

SOLUTIONS

News from the Department of Chemical and Biomolecular Engineering at the University of Tennessee, Knoxville

Volume 1, Issue 1 – Spring 2007

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CBE Welcomes New Faculty



Dr. Boder

Dr. Eric Boder will join the Department of Chemical and Biomolecular Engineering (CBE) August 1, 2007. He comes to the department from the University of Pennsylvania where he has been an assistant professor in the Department of Chemical and Biomolecular Engineering and Bioengineering since 2000.

Boder earned his Ph.D. and M.S. degrees in chemical engineering at the University of Illinois, Urbana, and was advised by Dr. K. Dane Wittrup. He holds memberships in numerous engineering organizations and has co-chaired many AIChE annual meeting sessions in the areas of protein engineering and biomolecular engineering. Boder was the invited session organizer and chair for the 1st International Conference on Biomolecular Engineering and was the PI on an NSF team for nanoscale interdisciplinary research.

In 2003, Boder received an NSF CAREER Award and was an NSF graduate fellow from 1993 to 1996. He holds four U.S. patents and has more than 18 refereed publications.

Department Head's Message

Embracing the Challenges of Tomorrow

Chemical Engineering education is at the threshold of significant changes, which have been brought about by recent advances in the life sciences and nanotechnology, as well as the looming energy crisis. We are transitioning to embrace and utilize fully these changes in order to meet global challenges in health care, the environment, renewable energy sources, national security and economic prosperity. Specifically, our educational and research focuses must be revised to emphasize biological systems and micro- and nano-structured materials, as well as sustainable energy. To this end, we have developed a strategic plan to facilitate this transition. An overview of our future directions is presented in the figure below.

Full implementation of this new paradigm requires willingness to cross boundaries in our research and teaching programs. To this end, we are in the process of instituting innovative partnerships with other disciplines at UT, such as medical, life and physical sciences, as well as with the College of Business Administration. Furthermore, we are also establishing collabora-

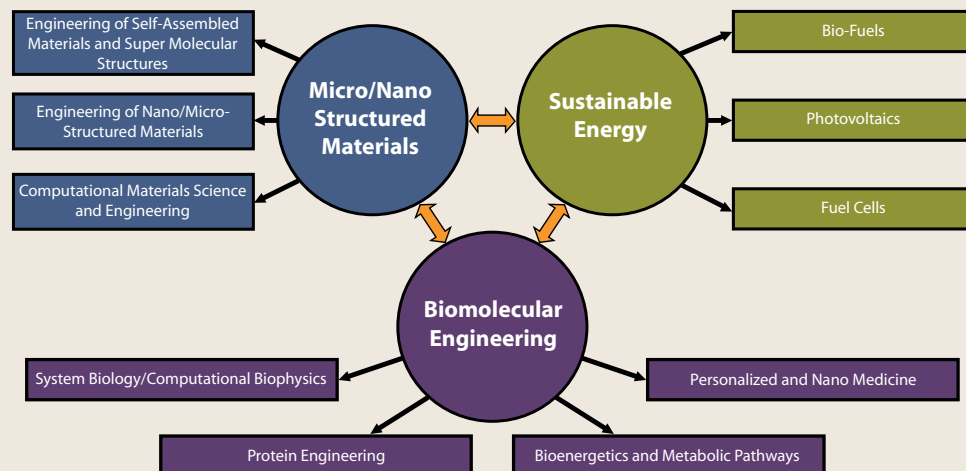
tions with nearby industries and Oak Ridge National Laboratory. In fact, we have adopted a new name, **Chemical and Biomolecular Engineering**, to reflect some of these changes.

Hopefully this brief overview has detailed the critical issues of this exciting transitional time in the Department of Chemical and Biomolecular Engineering. Please offer us your support as we begin this crucial and timely transition, in which we strive to educate students for leadership roles in the vital technologies of the future. "Graduates as leaders and innovators, not just highly skilled specialists."



Dr. Khomami

—*Bamin Khomami*
Armour T. Granger and
Alvin & Sally Beaman
Distinguished Professor and Head



UT Students Present Sustainable Energy Research Projects at National Competition

Dr. Paul Frymier accompanied a team of students to Washington, D.C., April 24-25th for EPA's "People, Prosperity and the Planet (P3) Student Design Competition for Sustainability," as part of the National Sustainable Design Expo on the National Mall in front of the U.S. Capitol Building. Chemical and Biomolecular Engineering (CBE) undergraduates LaToyia Thompson, Linda MacDonald and Nickyla Alliove, graduate student Mehrsa Raeiszadeh and biochemistry and molecular and cellular biology undergraduate Chris Lowe presented results of their two-semester design project: a hydrogen production facility for the sustainable production of a transportation fuel based on using photosynthetic micro-algae. In addition to the design study, the students demonstrated the concept in a laboratory scale version of the process.

The Annual P3 Awards competition was launched in 2004 as a response to challenges of the developed and developing world in moving toward sustainability. This national competition enables college students to research, develop and design scientific, technical and policy solutions to sustainability challenges. CBE Professor Dr. Robert Counce and Dr. Barry Bruce of the Biochemistry and Cellular and Molecular Biology (BCMB) Department, collaborated with Dr. Frymier on this project.

The P3 design competition is broken up in phases. In Phase I, students submit proposed designs and compete for \$10,000 initial funding to develop a concept into a solution suitable for implementation. The results of Phase I are then exhibited at the P3 competition for six Phase II awards of \$75,000 to further develop the solution. After completing design and experimental studies as part of their Phase I work, the UT student team joined 40 other student teams from universities across the country who received the initial Phase I grants to compete for the Phase II awards.

Although the team was not successful in winning the Phase II award, the students enjoyed the opportunity to participate in a nationally competitive research project and to share the results of their work with the public and representatives of several federal agencies present at the competition. After returning to Knoxville, the team was treated to a congratulatory luncheon hosted by Dr. Bamin Khomami.



CBE undergraduates (left to right) Nickyla Alliove, LaToyia Thompson and Linda MacDonald describe the results of their study to one of many interested visitors to their display.

CBE Department Honors and Awards



Dr. Prados

Dr. John Prados, professor emeritus of chemical engineering, received the 2007 Lifetime Achievement in Chemical Engineering Pedagogical Scholarship Award of the American Society of Engineering Education, the society's highest and most prestigious honor. Prados has devoted 50 years to chemical engineering education. He has been a leader in engineering education reform and the development of meaningful assessment criteria for academic programs through the modernization of accreditation processes to encourage innovations in engineering education. He has worked to secure the resources for development and institutionalization of engineering educational innovations as coordinator of the Engineering Education Coalitions program. He has also been a long-time proponent of ensuring engineering educational research meets the same standards of rigorous scholarship expected in scientific research through his editorship of *Journal of Engineering Education*.



▲ Associate Professor **Dr. Brian J. Edwards** (left) accepts his 2007 College of Engineering Research Fellow Award from Associate Dean Wayne Davis (right) at the COE Honors Banquet April 10, 2007. Edwards was recognized for his exceptional record of research activity and contributions to the overall mission of the college.



▲ Associate Dean Alberto Garcia (right) presents the 2007 Leon and Nancy Cole Superior Teaching Award to Associate Professor **Dr. Paul Frymier** (left) for demonstrating outstanding teaching skills, clear communication, depth of subject knowledge and the ability to motivate through effective advising and counseling.



▲ CBE junior **Jeffrey Keith Clark II** (right) was presented the 2007 Eastman Chemical Company Chemical Engineering Scholar Award by Mr. Murray Deal (left), Eastman's Vice President of Market Development, at the COE Honors Banquet.

Departmental Faculty and Staff Awards

Ms. Susan Seymour—*Outstanding Staff Member Award*

Dr. Brian Edwards—*Outstanding Advisor Award*

Dr. Tse Wei Wang—*Outstanding Teacher Award*

Dr. Brian Edwards—*Tom and Ruth Clark Chemical Engineering Excellence Award in Teaching*

Dr. Fred Weber—*Departmental Service Recognition*

CMRG Using Molecular Models to Investigate Membrane Nanostructures

Dr. David Keffer, associate professor in chemical engineering, and Dr. Brian Edwards, associate professor in chemical engineering, lead the Computation Materials Research Group (CMRG), a group of students, professors and researchers who use computational tools to understand the relationship between the molecular structure of a material and its effect on macroscopic properties and processability.

One of the Department of Energy (DOE)-funded projects Keffer and Edwards currently pursue is aimed at understanding the molecular structure of fuel cells. "The idea here is that it does not matter if your generating energy for power plants, your home or car, all these processes create CO₂ and contribute to the main cause of global warming," said Keffer. "We need to find alternative ways of generating power, and we believe fuel cells can help. However, we need to make them economically viable, which requires new material development."

In a fuel cell, hydrogen enters and is split into protons and electrons by a platinum catalyst. The electrons are carried off to do electrical work, but the protons have to complete the circuit by being transported through a membrane separating the electrodes. This is where Keffer and Edwards come in.

For over 40 years, researchers have tried to understand how the proton moves through the electrode-electrolyte interface. Because researchers do not fundamentally understand how the protons get from the catalyst particle into the membrane,

they have been unable to model it. But through their DOE grant, Keffer and Edwards have created a computer model membrane at the molecular level to look at the nanostructures that form.

"We want to see how the water wets the electrode, which gives us some idea of which of these catalyst particles can contribute to the overall power generation of the fuel cell. If we



Dr. David Keffer, one of the leaders of the CMRG, believes the group's fuel cell research could be integral to meeting the world's future energy needs.

can fully understand this procedure, it will lead to improved fuel cell membrane electrode assembly designs," said Keffer. "We're in year two of the project and making good progress. Our research is a complimentary technique. Through simulations, we can provide information alongside experiments, which enhances the understanding of fuel cells

on the molecular level and mediates the effect humanity has on the environment."

"Research in these areas is crucial to meet the energy needs of the national and global economies in the latter part of the 21st century as fossil fuels become depleted and too dangerous to continue to use," said Edwards.

Other projects Keffer and Edwards work on through the CMRG include atomistic design of lubricants for extreme environmental conditions; molecular diffusion simulation studies; multiscale simulations of bulk metallic glasses; and others through the American Chemical Society.

CBE Graduates for Fall 2006 and Spring/Summer 2007

Bachelor of Science

Jennifer Allison
Joshua Backman
Hannah Bailey
William Cosey
Jordan Edwards
Nathan Jansen
Bradley Jaquith
Min Hea Kim
Sarah Kyker

Linda MacDonald
Christopher Otuonye
Tina Stewart
LaToyia Thompson
Kate Wallen
Anne Wells
Harold Wheat
John Yates

Master of Science

Seth Bowman
Jacob Hutton
Ifeyinwa Iwuchukwu
Joy Watson

Doctorate

Bratendu Bagchi
Jiandong Zhou

Outstanding CBE Students for 2007

Sarah Kyker—AICHE Service Award

Latoyia Thompson—AICHE Outstanding Baccalaureate Award

Patrick Bowland—AICHE Outstanding Junior Award

Nickyla Alliove—Dow Outstanding Junior

Kristen Dobrodziej—Kenneth M. Elliott Outstanding Senior Awards

Jared Fern—Jim and Sandra McKinley Outstanding Graduate Student Award

Robyn Chaplin—Most Exceptional Student Award

Hillary Holback—American Chemical Society Outstanding Senior Award

Anne Wells—Alpha Chi Sigma Albert Cooper Award

Nathan Jansen—Scholar Athlete Award

Bradley Jaquith—Top Collegiate Scholar Award

Alumni News

Dr. Donald B. Bivens (BS/ChE '62) is one of three DuPont scientists recently recognized by the American Chemical Society with a *Heroes of Chemistry* Award. His team's research developed the first non-ozone-depleting alternatives to chlorofluorocarbons (CFCs). Bivens is currently a consultant for DuPont and lives in Kennett Square, Penn.

Gerald R. Hadder (BS/ChE '68) received the 2006 Society of Automotive Engineers International Award for Automotive Policy Analysis. He is retired from Oak Ridge National Laboratory and lives in Oak Ridge, Tenn.

Greg Parks (BS/ChE '78) has joined the Lyondell Company as manager of North America TiO₂ Distribution. He lives in Snellville, Ga.

Paul Horne (MS/ChE '82) is Senior Vice President of Product and Market Development for Buckeye Technologies. He lives in Germantown, Tenn.

Norman P. Pih (BS/ChE '82) is with W.L. Gore & Associates as a liaison between the intellectual property and R&D groups in the medical products division. He lives in Flagstaff, Ariz.

Department of Chemical and Biomolecular Engineering Faculty


Paul R. Bienkowski Professor
Duane D. Bruns..... Associate Professor
Robert M. Counce Professor
Shengting Cui..... Research Assoc. Professor
Brian J. Edwards Associate Professor
Paul D. Frymier Associate Professor
David J. Keffer..... Associate Professor

Bamin Khomami Professor and Dept. Head
Charles F. Moore..... Professor Emeritus
Simioan Petrovan.... Research Assoc. Professor
John W. Prados Professor Emeritus
William V. Steele Adjunct Professor
TseWei Wang..... Associate Professor
Fred E. Weber..... Associate Professor

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CBE Calendar of Events

2007

Classes Begin Aug. 22
Labor Day Holiday Sept. 3
Fall Break Oct. 11-12
Engineers Day Oct. 18
Homecoming Nov. 3
Thanksgiving Nov. 23-24
Classes End Dec. 4
Fall Commencement Dec. 16

2008

Classes Begin Jan. 9
King Holiday Jan. 21
Spring Break Mar. 14-21
Classes End Apr. 25
Spring Commencement May 9

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