



This Spring 2006 issue of **BMB Undergraduate Newsletter** highlights the research of Dr. Squire Booker, Associate Professor of Biochemistry and Molecular Biology. Dr. Booker earned his baccalaureate degree in Chemistry from Austin College and his Ph.D. in Biochemistry from MIT. Dr. Booker was asked the same

questions as all other faculty who have been featured in past issues of the **Newsletter**.

**Question 1: What is the immediate goal of the research being conducted in your laboratory?**

Response: The immediate goal of research in the Booker laboratory is to understand at the detailed molecular level how enzymes catalyze reactions with astronomical rate enhancements and amazing stereoselectivities. This involves a temporal dissection of bond-breaking and bond-making processes in the reaction, as well as the elucidation of the relevant transition-state structures. Our model systems are enzymes that require iron-sulfur clusters and/or S-adenosylmethionine as cofactors or co-substrates in reactions. We use a multifaceted approach to interrogate various reactions, which involves standard microbiological and molecular biological techniques, protein purification, kinetics, various spectroscopic, analytical, and biophysical techniques, and the use of substrate analogs and inhibitors of the reactions.

**Question 2: What are the possible larger implications/applications for the findings of your research?**

Response: Enzymes govern almost all of the myriad chemical transformations in the cell, and the ability to manipulate the activity of these protein catalysts has enormous implications in the pharmaceutical and industrial sectors of society. As examples, (1) methotrexate, a drug that is used for the treatment of leukemia, inhibits

the enzyme dihydrofolate reductase, which catalyzes a key step in DNA biosynthesis; (2) sildenafil, a drug that is used to treat erectile dysfunction, inhibits the enzyme 3'-5'-cyclic-GMP phosphodiesterase; and (3) papain, a common protease, is used in meat tenderizer, while a variety of proteases, cellulases, and lipases are used in laundry detergents to treat various stains. The enzymes that we study catalyze key transformations in the biosynthesis of lipoic acid and nicotinamide adenine dinucleotide (NAD), two cofactors that are nearly ubiquitous in nature and essential for cell viability. For example, one enzyme that we study catalyzes the first step in the biosynthesis of NAD in bacteria, and is absent in most eukaryotes. We hope to use what we learn about how the enzyme works to design inhibitors of it as potential antibacterial agents.

**Question 3: Why did you choose to pursue a career in academic research and why in your particular field?**

Response: I've always been a big fan of science. I had an uncle who had worked for NASA, and who was a commercial airline pilot. When I was a kid, growing up just outside of Houston, Texas, he and I would regularly visit NASA, and he'd also teach me about how the constellations were sometimes used by pilots to navigate their aircrafts. I fell in love with astronomy at the time. My interest in life science blossomed as I began to understand the impact that science has on human health and civilization in general. I was particularly interested in chemistry, originally because it was math intensive, but also because it seemed so logical. After graduating from college with a degree in chemistry, my challenge was to decide on which type of chemistry I would focus upon matriculating in graduate school. I chose enzymology, the study of enzymes, because it is very much a multidisciplinary field, combining biology, biochemistry, inorganic, organic, and physical chemistry, as well as physics. My decision to pursue academic research was fueled by the broad freedom it allows to investigate anything that one can convince the government or the private sector to fund. (**Continued on page 2**)

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**Question 4: What do you look for in selecting an undergraduate student to do research in your lab?**

Response: The qualities that I look for when admitting undergraduate students into my laboratory are motivation and enthusiasm. The training of undergraduate students is very time consuming for myself, my graduate students and post-doctoral associates, and my research scientists. No one can afford to waste time in this business; science is incredibly competitive and it moves quickly. Unmotivated students, or students who are seeking to simply add another line to their resumes make teaching more unappealing than it already is. Nevertheless, in order for our students to be competitive at the next level it is vital that we provide them with meaningful research experiences as soon as possible. I have been working with the MURE and WISER programs for several years, and have been trying to get students involved in research as early as the second semester of their first year. Ideally, however, I prefer students who have completed general and organic chemistry, and who are willing to work (with pay) during the summer. A couple of months of intensive research allow them to become independent in the lab, so that during the subsequent fall semester they can conduct their research with only modest guidance from others in the lab. My goal for every undergraduate student is for him or

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## **BMB Junior Selected for McNair Scholars Program**

The largest class of new McNair Scholars at Penn State, numbering 20 students, includes **Dieudonne Habiyareyme**, a Junior majoring in BMB. McNair Scholars prepare for graduate study through a program of seminars, workshops, and graduate school visits. Scholars are given the opportunity to engage in research and to present their findings at local and national meetings. Dieudonne will work with Dr. Surinder Chopra in the College of Agricultural Sciences on molecular mechanisms of maize genetics. He joins over 5000 other undergraduates at more than 180 institutions nationwide, all of whom are preparing themselves for graduate study through the support of the McNair Program. Dieudonne follows in the footsteps of Luis Agosto who graduated as a McNair Scholar in the Microbiology major last Spring and is currently a graduate student at the University of Pennsylvania. **CONGRATULATIONS AND BEST WISHES, DIEUDONNE!**

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## **Havin' fun.....Studyin' Abroad!**

Three students from the BMB Department have taken up the fun challenge of studying abroad for Spring semester 2006. Kathleen Carey (Micrb) is studying at the University of Sussex in Brighton, England. Elizabeth Wert (Micrb) is studying (and probably enjoying a 'down under' summer!) at the University of Sydney in Australia. Daniel Michelson-Horowitz (BMB) is spending Spring semester at the University of Seville in sunny Spain.

Have you given any thought to studying abroad? It truly is the opportunity of a lifetime. Live in another country, see the world from a different perspective, travel, make international friends – and all of it while making progress toward your baccalaureate degree. What a deal !!

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## **Cress Gives a Winning Presentation**

Christina Cress (Micrb 06) was awarded a \$200 prize for the best oral presentation by an undergraduate at the 9<sup>th</sup> Annual Environmental Chemistry Student Symposium (ECSS) held March 17-18<sup>th</sup>. The ECSS is a student-organized and student-run symposium that seeks to encourage interactions between undergraduate and graduate students and engineers who are engaged in environmental research. The Symposium is sponsored by Penn State's Center for Environmental Chemistry and Geochemistry and is held here at University Park. Christina, a Schreyer Scholar, presented her research on the ModE transcriptional repressor and its regulon in *Chlorobium tepidum*. **Congratulations, Christina!!**

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## Calinski Named Science Co-op Student of the Year!

Diane Calinski (BMB05) was selected the 2005 Co-op Student of the Year. The award is given annually to a participant in the ECoS Co-op Education Program in recognition of academic achievement and contributions to employers, the University, the community and the field of cooperative education. Diane undertook two co-op experiences. The first was at Walter Reed Army Institute of Research where she worked on the crystallization of thermolysin as a model for botulin toxin B. Her second was at SUNY at Buffalo in the Department of Pharmacology and Therapeutics at Roswell Park Cancer Institute where she worked on a new anti-cancer drug undergoing clinical trials. Diane received a \$500 award and a certificate of achievement.

## Natalie Hutnick Featured on PSU Admissions' Web Page

BMB's own **Natalie Hutnick** is one of the featured undergraduates on the Admissions Office web site. Natalie (BMB06) tells the story of how she became involved in undergraduate research as a Freshman at Penn State and where her interests took her through her undergraduate career. Under the links of *Student Life* and *Be Inspired In and Out of the Classroom*, Natalie relates the route she took to enter the laboratory of Dr. Andrea Mastro where she performed research on how exercise can affect the recovery of the immune system in breast cancer patients. Natalie presented her research at a meeting of the American Association of Cancer Research in Orlando. Natalie was also selected for the internship program at biopharm giant, Merck, in its pharmaceutical research and design laboratory. You can read the full text of Natalie's story by visiting <http://www.psu.edu/dept/admissions/whypsu/student/alresearch.htm>

## BMB Supports Heart Association

*Undergraduate Newsletter* wants to acknowledge the terrific job that faculty, staff, graduate students and other members of the BMB Department did last September in supporting the Centre County chapter of the American Heart Association in its fund-raiser walk. The Department had 29 walkers - more than any other team - and raised \$1655. In a way, the participation of these walkers represented a 'giving back' to the Association. Currently, grants from the AHA fund research efforts in the laboratories of Drs. Cameron, Reese, Schlegel and Teng.



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