health & Human Sciences. In addition, there are faculty participants from the College of Veterinary Medicine (Institute of Agriculture) and UT Medical Center at Knoxville (UT Health Science Center).


The CCoS is serving as a catalyst for generating application for institutional grants to fund research engaging students and faculty. Recently an application was submitted for an American Cancer Society Institutional Research Grant aimed at supporting the research of the junior faculty of the CCoS with seed money and guidance and mentoring provided by senior faculty members of the CCoS. The application is under review with a decision pending.

Work is currently underway to apply for an NIH R25 Cancer Education Grant, spearheaded by Tim Sparer. If funded, this grant would afford BCMB undergraduate students interested in cancer invaluable opportunities for first-hand research and clinical experience. In particular, they would be able to witness at the UT Medical Center the different stages through which an oncological patient travels, as well as how cancer diagnostics and treatment proceeds.

“If funded, this grant would afford BCMB undergraduate students interested in cancer invaluable opportunities for first-hand research and clinical experience.”

BCMB faculty Maitreyi Das (second row from bottom) Josh Bembenek and Fran Barrera (third row) attended the CCoS mini-symposium at UT Medical Center-Knoxville.
Randy Lacey is proud to claim his birthplace of McKenzie, Tennessee. The son of a father who is a retired physical therapist and a mother who teaches special education, Randy spent his early life in west Tennessee before heading east to pursue postsecondary education.

His first stop on his eastern trek was Austin Peay University in Clarksville, Tennessee where he majored in biology. It was here, while taking cell biology courses, that Randy developed an interest in biology and research.

Following graduation from Austin Peay with a bachelor’s degree, Randy continued eastward to UT in 2009 to start work on a doctorate. He subsequently joined the lab of Brad Binder in 2010 where he is studying how the simple gas, ethylene, is used by cyanobacteria (aka blue-green algae) as an environmental signal.

In plants, ethylene is a hormone that regulates many key processes such as fruit ripening and stress responses. The production of ethylene by ripe apples stimulates ripening of other apples and as a result “one bad apple spoils the whole bunch.”

The receptors for ethylene are believed to have been obtained by plants during evolution when chloroplasts were acquired from a cyanobacteria in a process called endosymbiosis. However, no one has examined the role of ethylene and the receptors in cyanobacteria. Do they do anything useful?

Randy’s research shows that there is an ethylene receptor in the cyanobacterium, *Synechocystis*, and that ethylene enhances movement towards light (phototaxis). His research indicates that ethylene is an environmental cue that modulates cyanobacteria movement. Ethylene is released from organic matter dissolved in seawater by light and thus points movement of cyanobacteria to environmental conditions optimal to the growth and survival of bacteria.

Randy has presented his work at several regional and international meetings and is currently drafting his results for publication. In 2012 Randy received the James and Dora Wright Fellowship that recognizes a graduate student in the BCMB program who demonstrates leadership and excellence in scholarship and research.
Undergraduate Research

Jordan Roach

PREPARING FOR A CAREER IN MEDICINE

Research focus: Bacterial enzymes that deactivate antibiotics. How do they work?

Widespread use of antibiotics fosters the emergence of antibiotic resistant bacteria. These bacteria evolve enzymes that modify antibiotics to make them useless. Jordan Roach studies how these enzymes function, which should help find novel drugs to fight antibiotic resistant bacteria.

Jordan is from Englewood, Tennessee, a small town of less than 2000 southwest of Knoxville. He became interested in biology at McMinn Central High School thanks to a great biology teacher, Ronnie Galloway. Taking classes at UT confirmed his interest in biology.

When he joined Engin Serpersu’s lab Jordan wanted to work with proteins on a topic related to medicine. His project was the optimization of expression, isolation and characterization of an enzyme (aminoglycoside N3-acetyltransferase-Ib (AAC)) that causes resistance to aminoglycoside antibiotics. At first this enzyme precipitated during isolation, rendering it unusable, and several graduate students had tackled the problem without success. Jordan took on the challenge and tried a number of approaches that included a variety of expression conditions and even re-cloning the plasmid. By the end of the semester, he was successful in expressing the enzyme in soluble fraction in sufficient quantity for purification and biophysical studies. He is currently trying to determine the kinetic properties of this enzyme.

In the future Jordan plans to apply to Medical Scientist Training Programs funded by NIH which will allow him to do medical research. His dream is to specialize in oncology and work at St. Jude Children’s Research Hospital. Last year Jordan received the competitive BCMB Undergraduate Research Scholarship.
In 2010 the Department began sponsoring a scholarship for an outstanding undergraduate. The scholarship is in memory of Tyler Duke, a talented BCMB major who died unexpectedly at the end of 2009, in the middle of his senior year at UT. He had already been accepted to attend pharmacy school after graduating. The scholarship was established by his family in the amount of $1000 initially, but was recently increased to $2000. It recognizes an outstanding BCMB undergraduate major who likewise intends to attend pharmacy school after graduation from UT. This award is intended for a rising senior who has declared a BCMB major and who has an overall GPA of 3.6 or above and a score on the PCAT in the 80th percentile or higher. Past recipients of this award include Rachel Childers, Courtney Manlove, Anna Kegley, and Erin Sherwin.

Anna Kegley received the scholarship in 2014. She is from Clinton, a small town north of Knoxville. In high school she fell in love with chemistry. During her junior year of high school she worked at a small independent community pharmacy and finally put the two together; pharmacy revolves around chemistry! In 2014 Anna graduated from BCMB with a 3.84 GPA and was accepted into pharmacy school.

“My love for chemistry lead me to the profession of my dreams, pharmacy,” Kegley explains. “I am so excited about my future career and am ready to combat many of the pharmaceutical related problems society is facing, including antibiotic resistant bacteria, prescription drug abuse, patient medication compliance, and insurance reform.”

Kegley says she is thankful to be awarded the Tyler Duke Scholarship which was absolutely essential to her affording the cost of completing another year of undergraduate studies. “I think the upper division and general education courses I took that were not in the pharmacy prerequisite course work will prove useful in my professional career,” she said.

Kegley has just started the first year of pharmacy school at the UT Health Science Center in Memphis. Although she hasn't yet decided what branch of pharmacy she wants to pursue—community, independent, or clinical—her goal is to end up in academia.
Giving opportunities

Your gifts make a difference! Over the years, we have been fortunate to receive generous donations from a variety of supporters, including former graduates. These gifts have made it possible for us to offer undergraduate and graduate scholarships. Other donations have been used for Research Incentive Awards to faculty who propose pilot projects that promise to lead to extramural grant funding from national agencies. Our generous donors have made all of these things possible.

To contribute online, please visit: bcmb.utk.edu/support-the-department and click on “Give to UT”.

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