

The Catalyst

An annual newsletter for alumni and friends of the University at Buffalo's
Department of Chemical and Biological Engineering

What's Inside

Fall 2011

Who delivered the 3rd Ruckenstein Lecture?
 Page 2



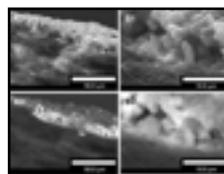
Awards and recognition
Faculty and students are honored for their achievements.
 Page 8



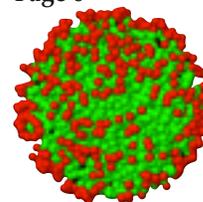
Transitions
 Page 3



Research advances
CBE applies chemical engineering principles to expand the frontiers of nano and biotech.
 Page 4



Tools for teaching
Molecular simulation aids students to understand thermo, transport and kinetics.
 Page 6



Fun and games
Chemical engineering faculty and students find time to relax a bit.
 Page 11



CBE Slated for Significant Growth

Major legislation signed by Governor Cuomo in August (pictured at right) is expected to have a “transformative impact” on UB, and CBE in particular. New York State understands that difficult economic times provide even more reason to invest in its educational infrastructure. Part of the legislation will allow UB to increase its tuition by \$300 annually for the next five years, thereby rising to \$6500/year. This extra revenue will be targeted largely at growing faculty numbers, and it is expected that UB will add 300 faculty in all. About six or more of these faculty will go to CBE, increasing our number from 17 to 23. Such rapid growth can present problems as well as opportunities, and we are conducting careful planning to ensure that space, instrumentation, staff, graduate students, and other needs will be met for these new recruits. Significant space for the expansion will be freed up in Furnas Hall as the result of a series of moves related to the opening of Davis Hall, the new home for the Electrical Engineering and Computer Science departments. Substantial funds are now being allocated toward the renovation of our existing



and new space, which will be a task comparable in scope to the opening of a completely new building for our labs.

MESSAGE FROM THE CHAIR



I'm writing to you from this space for the last time. My second 3-year term as Chair will be complete next summer, and after that I'll be stepping back ~~down~~ up to the ranks of the regular faculty. CBE will certainly be left in good hands, as Prof. Stelios Andreadis will be taking on the Chair duties when I'm done.

Any time I'm asked, I always say how lucky I have been to serve as Chair of such a great department, with faculty, staff and students who are so collegial, and so devoted to the mission of generating and disseminating knowledge. I've also been fortunate to serve with a terrific university administration, who have made clear the importance of Engineering, and CBE in particular, in the future of UB.

These auspicious circumstances have made my tenure as chair rather eventful. We hired eight new faculty since 2006, including two members of the NAE, while losing three to retirement or departure. We started a campaign to endow the Ruckenstein Fund, and applied it to a form a new lecture series, now in its third year. Our graduate research symposium has outgrown Furnas Hall. Research expenditures have increased by 50%, and our undergraduate and graduate class sizes have both doubled.

And believe it or not, even with all that has happened in the past six years, today it truly seems that the best is yet to come. Exciting developments are on the horizon, and we hope to report on them to you next year. Until then, please enjoy this year's issue of The Catalyst!

Sincerely,

David Kofke

Pablo Debenedetti delivers the 3rd annual Ruckenstein Lecture

The Eli Ruckenstein Lecture Series continued this spring, bringing another distinguished Chemical Engineer to UB on Tuesday, April 19.

Pablo G. Debenedetti, Vice Dean of the School of Engineering and Applied Science at Princeton University, spoke with faculty, industry professionals, and students about research advances and ideas on the subject of hydrophobicity. Dr. Debenedetti's visit provided an opportunity for the Department of Chemical and Biological Engineering to showcase its education and scholarship activities to one of the leaders in our field, while providing students here with exposure to state-of-the-art developments in chemical engineering research.

Alumni and industry support of the Eli Ruckenstein Fund and its Lecture Series has enabled further growth and advanced the stature of the UB CBE department, while also fostering dialog that will lead to new directions for advancing the field of chemical engineering. Our profession has proven its value to society many times over, and we hope to continue to do so through scholarship and innovation that are promoted by this and other activities.

Pablo Debenedetti's research interests include the thermodynamics and statistical mechanics of liquids and glasses; the structure and thermodynamics of water and aqueous solutions; protein thermodynamics; the theory of nucleation; and metastability. He is the author of one book, *Metastable Liquids*, and more than 200 scientific articles.

Among numerous professional honors, Debenedetti was named one of "100 Chemical Engineers of the Modern Era" by the American Institute of Chemical Engineers, and he is a member of the National Academy of Engineering and the American Academy of Arts and Sciences.

Dr. Debenedetti's lecture abstract and a photo gallery of the event can be found at www.cbe.buffalo.edu/ruckensteinlecture



CBE welcomes two new faculty



This year we welcomed two new faculty to the department. In January, **Edward Furlani** joined us, appointed jointly as a Professor in CBE and Electrical Engineering. His interdisciplinary research applies computational physics and modeling to the development of innovative materials and devices that are

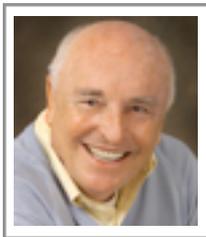
engineered at the nanometer to micrometer length scale, with uses that include microfluidics, MEMS, photonics, electro-optics, sensors and magnetic devices. Dr. Furlani came to us from the Eastman Kodak Research Laboratories, where his research led to 150+ patents and the commercialization of numerous products. Upon joining CBE, Dr. Furlani developed a new elective on applied mathematics in chemical engineering; the course is already popular and is currently under consideration for adoption as a CBE BS degree requirement.



Blaine Pfeifer joined CBE as an Associate Professor this fall, coming from a prior appointment at Tufts. Dr. Pfeifer conducts research in metabolic engineering, where he seeks to influence genetic, metabolic, cellular, and process events required for the production of a therapeutic product. He strives to

produce compounds and processes targeting diseases that include cancer, bacterial infections, and diabetes. One approach taken is to transplant the genetic material responsible for an important therapeutic product into a convenient and process-friendly bacterial microorganism (such as *E. coli*) for eventual product scale-up and development. Dr. Pfeifer's teaching duties include the sophomore materials & energy balances course, and a graduate elective on metabolic engineering.

Remembering Vladimir Hlavacek



1939-2010, *Vladimir Hlavacek, PhD*

by Prof. Jan Puszynski
South Dakota School of Mines

In November 2010, Dr. Vladimir Hlavacek, professor emeritus, passed away at the age of 71. Professor Hlavacek joined the State University of New York (SUNY) at Buffalo in 1981 as a professor of chemical engineering as a world-recognized leader in the field of reaction engineering. Professor Hlavacek's received his B.S. degree from Charles University in Prague in applied mathematics, and M.S. and PhD. from the Institute of Chemical Technology in Prague in chemical engineering. He began his career in the Institute of Chemical Technology in Czech Republic (former Czechoslovakia) where he built a very strong research program in the area of mathematical modeling of chemical reactors. His contribution to this field resulted in the publication series consisting of more than thirty consecutive papers in the Chemical Engineering Science journal. In 1970s he also served as an associate editor for Eastern Europe of this journal. Since the arrival at SUNY/ Buffalo he continued his modeling research but at the same time he expanded his interest into combustion synthesis of advanced ceramics, computer-aided design of chemical operations and formulation and performance analysis of energetic materials. Dr. Hlavacek published hundreds of peer-reviewed papers and presented numerous papers and invited seminars at national and international conferences and academic institutions. He co-authored one book with his former PhD student, Professor Milan Kubicek, on Numerical Solution of Nonlinear Boundary Value Problems with Applications. He also published another book on Dynamics of Nonlinear Systems. During his career, he co-authored several patents.

In 1991, Dr. Hlavacek was recognized by UB and he was named Clifford C. Furnas Eminent Professor of Chemical Engineering. In 1989, he was also recognized by the AIChE with the R.H. Wilhelm award. In 2002, Professor Hlavacek received Honorary Doctorate of Chemical Sciences from the Slovak Technical University in Bratislava, Slovak Republic. He also was recognized by NASA, Office of Naval Research, Fulbright and Humboldt foundations and AIChE. Professor Hlavacek served as a consultant to several companies, Los Alamos National Laboratory, U.S. Army and U.S. Navy. In 1989, he established Ceramic and Material Processing Company, which was involved in consulting and R&D activities for the Department of Defense. Professor Hlavacek educated hundreds of chemical engineers and mentored dozens of graduate students and postdoctoral fellows. Many of his former students are working as faculty members at many universities or successful researchers in well recognized companies in the United States and around the world.

In his private life, Dr. Hlavacek was a prominent fisherman who, with his fishing rods, navigated waterways on all continents. He had also another passion of collecting antique China porcelain.

Professor Hlavacek left behind his devoted wife, many former students, colleagues and friends.

Definitely, we all will miss his wisdom, knowledge and sense of humor.

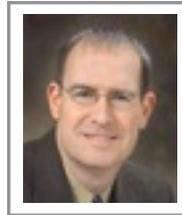
Darlene Innes retires

An era has ended for CBE. Darlene Innes' career here started right after graduating high school, and through her talent, good nature, and terrific work ethic, she eventually rose to the position of Assistant to the Chair. Her efforts impacted every aspect of the department's operation, and faculty, staff, and students alike relied on and appreciated her ability to get things done, and done well. After more than thirty years of loyal service to UB, Darlene is now focusing on family and friends, gardening and cross country skiing with her husband Bob—also recently retired from UB. Best wishes Darlene!



Errington promoted

Jeffrey Errington has received a well-deserved promotion to the rank of Professor. Errington is an expert in molecular simulation and statistical thermodynamics, and he focuses his expertise on problems involving interfacial and confined systems, and on elucidating the link between molecular structure and dynamics. Errington has also been an extremely active Director of Undergraduate Studies for CBE. He led sweeping changes to the content and the implementation of the program, and in doing so has positioned CBE as a model for undergraduate programs. Errington has been a faculty member at UB since 2001, and he received his BS degree here. He earned his doctorate from Cornell in 1999 and he conducted post-doctoral research at Princeton. In 2003, Errington was awarded a prestigious NSF Faculty Early Career Development Award. More on Errington's accomplishments can be found at www.cbe.buffalo.edu/errington.



New Staff Arrive

We are happy to welcome **Joan Wilson** as CBE's new Assistant to the Chair. Joan came to CBE from WBFO, UB's NPR station, and prior to that, worked in UB's Human Resources department. In her new role, Joan maintains financial records, tracks statistical data, handles external affairs, website content, special events, and assists the chair in day-to-day administrative duties.



Marlo Kerr has joined CBE's administrative support team as our new Academic Coordinator. Marlo earned a BS ('03) in Business Administration from UB and a MS in Education from Canisius College ('06). She has experience teaching high school business and she worked in academic advising for UB's undergraduate program in Biomedical Sciences. She is currently pursuing a MS in Higher Education Administration at UB.



other news on departures on page 9

Top 10 reasons Darlene retired

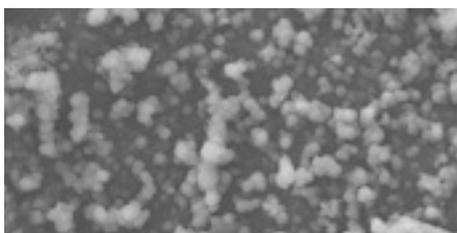
10. It finally dawned on her that Carl Lund is no longer the Chair.
9. Still smarting from not winning "best pot-luck dish" at the 2010 Fall picnic.
8. She found out what the next service pin looked like and figured it was no longer worth it.
7. Now topping \$9/year, campus parking has gotten too darn expensive.
6. She learned from Irene's retirement last year that it's a good way to get your photo in *The Catalyst*.
5. Filling out IFR forms has finally lost its novelty.
4. Disappointed that the 2010 Ruckenstein Lecturer (George Stephanopoulos) wasn't that guy from TV.
3. Um, maybe it was that big ol' retirement incentive.
2. The department just isn't the same without Irene.
1. She deserves to.

Research Highlights

CBE's strengths in nanotechnology, biological engineering, and computational science are well aligned with the University's and the Nation's priorities

Humic growth studies

UB CBE Distinguished Teaching Professor and past CBE chair **Carl Lund** spoke at the 2011 Engineers for a Sustainable World National Conference at UB in October. The conference theme was *Green Tech: Sustainable Cities in the 21st Century*. The goal of the conference was to create "a world in which engineering fosters environmental, social and economic sustainability to improve both the quality of life and the condition of our planet." Lund's topic was *Reducing Waste Byproducts of Cellulose Hydrolysis*. Cellulose is an abundant, non-food component of biomass, making it an attractive feedstock for the production of fuels and chemicals. When cellulose is treated with a mineral acid, it de-polymerizes forming glucose, which then continues to react to form levulinic acid. Levulinic acid is a platform chemical that can be converted into a variety of useful chemicals, fuels and fuel additives. Unfortunately, not all of the cellulose is converted to levulinic acid; some of it turns into a dark-colored, tarry substance called humic



SEM image of humins formed from fructose showing that addition of formaldehyde leads to more uniform particle sizes

material or humins, which have very little economic or practical value. Dr. Lund's presentation described experimental research to understand how humins grow and form, process modifications that reduce the amounts formed during hydrolysis, and it showed that the same reactions that are responsible for humin growth may eventually be used to modify and convert them into higher-valued products.



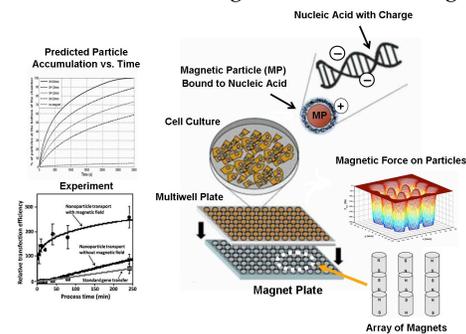
ChE principles toward understanding transport through skin

Johannes Nitsche uses a computer model analyzing drug diffusion around a hair follicle. His theoretical research on skin permeability is elucidating the pathways, mechanisms, and rates by which different molecules are absorbed through skin. His work directly impacts the development of transdermal drugs, and the assessment of risks associated with chemical exposures in the workplace and other settings. Nitsche explains, "You could have a great drug and know

exactly what dose you want in the bloodstream — that's a pharmacological question. But what concentration and formulation you need in a patch to achieve what you want in the bloodstream — that's a complicated physical problem in diffusion that a chemical engineer is ideally suited to solve. Similarly, the actual danger posed by a chemical depends partly on its toxicity, but also largely on the extent it can penetrate into the body. Transport of molecules from point A to point B is an important part of any medical problem. Transport is where I enter the picture." Following an important mechanistic theory of steady state barrier permeability, the most recent areas of his research focus have been the impact of molecular binding to skin proteins on rates of absorption, drug/ chemical diffusion in epidermis below the surface barrier, and hair follicles as short-cut pathways through this barrier. Nitsche's project began over a decade ago with a sabbatical leave at the Procter & Gamble company. The research has appeared in the *Journal of Pharmaceutical Sciences*, *Chemical Engineering Science*, and elsewhere. Nitsche's collaborators are Professor **Gerald B. Kastig** (University of Cincinnati) and Dr. **H. Frederick Frasch** (National Institute for Occupational Safety and Health).

Bioapplications of magnetic particles

Magnetic particles are proliferating in fields such as microbiology, biotechnology and nanomedicine. These particles can be functionalized to bind to target biomaterials such as proteins, antigens, DNA and whole cells, and once bound, they can be manipulated using an external magnetic field to enable accelerated transport and controlled steering of the target materials. **Ed Furlani** has developed models for predicting the transport of magnetically tagged biomaterial for applications such as *in vivo* drug delivery for cancer therapy, and microfluidic-based bioseparation for diagnostics. Most recently, he and CBE student **Xiaozheng Xue** have modeled magnetofection, a process in which magnetic particles with surface-bound gene vectors are magneti-



cally attracted to target cells to enable transfection as shown in the figure. Magnetofection is performed using conventional multiwell culture and magnet plates. Target cells are located at the bottom of the wells and rare-earth magnets beneath the wells provide a magnetic force that attracts the particle-gene vector complex towards the cells. Furlani has developed models to predict the magnetic force on the particles, their transport dynamics and accumulation on cells. He is using the models to determine the feasibility of scaling the process to the microscale, using microfabricated multiwell systems to achieve enhanced performance. This work will appear early next year in *Pharmaceutical Research*.

Nanotechnology for energy storage

Esther Takeuchi and collaborators have shown that when carbon nanotube substrates are employed as novel cathode supports, they provide opportunity for 20-60% cathode energy density improvement, by replacement of conventional inert materials. Lighter weight and longer life batteries for electrochemical energy storage are needed for many applications including transportation, portable electronics, and biomedical devices. Gravimetric energy density and cycle life considerations are especially important for aerospace applications, where lithium-ion can afford significant mass and volume advantages over alternative Ni-Cd and Ni-H₂ battery technologies. Conventional lithium-ion battery cathodes are prepared from mixtures of carbon (conductive additives), polymer (binder), and active material particles which are coated onto metallic foils (current collector) to form composite electrodes. Inclusion of inert materials as part of the battery electrode significantly decreases energy density as they contribute to the weight and volume of the electrode, but not to its energy content. The team's work demonstrates the viability of using novel metal oxide/carbon nanotube substrate (CNT-S) electrodes in rechargeable cells. The researchers believe this to be the first reported use of CNT-S for lithium battery cathodes without the use of a supporting metal current collector. Calculations show that the use of CNT-S can increase the cathode specific capacity by 20–60%, due to the low mass of the CNT-S and elimination of binders and other inert conductive carbons typically added to conventional composite cathodes on foil current collectors. This

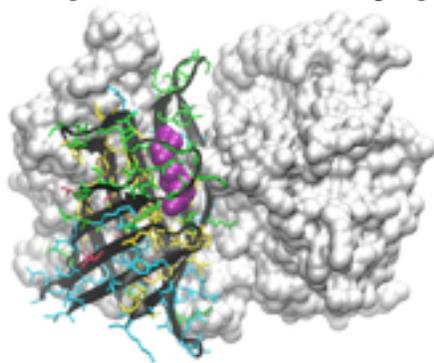


Conceptual image of vanadium-oxide/carbon-nanotube electrode, showing substrate-integration method with low active-material loading.

work has appeared in *Energy & Environmental Science*. Co-authors on the paper are Prof. **Kenneth Takeuchi** of Chemistry, as well as Research Assistant Professor **Amy Marschilok** and CBE PhD graduate students **Chia-Ying Lee** and **Aditya Subramanian** (MS CE '11).

Biomolecular engineering breakthrough

Sheldon Park has succeeded in engineering of monomeric form of streptavidin. Streptavidin is a bacterial protein that binds to biotin (vitamin H) with an extraordinarily high affinity. This behavior enables numerous biotechnology applications based on the interaction. However, mature streptavidin needs four identical subunits arranged in a locked position for folding and function. Although the protein has been known for nearly 30 years and its structure was determined over 20 years ago, there has been limited progress



Engineered streptavidin monomer is shown in a ribbon diagram with licorice side chains while the remaining three subunits are in white surface. Bound biotin is colored purple.

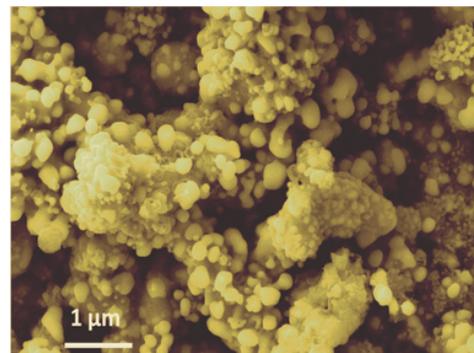
in terms of altering its assembly. With his student **Kok Hong Lim**, Park has spent much of past five years trying to figure out how to “monomerize” streptavidin without losing stability or function. The streptavidin monomer that they recently designed, which is far more stable and functional than any other monomer that has been reported in the past, is expected to vastly simplify live cell imaging. Lim and Park are collaborating with groups at the Hauptman Woodward Institute, Harvard University, and the University of Bordeaux, France, to further elucidate the biophysical properties of the molecule. The work was initially reported in *Biochemistry* and is under review at another journal. The designed monomer is being patented.

UB-Praxair collaboration leads to new technology and a new grant

In collaboration with researchers from Praxair, Inc., the group of **Mark Swihart** has developed a new technology for producing nanoparticles of copper, silver, palladium and other metals and their alloys. These nanometals have potential applications in areas including printed electronics, high-performance soldering, catalysis, antibacterial coatings, and hydrogen storage and separation.

Initial research was funded by Praxair and carried out in collaboration with Praxair researchers, Dr. **Vasilis Papavasiliou** and **Perry Pacouloute** (M.Eng. 2009). Mr. **Raymond Buchner**, a Praxair retiree who volunteers in the Swihart group, also made key contributions to reactor development and construction. The first peer-reviewed scientific publication on this work, entitled *A High-Temperature Reducing Jet Reactor for Flame-Based Metal Nanoparticle Production*, appeared in 2010 in the journal *Aerosol Science and Technology*. Dr. **William Scharmach** (Ph.D. 2011), first author on that paper, completed his doctoral dissertation on this project and is now employed full-time at the Praxair R&D Center in Tonawanda, NY.

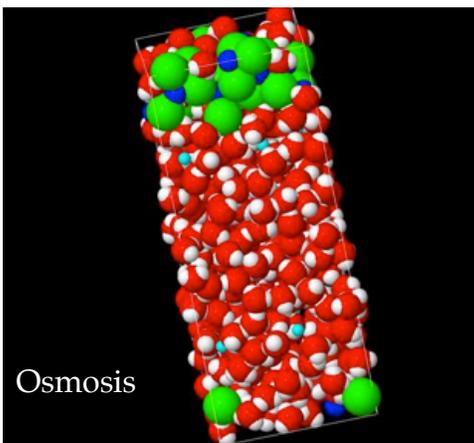
Since March, 2011, the work has been supported by a new 3-year grant from the NSF's Grant Opportunities for Academic Liasons with Industry (GOALI) program and Process and Reaction Engineering program. Recent advances have included the production of multicomponent metal nanoparticles, and the direct deposition of metal nanoparticles onto substrates to create nanostructured metallic thin films.



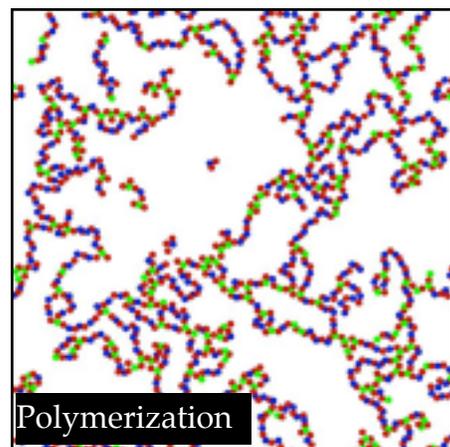
Colorized scanning electron microscopy image illustrating the microstructure of a particular copper-silver bimetallic nanostructured thin film.

Molecular simulation as a tool for teaching

Although we experience the world around us as a continuum, we know it is all made of discrete atoms that exist on the scale of Angstroms. Amazingly, the practice of engineering is often able to ignore all of this detail, and accomplish many useful things using the comparatively blunt tools of thermodynamics and continuum mechanics. The cost of doing this is a glossing over of the fundamental reality governing the behavior of material systems. Thus, as part of their training, engineers are forced to develop new in-



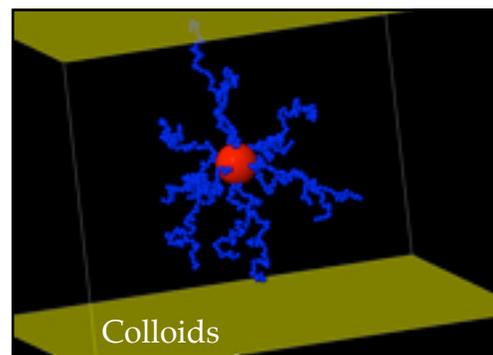
tuition to guide their thinking, adopting ideas such as entropy that have no analog in their prior experience. Now, with the emergence of nano- and bio-technology as the new frontiers of knowledge, engineering is undergoing a revolution. Engineers are increasingly required to delve into this microworld, acknowledge the molecules more completely, and thereby develop an intuition suitable for engineering at this scale. However, it is difficult to present educational experiences



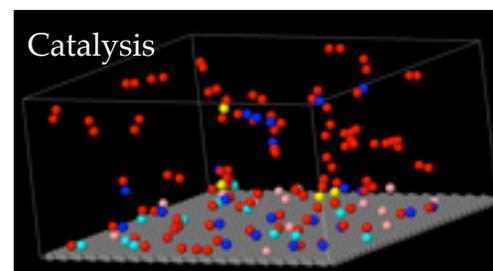
that foster intuition of the microscopic world—it is not feasible to devise a broad array of affordable experiments that manipulate and probe materials in molecular detail. So how can educational methods keep up with these changes?

Molecular simulation is the application of computers to calculate properties of materials defined in terms of a molecular model. The complexity of behavior that can emerge from even simple molecular models gives molecular simulation much of the character of an experiment. Yet it is an experiment in which the full detail of the microscopic world is open to examination and manipulation. Students of molecular simulation often find satisfaction from the insight they gain on the microscopic origins of molecular behavior. Simulation allows for a better understanding of commonplace but nonetheless quite abstract concepts such as temperature, viscosity, surface tension, *etc.* Simulation shows clearly how these properties emerge from the collective motion of many molecules, each interacting with its neighbors in an intuitively understandable way. Consequently simulation can indeed be a superb tool for developing intuition about the molecular origins of macroscopic behavior.

David Kofke and Research Assistant Professor **Andrew Schultz** have recently completed an NSF/CACHE-funded project to develop molecular simulation as a tool for learning. The project led to the development of 12 instructional “modules” that use simulations to explain the molecular origins of abstract concepts in thermodynamics, transport, kinetics, and materials engineering. Each module consists of an interactive, graphically-oriented molecular simulation programmed in Java (some screenshots shown here), and written supporting material which provides an introduction to the concepts demonstrated by the applet. There are also examples describing the use of the simulation, and exercises suitable to use as homework assignments.

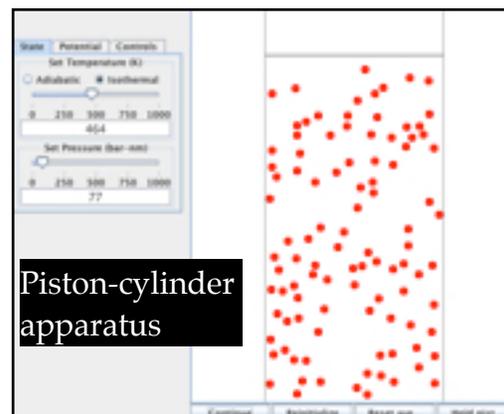


In an interesting twist, ideas for the modules came from the science and engineering community. Proposals for module ideas were solicited, with the best selected for development. Those proposing the modules were then tasked with assisting production of the documentation. This led to a much broader variety of module ideas, and it had the added benefit of ensuring interest in the module at other educational institutions.



Assessment of the modules was done by Prof. George Bodner of Purdue University, and indicate that the modules are effective in helping students learn the concepts, and are popular with them too.

You can try them yourself. Visit modules.etomica.org and have a look!



Illustrating here the GUI-based simulation controls

Takeuchi in National Inventor's Hall of Fame

The accolades for **Esther Takeuchi** continue to accumulate. After last year's news that she was recognized by President Obama with the National Medal of Technology and Innovation, we are happy to report that Esther's accomplishments have this year been honored by the National Inventor's Hall of Fame. She is now one of only nine living inductees, earning more patents than any other woman in the U.S.—148 at last count and growing—most of them related to her pioneering development of sophisticated power sources for implantable devices, now a booming multibillion-dollar business. Takeuchi developed the battery that enabled implantable cardiac defibrillators (ICDs). ICDs are the leading therapy for treating serious cardiac arrhythmia, with more than 300,000 lifesaving devices implanted per year. There was no prior battery technology that could provide the essential energy needed to bring ICDs from concept to reality. A UB faculty member since 2007, Takeuchi has been conducting research targeted at creating special energy storage solutions for special circumstances. "This is an exciting time to be working in energy," says Takeuchi. "On the human level, there is a multitude of currently intractable medical conditions that could be addressed by electrotherapy, ranging from cardiac-rhythm issues to neurological disorders to paralysis to epilepsy to chronic pain. On the societal level, batteries could revolutionize transportation and grid-level energy storage, liberating us from dependence on fossil fuels and bringing us closer to a sustainable energy future. All of this is possible with new approaches to harness the delicate and microscopic interactions of molecules with electrons." During her tenure at UB, she has been an inventor on two patents to date. "Patents are one of the things that drive me," says Takeuchi. "I have this belief that what we are doing in the lab should

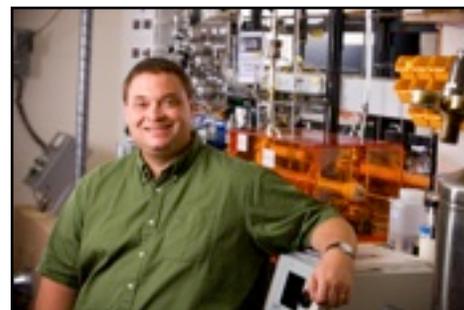


Prof. Takeuchi at the induction ceremony, flanked by USPTO Director David Kappos (left), and Edward W. Gray, Jr., Chairman of the National Inventors Hall of Fame.

have a direct impact on human lives. Fundamental research is the basis, but for me, thinking about that next step is also important." Universities are beginning to understand that patents are as important to academic success as the more traditional measures, such as peer-reviewed publications and external funding, Takeuchi says. She notes that inventions that occur at a university can provide the core ideas to launch new companies if the initial funding is available, companies that can play a significant role in driving the future U.S. economy. But the pipeline of innovation that patents represent could be threatened, Takeuchi says, by the continued lack of diversity in science and engineering. "Individuals with different backgrounds and distinct perspectives are the core of innovation," she says. "What is considered creativity on the part of an individual may, in fact, be a different perspective. By not involving huge segments of society, such as women, we lose out on potential progress."

Nigerian commission partnering with UB to build nanomedicine research capacity

Mark Swihart, Professor, Director of Graduate Studies, and Director of the UB2020 Strategic Initiative in Integrated Nanostructured Systems (INS), helped develop the recent NANO agreement, a CBE Nigerian commission partnership with UB to build nanomedicine research capacity. The National Universities Commission of Nigeria selected UB's Institute for Lasers, Photonics and Biophotonics (ILPB) as its partner to form the Nigerian American Nanomedicine Organization, which will establish joint research centers in Nigeria and at ILPB. Establishment of NANO represents the culmination of an effort led by **Folarin Erogbogbo**, a UB chemical engineer who grew up in Lagos, Nigeria, earned his undergraduate and doctoral degrees at UB, and is now research assistant professor and group leader for cancer nanotechnology in the ILPB. The project focuses on a new generation of biocompatible, silicon-based nanomaterials that Erogbogbo has developed based on research begun with Mark Swihart, when Swihart was his doctoral advisor. The goal is to develop nanomaterials for the *in vivo* and *in vitro* diagnosis and treatment of human diseases, especially cancer. The organization will be headed by Paras N. Prasad, ILPB Director and SUNY Distinguished Professor.



Prof. Swihart in his laboratory

Summer Research in Africa

This summer, CBE Junior **Jonathan Cole** (pictured at right) participated in a Research Experiences for Undergraduates program with Case Western University to study sustainable energies, particularly solar, in Botswana. The program was in collaboration with the University of Botswana and lasted for four weeks, in which time Jonathan and his colleagues completed experiments examining the effectiveness of different solar panel thin films. Botswana is an ideal location for solar power usage because of the amount of sunlight received there year round and because of the high cost of setting up electrical lines to outlying villages. Abstracts from the experiments were accepted for presentation at the Africa Materials Research Society conference in Victoria Falls, Zimbabwe on December 11-16. During his stay in Botswana, Jonathan and the other participants visited many sights, including nature parks, game drives, a cultural village, and Jwaneng diamond mine. They also took a three day safari trip to Kasane, a beautiful location on the northern border of Botswana, and took a day trip into Zimbabwe to Victoria Falls.



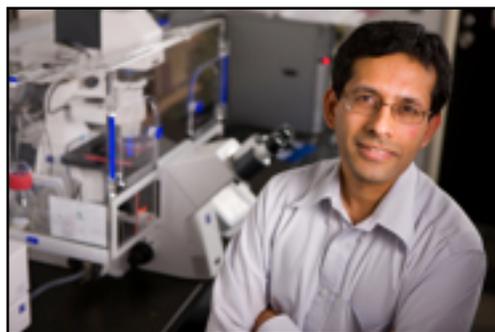
Alexandridis accorded Visionary recognition

UB Distinguished Professor and Acting Associate Dean for Research and Graduate Education **Paschalis Alexandridis** and his industrial partner



Global EIS were recognized as Visionaries at the 2011 Inventors and Entrepreneurs Reception on March 29, 2011. They were honored for their collaborative work in controlled synthesis of nanocrystals and nanoparticles by a gas-emulsion process, and controlled synthesis of polymorphic nanostructures using templates.

Exceptional Scholar Award



Sriram Neelamegham, Professor in Chemical and Biological Engineering and Biomedical Engineering, was honored in April with Exceptional Scholar Award. Dr. Neelamegham won in the category of Sustained Achievement, based on his body of work over a number of years. His research work has “garnered public and professional accolades beyond the norm”, according to award criteria. He was honored at a ceremony in September as part of the fall Celebration of Faculty and Staff Excellence.

Dawn Townsend recognized for service excellence

Graduate Secretary **Dawn Townsend** received 2011 Chancellor’s Award for Excellence in Service for CBE Graduate Admissions.



The Chancellor’s Award for Classified Service honors employees in the classified services who have demonstrated exceptional achievement and superior per-

formance of duties. Dawn Townsend began working at UB in 2002 as the graduate admissions secretary in the Department of Chemical and Biological Engineering. She became graduate secretary in 2006, assuming as duties appointment processing and helping students with their obligations outside the classroom, including ensuring they register for the right courses and complete the appropriate paperwork related to their degree. CBE Chair, Professor David Kofke noted that Townsend’s interactions with so many potential students make her the face of the CBE department. Kofke called her “a trusted advisor and advocate” for current students.

Ruckenstein’s third volume

Eli Ruckenstein will be publishing a third collection volume, with coauthor Dr. Haiyou Wang, this time focusing on his work in catalysis: *Contributions to Heterogeneous Catalysis, Experimental and Theoretical Studies*.

Excellence in Scholarship

Paschalis Alexandridis received the 2011 SUNY Chancellor’s Award for Excellence in Scholarship and Creative Activity, recognizing outstanding academic and creative achievements across a broad spectrum of scholarly and artistic fields.

Alexandridis is a double Chancellor’s Award winner, having been the recipient of the award for excellence in teaching in 2006. He began his career at UB as an assistant professor in 1997 and was named a UB Distinguished Professor in 2009. He has served on the Faculty Senate and the University Faculty Senate Graduate and Research Committee. Alexandridis’ research aims to create and manipulate molecular organization at the nano-scale and organization at the micron-scale of nano-objects. His expertise has a wide range of applications in pharmaceuticals, coatings, inks and thermoplastic elastomers. He holds six patents and has published two books, as well as dozens of articles in peer publications. Last fall, he was named the recipient of the Jacob F. Schoellkopf Award, given annually by the Western New York section of the American Chemical Society in recognition of out-

standing work and service in the fields of chemistry or chemical engineering.

Woman of Distinction

Amy Marschilok, Research Assistant Professor for CBE and EE, was recognized as a Woman of Distinction by the Girl Scouts of WNY in the Education Category.



Amy was one of only nine women in Western New York to be honored for their strength of character, commitment to community service and dedication to mentoring girls and young women.

Swihart noted for invention

Mark Swihart was celebrated as one of twenty UB faculty who are inventing and patenting new products and discoveries, commercializing research and developing startup companies during the 2011 Inventors and Entrepreneurs Reception held during the spring semester. In 2010, twenty patents were awarded to UB faculty covering a broad range of research topics. Swihart was named along with his interdisciplinary co-inventors on patent 7,767,226, *Calcium Sulfate Based Nanoparticles*.

Ruckenstein recognized as Fellow

Eli Ruckenstein was recently elected as a Fellow of American Nano Society American, the largest scientific society exclusively serving the nanotechnology community both nationally and internationally.



Professor, Student of the Year

The student chapter of the AIChE held their end of the year banquet at the Pearl Street Grill and Brewery on April 29. One of the highlights of the banquet was the presentation of the Professor of the Year and Student of the Year. This year’s selections were **Mark Swihart** as Professor of the Year, and senior **Brandon Wing** as 2011 Student of the Year. Winners were presented with plaques and gift cards.

Student recognitions

Ryan Barton, WNY AIChE Outstanding Senior Award; **Karl Barber**, WNY AIChE Outstanding Junior Award; **Peiwen Chen**, ACS Outstanding Senior Student Award; **Christopher Owen**, **Andrea Belair**, **Joseph Ferrar**, **Vijay Singh**, and **Jonathan Cole**, CBE Academic Excellence Awards; **Ivie Aifuwa**, **Jonathan Cole**, **Belle Cunningham**, and **Mark Falinski**, Dean's Scholars; **Rohitesh Gupta** and **Yongjia Fan**, Graduate Dean's Scholars; **Michelle Reelee**, the Matthew R. Grapone Book Award; **Ankitkumar Fajalia**, **Yukun Li**, and **Nandina Mondal**, Graduate School Ambassador Award; **Ivie Aifuwa** and **Shaun Setlock**, James W. and Nancy A. McLernon Engineering Scholarship; **Megan Hann**, The Samuel R. McLernon and the Nancy Stillwell McLernon Memorial Scholarship; **Ivie Aifuwa**, **Andrea Belair**, and **Shuen Shivan Wang**, Senior Scholar Award; **Hila Dvora** and **Katherine Shaul**, Schomburg Fellowship; **Angelica Corby** and **Kristina Kolp**, Felix Smist Scholarship; **Daniel Salem**, AIChE Donald F. Othmer Sophomore Academic Excellence Award; **Ryan Green**, Robert B. Kleinschmidt Memorial Scholarship; **Alecia Bernard**, S-STEM and Bridge to Doctorate Graduate Fellowships. Many of the awardees appear in the photo below.



Rob Morrow was awarded the 2011 Donald F. & Mildred Topp Othmer National Scholarship Award. Each year, fifteen national AIChE student members receive a scholarship of \$1000. Awards are based on academic achievement and involvement in student chapter activities, and nominations are made by the student chapter advisor.

Two CBE graduate students were recipients of the SEAS Recognition for Significant Scholar Contribution for the academic year 2010-1022 were:

R.M. Padmashali from the Andreadis group for the paper *Engineering fibrinogen-binding VSV-G envelope for spatially- and cell-controlled lentivirus delivery through fibrin hydrogels*. Roshan has worked on both basic science as well as development of novel technologies for lentivirus gene transfer. Specifically, he made significant contributions in understanding intracellular pathways affecting lentivirus-cell interactions. He also developed a novel method to immobilize lentivirus on hydrogels for engineering microarrays to monitor gene expression dynamics in real-time. He is currently developing a library of lentiviral vectors carrying tissue specific promoters to monitor stem cell differentiation.



Kok Hong Lim was also recognized, for his work with Sheldon Park described on page 5, and in more details in the publication *S. Biotin-assisted folding of streptavidin on the yeast surface*, which is currently in press in the journal *Biotechnology Progress*.



Zhiqi He has received a Presidential Fellowship for the 2011-2012 academic year. This fellowship is intended for exceptional graduate students who are commit-

Are you an alumnus with some news? We (and your classmates) would love to hear from you! Please send us any updates about the goings-on in your life and career. Submit your information at the News from Alumni link found at: www.cbe.buffalo.edu/alumni.

ted to doctoral studies at the University and who, in the estimation of the faculty, have potential for an outstanding graduate career at UB.

Celebration of Academic Excellence: Student Posters

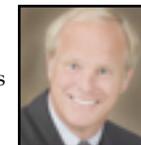
The following students presented at UB's Center for Undergraduate Research and Creative Activities (CURCA) Celebration of Academic Excellence. **Karl Barber** with CBE Assistant Professor **Sheldon J. Park**: *ERK2-peptide interaction on yeast cell surface*; **Ryan Barton**, with CBE's SUNY Distinguished Teaching Professor **Carl R. F. Lund**: *Study of Acid Catalyzed Hydrolysis of Fructose and Formation of Humins*.

Moving on

We regret this year to have to say goodbye to a valued colleague and friend. Prof. **Mattheos Koffas'** contributions advanced both our research and teaching missions, and we are a better department for the time he spent here. We will wish him all the best as he transitions to this new phase of his career at Rensselaer Polytechnic Institute.



We also must congratulate our CBE colleague, former dean, and interim provost **Harvey Stenger** as he moves on to the position of President of SUNY Binghamton. Expect many great things from that institution in the years ahead (remember: you heard it here first!).



Giving to CBE

Support from alumni and other benefactors is an increasingly vital ingredient for the success of universities today, and this is all the more so for academic departments in public universities. An important part of our mission is to provide access to higher education—and all the opportunities that entails—to people from every walk of life. However a consequence of low tuition can be funding shortfalls that impair our ability to realize our mission, and which ultimately erodes our reputation. As an alum and friend of the department, that may be important to you, too. So if you haven't thought of giving to your alma mater before, we hope you will consider doing so now.

There are two primary ways in which you can direct your support to benefit CBE:

The Ruckenstein Fund. This is an endowment, so contributions are invested. Revenue is generated in perpetuity to support the Ruckenstein Lecture (see p. 2) and help with laboratory improvements. *Donations to the fund are matched 1-to-1 by SEAS!*

Donations to the CBE department are spent where need is greatest to advance CBE and our students. Funds help us attract outstanding faculty, promote the department, and enrich student experiences.

For your gift to have the most impact on CBE, direct it to the department using the attached mailer, or follow the link on our web site at the address given below.

Thank you!

14th Graduate Research Symposium

UB CBE presented its 14th Annual Graduate Student Research Symposium on Friday, October 7 in the Center for the Arts Screening Room and Atrium. This annual symposium provides CBE PhD and Masters students with the opportunity to showcase their work to their peers and professionals in the engineering field who visit on this day. We began with lectures from PhD candidates **Biswajit Sarkar** regarding *Self-Assembled Block Copolymer - Nanoparticle Hybrids*, and **Alexander Buffone**, presenting his research *Silencing $\alpha 1,3$ fucosyltransferases in human leukocytes reveals a role for FUT9 during E-selectin mediated*

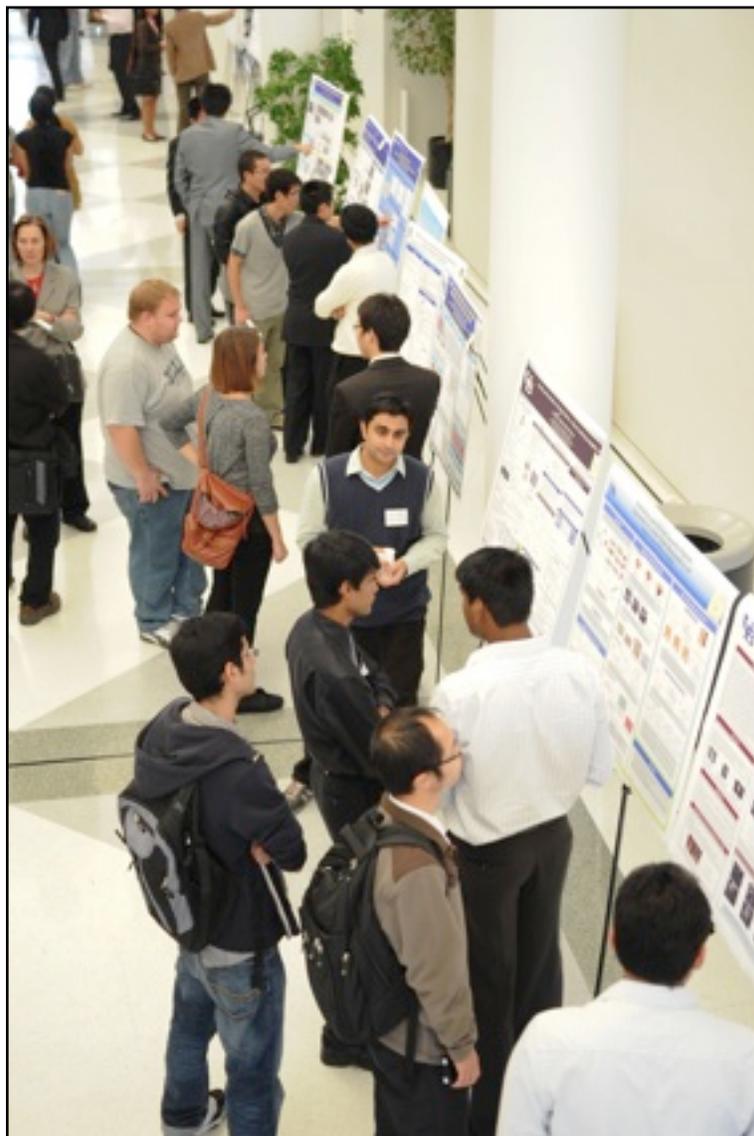


Sarkar, Buffone, and Shiflett

cell adhesion. CBE then welcomed our 2011 keynote speaker **Woodrow (Woody) K. Shiflett** from Chevron Products Company, who presented *Moving Innovation into the Marketplace: Harvesting R&D Value in the Global Hydroprocessing Catalyst Arena*.

Woody discussed managing an effective business enterprise R&D program, deriving value from it, and how it offers all the challenges of managing your family's investment portfolio...and more.

The second half of this event included a display of research posters from over 60 graduate students, arranged throughout the Center for the Arts Atrium. **Sri Madabhushi**, **Kaustubh Rane**, and **Sushil Patil** shared top honors for best poster, judged by faculty and industry experts at the event, and **Munish Sharma** took the "student's choice" award based on selection by his peers. Students used the symposium as a prequel to their presentation at the national AIChE convention later that month. A free reception in the atrium followed the lecturers and poster viewing. To see photos from this and other CBE events, visit www.cbe.buffalo.edu/news.



CBE forms new advisory board

This year CBE instituted a new advisory board, with the purpose of providing an external perspective on the functioning of the department, and (we hope) also getting the word out about all the really great developments going on in CBE. Presently the Board is formed from nine representatives from industry, selected for their connection to UB and Western New York—either as alumni or because of their business presence here. Board members include:

- **Weidong An**, Site Technology Manager, *FMC*
- **Shawn Barrett**, Sr. Manager for New Product Introduction, *Life Technologies*
- **Paul Boymel**, Worldwide Vice President of Technology, *Unifrax*
- **Gregg Eagan**, Director of Manufacturing, *Niacet Corporation*
- **Cynthia Hoover**, Director, Healthcare and Biopharma R&D, *Praxair*
- **Mike Kucharski**, President & CEO, *VanDeMark Chemical Company*
- **Mitch Pulwer**, President, *Celgard LLC*
- **Charles Rader**, CEO (retired), *IsleChem LLC* and former VP, *Occidental Chemical*
- **Ian Shankland**, VP & CTO, *Honeywell Specialty Materials*

We look forward to the years ahead working with this group and others that will join.

Students at AIChE Meeting

A group of undergraduates attended the AIChE 2011 Student Conference in Minneapolis, Minnesota. They found the conference to be a valuable networking experience technically interesting. They met students from other university chapters and also found a bit of time to visit the Mall of America. Students involved in the Chem-E car team came back with great concepts for their next design.



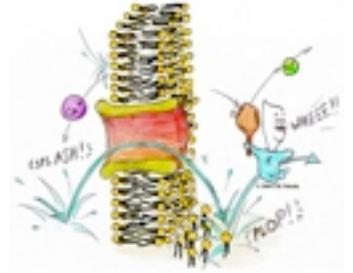
Back: Mitchell Muehlberger, Robert Morrow (Vice President), Joshua Allen, Ashhad Khan. Front: Kaixin Li and Michelle Reele (President).



The Lighter Side

“Play is the only way the highest intelligence of humankind can unfold”

— Joseph Chilton Pearce



Fall picnic, pancake breakfast, harbor cruise welcome new students to CBE

CBE is delighted to welcome our 17 new PhD students, who got to know everyone at a picnic in September at Ellicott Creek Park. Outgoing CBE president Apurv Puri passed the torch to Jacob Heltzel, who is busy rounding everyone up for fun and games. So far the group has enjoyed a pancake breakfast in the student lounge, midnight bowling, a beer making contest, Halloween costume party, and another fun filled night ice skating at the Northtown Center in Amherst. We can't wait to see what's planned for next semester.



MESSAGE FROM THE AIChE

**Michelle Reele**

President of the Student Chapter of the AIChE

The UB student chapter of the American Institute of Chemical Engineers is diligently striving for an even more successful year than last. To accomplish this our club is offering exciting events and valuable learning experiences while attempting to excel in our competitions and to work as a collective focused team.

This year, we have excellent student involvement throughout all class levels. We appointed class representatives and created a Facebook page, UB AIChE. In October, we hosted our first student-faculty coffee hour. Professor Nitsche surprised everyone with Elroy mug giveaways and everyone had a great time. We look forward to next semester's potluck dinner, shirt design contest, bowling nights, and the fun events of E-Week 2012 such as, continuing the liquid nitrogen ice cream tradition during our youth outreach at the Buffalo Museum and Science Center.

As an important part of our student chapter, the Chem-E car team is hard at work and has been meeting frequently throughout the fall semester. Unfortunately last year, the "Blue Bull" did not qualify for the national competition. We are determined to make a comeback in this year's regional competition. This semester, the team was awarded a Sub-Board I, Inc. Programming Grant which will help us in our efforts.

Finally, our student chapter is committed to providing professional development opportunities for all chemical engineering students. So far this semester, we were fortunate to host guest speakers, Paul Ameis from VanDeMark Chemical, Dr. Woody Shiflett, this year's Graduate Research Symposium keynote speaker, and Dave Collins from the Buffalo Brewpub. We hope to offer additional opportunities for students to learn from alumni and explore their career interests. Please contact me at mreele@buffalo.edu if you would like to become involved with our chapter.

Acknowledgements

This newsletter was written and produced by the UB Department of Chemical and Biological Engineering. UB News Services contributed to some of the stories. For more information, contact us at 716-645-2911, or email us at cbe@buffalo.edu

MESSAGE FROM THE CBE GSA

**Jacob Heltzel**

President of the CBE Graduate Student Association

The Department's Graduate Student Association (GSA) has been really busy this year. Instead of hosting just a few yearly events, we now average over one event per month. In addition to our traditional socials, we have several new fun events to bring together students and faculty more often. At the start of the semester, we hosted "Waffle Hours" to serve freshly made Belgium waffles that were popularly topped with maple syrup, whipped cream, and even ice cream. Then, we tested our bowling skills at the Tonawanda Bowling Center, had a spooktacular Halloween Party, and got our feet slippery ice-skating at the Northtown Center. As always, the CBE GSA can be found online at our website gsa.buffalo.edu/cbe/, which recently underwent major necessary upgrades. I encourage all students, faculty, and staff to visit our website for informational as well as entertainment purposes as we regularly post event information and pictures.

Professionally, we helped the Department host the annual CBE Graduate Research Symposium. This year's keynote lecture, *Moving Innovation into the Marketplace: Harvesting R&D Value in the Global Hydroprocessing Catalyst Arena*, was delivered by Dr. Woodrow K. Shiflett from Chevron Products Company. There was also a poster session in which all CBE graduate students had the opportunity to showcase their current research findings to the UB community and representatives from local and international companies. Congratulations to those who were acknowledged for presenting exceptional posters. Details may be found inside this newsletter.

We will end this semester with the Holiday Party on December 2, which will feature a highly anticipated first ever, beer brewing competition. So far, we have received enthusiastic and positive feedback regarding the events we have brought to you. The purpose of the GSA CBE is to strengthen the bonds between students and also between students and faculty by making exciting events happen, and so feedback is always greatly appreciated and vital to our success. I hope that student and faculty participation will remain strong as we head into the spring semester. We would like to offer opportunities for participation in volunteer work and fundraisers as a way to help the CBE GSA increase the financial budget so that more events can be offered. We hope to see you soon.