University at Buffalo *The State University of New York*

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 2010

Esther Takeuchi awarded National Medal of Technology and Innovation

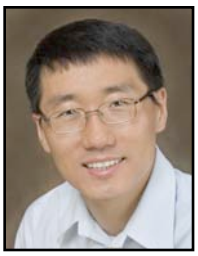
Esther Sans Takeuchi, member of the National Academy of Engineering and Greatbatch Professor in Advanced Power Sources Research, received the National Medal of Technology and Innovation from President Obama at a White House ceremony. The medal honors her outstanding contributions to technology that have improved health and quality of life for millions of people worldwide. Takeuchi's research and achievements in power sources for biomedical devices have made longer lasting and more reliable life-saving technologies possible. In President Obama's words, she is one of the awardees who embodies "the very best of American ingenuity and inspires a new generation of thinkers and innovators." She has been awarded 142 patents.

Concurrently, her achievements earned her a promotion by the SUNY trustees to the system's highest academic designation of SUNY Distinguished Professor.

Takeuchi joined UB Engineering's faculty in 2007. For 22 years, she was Executive Director of Battery Research and Devel-

see **National Medal** *on page 10*

Sheldon Park receives NSF CAREER award



CBE Assistant Professor Sheldon Park has been granted a CAREER award from NSF. Sheldon conducts research in protein engineering, where he uses modeling and experiment to characterize and de-

see **CAREER** *on page 10*

NRC report shows CBE among top 10 in US for key research measures

The National Research Council has released its long-awaited assessment of doctoral programs in the US, and we are very pleased to report that CBE@UB has placed

see **NRC report** *on page 10*

Message from the Chair

Like much of the country, UB is going through some tough economic times, but in CBE we are weathering it well. Much credit is due to leadership in the School of Engineering, which has crafted ways that we as a department can act to help ourselves. We've increased enrollments, we're experimenting with summer courses, and we've managed to substantially increase support from alumni and friends (thank you!). We've been pretty successful with grants this year too. All of this helps us tremendously to maintain the quality of our programs and facilities. We're pleased also to tell you that a surge in our undergraduate enrollments has been achieved even in the face of an initiative by the School to raise admission standards. We're getting more, better students, which I think is an indicator of the value of a chemical engineering degree when times are rough.

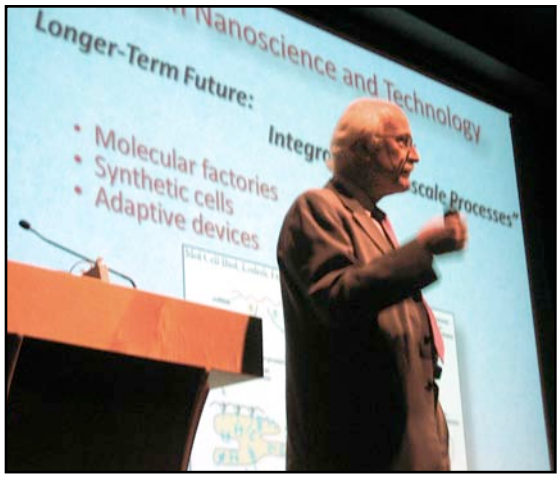
We're saddened to report that another of our founding faculty members passed away this year (following Sol Weller last year). Bob Good was a consummate scientist, and a man not forgotten by anyone who met him. A tribute to him is provided in this edition.

You'll also find a lot of good news in this issue, including research and teaching advances, awards and recognition, outstanding events, and a great outcome for us in the latest NRC assessment. As I said last year, it is a great time to be a friend of CBE, and we look forward to giving you ever more reason to be proud of your association with us.

Sincerely,

David Kofke

MIT's George Stephanopoulos delivers the 2010 Ruckenstein Lecture



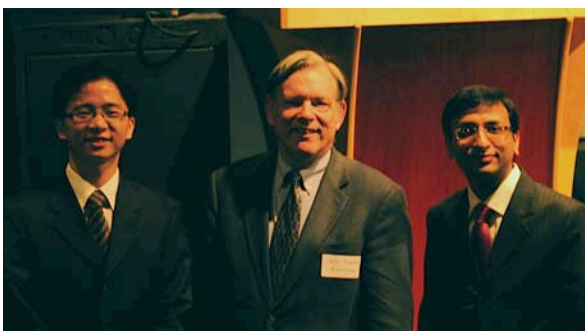
The 2010 Eli Ruckenstein Lecture was held on April 29. This year's Lecturer was **George Stephanopoulos**, Arthur D. Little Professor at the Department of Chemical Engineering at the Massachusetts Institute of Technology.

Professor Stephanopoulos' seminar was entitled *Nanoscale Process Systems Engineering: Towards Molecular Factories, Synthetic Cells, and Adaptive Devices*. The focus of this fascinating talk was on the design, fabrication and operation of integrated "nanoscale factories." Prof. Stephanopoulos pointed out that it is progress at this frontier that will enable the visions of nanotechnology — molecular factories, synthetic cells, adaptive devices, and more — to become reality. The talk first covered essential systems engineering questions needed to design, fabricate and operate processes at the nanoscale. Focus then turned to the controlled formation of self-assembled nanostructures with desired non-periodic geometric features. Prof. Stephanopoulos then put forth the design principles and methodologies to guide such a formation, featuring a hybrid approach combining top-down (externally controlled) and bottom-up (guided self-assembled) techniques.

The annual Ruckenstein Lecture is made possible by support from alumni and friends of CBE, via the Ruckenstein Fund. The 2010 lecture is the second in the series.

CBE celebrates excellence in scholarship with 13th Annual Graduate Research Symposium

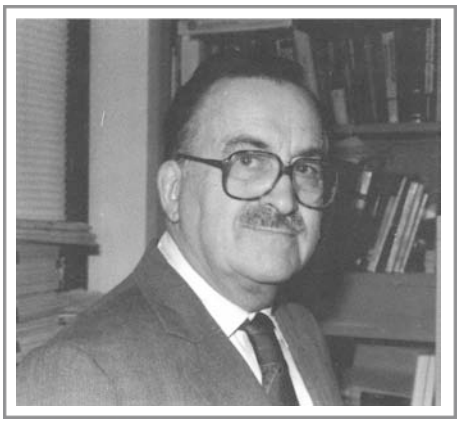
Since 1998, CBE has put on a symposium each year featuring the work of all doctoral students in the department. This year the event was held on October 1. The students' research is showcased in a huge poster session attended by UB students, faculty and administration, as well as by alumni and friends from industry in the Western New York region. A keynote lecture from a prominent chemical engineer highlights the event, and this year we were treated to a superb presentation delivered by **Dr. Jeff Siirola**, Technology Fellow at the Eastman Chemical Company in Tennessee. Dr. Siirola talked on *Sustainability and Carbon Management in the Chemical and Energy Industries*. In it he provided a comprehensive analysis of sustainability from almost every conceivable technological standpoint, including raw materials, energy, and environment. Many in the audience found it a pleasure to receive a clear, detailed and thorough explanation of how these prominent issues will (or will not) affect society in the future.



Eric Peng, Jeff Siirola, and Gaurav Vajani

This year we added a new component to the event: two seminars by senior CBE PhD students prior to the keynote. **Gaurav Vajani** spoke on *Deactivation of Gold-Ferrochrome Very Low Temperature Water-Gas Shift Catalyst*, and **Eric Hao-Fan Peng** presented *Engineering Arterial Substitute from Hair Follicle Stem Cells and Small Intestine Submucosa*. At the end of the event, a vote for best poster was tallied, with **Ankitkumar Fajalia**, **Young Jin Kim**, and **Kok Hong Lim** declared the winners. Congratulations to all for another outstanding Graduate Symposium!

An appreciation of Bob Good



1920-2010, Robert J. Good, PhD

by Robert E. Baier, Ph.D., P.E.
Professor and Director, Biomaterials Graduate Program

Dr. Robert J. Good was recipient of the 1996 Adhesion Society's Award for Excellence in Adhesion Science, and even as he was passing to his next incarnation, remarks about Bob's philosophy of RE-Search first published in the November 1995 Adhesion Society Newsletter were being repeated again to a new class of graduate students frustrated by the need to re-evaluate their hard-won data sets. Bob Good served as Professor of Chemical Engineering at UB from 1964 to 1991 and as Professor Emeritus after that—always delivering a rich philosophical context for the many advanced students and international faculty he so generously mentored until serious illness curtailed his activity in the past decade. He was recognized by the most bitter foe of theoretical attempts to "explain" surface science ["Young man, in Surface Science a pound of experiment is worth a ton of theory", W.A. Zisman, 1967] as the "only theorist who actually took honest experimental data into account!".

Professor Good was an aggressive proponent and participant in UB's NSF-sponsored Industry/University Cooperative Research Center for Biological Surface Science, extending pioneering theoretical work he had done with Medical School and Chemical Engineering Professor Carel Jan van Oss, now cited around the world. The Good-van Oss-Chaudhury (a Chemical Engineering graduate student at the time, now Professor at Lehigh University) equations for determining "surface acidity" vs. "surface basicity" components of total surface energy engendered a great deal of early criticism. Bob Good's response was "Condemnation is fine! Just don't ignore me!". When presented with a new and corrected laboratory data set, after honing a beautiful theory to account for all the details of the older, erroneous numbers, he simply –with a smile— reached into his desk's lower right drawer and took out a fresh yellow legal pad and a container of sharpened pencils, happy for the new challenge and not at all resentful that his time had been wasted.

His "research" message to students was that the word is most properly divided as RE –SEARCH, requiring first acquisition of the data and—-only then—thorough and repetitive examination to discover the actual "truths" revealed there. Early in his career, he espoused this message to industry and university colleagues in Cincinnati (1953 Good-Girafalco correlation of surface energy with contact angle data) and San Diego (at General Dynamics) before arriving at Buffalo in 1964. He was recognized during his time in Buffalo with the Kendall Award, for Surface and Colloid Chemistry, of the American Chemical Society, as well as our local ACS section's Schoellkopf Medal. Bob Good published more than 150 refereed papers, which have provided an essential foundation for the application of the physical-chemical principles of adhesion to the now rapidly growing fields of bioadhesion and biomaterials development. He would have been proud to meet and help educate the first UB class of Bio-engineering students.

We miss him!

More on the life and times of Professor Good can be found in a tribute prepared by Prof. van Oss on the occasion of a Festschrift honoring Bob in J. Adhesion Sci. Technol. A reprint of the article may be downloaded at www.cbe.buffalo.edu/documents/good.pdf

Ryan steps down as VPUE

Michael E. Ryan, Professor of CBE, is stepping down as vice provost and dean of undergraduate education to oversee UB's Middle States reaccreditation process.

Ryan, who serves as an external reviewer for the Middle States Commission on Higher Education, transitioned into his new position as director of university accreditation and assessment on June 1.

UB's decennial accreditation expires in 2013-14, and the university is gearing up to begin the lengthy process of reaffirming accreditation. That process, a major institutional undertaking that takes two to three years, includes an extensive self-study report in which the university outlines its institutional goals and the progress it's made in reaching these goals. After UB submits its self-study report, a team of external reviewers will visit campus and meet with senior administrators, deans, faculty, staff, students and alumni to gather information and perspectives on how well UB is meeting its institutional goals.

Ryan's extensive knowledge of UB from both faculty and administrative perspectives, as well as his experience as a reviewer, positions him as the ideal person to lead this process.

Departures

Dr. Michael McKittrick has left UB to take a position with the US Environmental Protection Agency in Washington, DC. He is working on the nanomaterials extramural grants program and is developing a new program on rare earth metals.

The move allows the McKittricks to be closer to their family, which is especially important with the recent addition of a new baby to their home.

Tzanakakis promoted

Emmanuel (Manolis) Tzanakakis has been promoted to Associate Professor. Manolis' research focuses on the differentiation and production of stem cells, focusing in particular on diseases of the pancreas (diabetes) and heart. He teaches several undergraduate and graduate bioengineering courses, and he has also found a useful synergy between his research and his co-teaching of the capstone plant design course. And in other exciting news, Manolis and his wife Persefoni have welcomed their second child, just in time for the start of the Fall semester. Someone's ready for a sabbatical!

Irene Brubaker retires

Irene Brubaker has retired after 23 years of dedicated service to the department. Irene began working in CBE in June 1987 and has been a steadfast member of the clerical staff. Anyone who has visited us to deliver a seminar during this time knows Irene as the steady and reliable voice of CBE, the person who arranged their schedule and travel details. Apart from logistics of the seminar series and other CBE support, Irene's major duties also included secretary to Professor Eli Ruckenstein.

Irene's retirement plans include relaxing and spending more time with her husband, their three children and seven grandchildren. We will miss her greatly, and wish her the very best.

Research Highlights

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

Fundamental research for new therapies

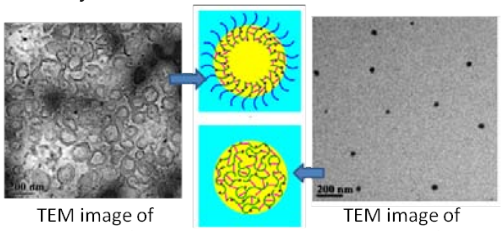
Last year three faculty members from CBE received close to $3 million from the New York Stem Cell Science (NYSTEM) fund to conduct research on stem cells. The grants are currently supporting four projects in diverse areas of stem cell science and bioengineering, and complement other projects supported by NSF and NIH. Using NYSTEM funds **Sriram Neelamegham** seeks to alter structures of certain sugars (glycans) on stem cells in order to improve their homing to sites where stem cells are needed to promote tissue regeneration. **Manolis Tzanakakis** is using NYSTEM funds to develop systems for the large-scale expansion of stem cells and their differentiation into pancreatic islets that can be used for the treatment of diabetes. Finally, NYSTEM funds enable two projects in **Stelios Andreadis**' group. One project aims at using stem cells derived from hair follicles to engineer small-diameter blood vessels for treatment of cardiovascular disease. In the second project, the Andreadis group seeks to develop lentiviral microarrays for high-throughput monitoring of gene expression during differentiation of mesenchymal stem cells into bone or cartilage.

Vascular graft produced from hair follicle stem cells

The NYSTEM awards are testament of the department's strength in this area and are expected to further promote multidisciplinary collaborative research between bioengineers, biologists and physicians across UB.

New route to biodegradable nanomaterials

Chong Cheng and his group are studying the synthesis and biomedical application of novel polymeric biomaterials. Sponsored by a NSF EAGER grant, they recently developed a new and efficient method for the preparation of biodegradable nanomaterials. Polylactide-based nanoparticles and nanocapsules with well-controlled dimensions and morphologies were prepared by UV-induced thiol-ene miniemulsion crosslinking of precursor polymers within 30 minutes. These biodegradable nanomaterials are expected to have minimal long-term health and environmental impact and may serve as idealized scaffolds for drug delivery.

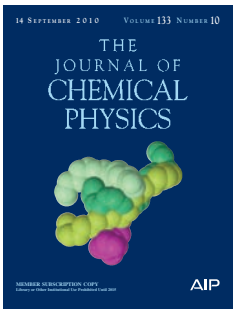


TEM image of nanocapsules

TEM image of nanoparticles

Developing a path from quantum mechanics to thermodynamics

In 1929 Paul Dirac pointed out that with the advent of quantum theory, the underlying laws governing chemistry are fully known, but the equations are too complex to be solved. Today, eighty years later this is still true in many respects. We still cannot predict most material properties of engineering interest from first principles. The virial equation of state may provide a route to advance this problem. Its coefficients can be derived exactly from molecular principles involving only a few molecules at once, a simplification that opens a door to the application of the equations that were too hard to compute in Dirac's time. **David Kofke** is developing methods that permit this theoretical notion to become a practical modeling tool for engineers. With Research Assistant Professor **Andrew Schultz**, his group is developing ways to compute virial coefficients from molecular models, while also extending the useful range of the theory. They are starting now to look at first-principles methods, whereby coefficients are calculated from *ab initio* computational chemistry. This direction is supported by a new $1.4M grant from NSF, with collaborators at Q-Chem Inc. and at UB.



Snapshot from calculation of B_4 for *n*-icosane ($C_{20}H_{42}$) using empirical molecular models graces the cover of *J. Chem. Phys.*

Molecular simulation models roughness and wetting

Jeff Errington is studying how the microscopic aspects of surfaces influence the macroscopic behaviors of fluids on them, with potential impacts from stain resistance to drag reduction. Nanoscopic substrate features can significantly affect interfacial properties like wetting, from one of a fluid spreading evenly across an entire surface to one of a liquid beading up into droplets.

Errington has developed molecular simulation methods for determination of interfacial properties of model systems, notably, measurement of the contact angle that a fluid droplet forms on a surface. Scientists use this property to infer a fluid's propensity to wet a surface. The group's data indicate how the contact angle a droplet forms on a surface evolves with the height of regularly-spaced (nanoscale) hills on a relatively "strong" surface. Results suggest that the spacing between the surface features has a substantial influence on the observed behavior. For small spacing (e.g., less than 5 nm), the often-used Wenzel equation significantly overestimates the change in the contact angle with roughness. From a technological perspective, these results suggest that the use of roughness to influence wetting behavior provides diminishing returns upon reducing the periodicity of the substrate heterogeneity below a critical length scale.

The research is supported by NSF and the American Chemical Society.

Less toxic, more efficient dispersants

After the failure of the Deepwater Horizon oil well last spring, nearly 2 million gallons of dispersant were released into the Gulf of Mexico to mitigate the spill. While preliminary reports suggest that it successfully dispersed much of the oil, the long-term effect of such a massive volume of dispersant on ecosystems, wildlife and humans remains to be seen.

Marina Tsianou has expertise in the main ingredients of dispersants — polymers and surfactants — and she is working toward designing environmentally friendly formulations, including those based on natural, mineral-based components.

The work is conducted under a recently awarded RAPID Response Research Grant from the NSF. The grant aims to create novel dispersants through the utilization of polymers, surfactants and solvents that would be less harsh to the environment, developing them using a better understanding of how they interact with crude oil and naturally occurring particles at the nanoscale level.

Tsianou will explore the suitability of alternative solvents and surfactants, such as those found in processed foods, for some dispersant formulations, as well as mineral particles that could serve as environmentally friendly surface active agents.

Her research will take into consideration many factors, including the composition of the oil (which varies with its source and with time), mechanical disturbances (such as those caused by hurricanes and storms), and local environmental conditions (such as those on the Great Lakes where smaller-scale spills also occur).

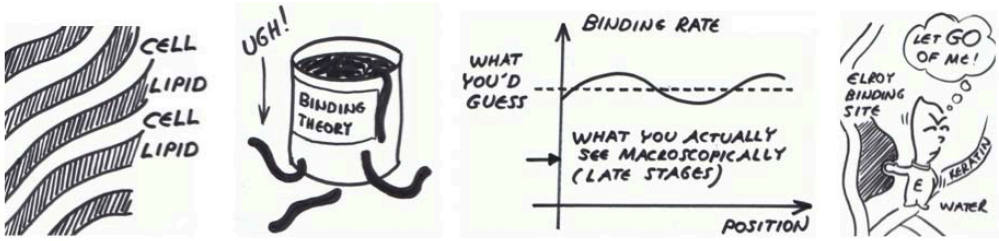
"If we make a more efficient dispersant, then we can use far less of it," she says. "Millions of gallons of anything, even a very benign material, is a lot to release into the environment."

Waiting around the stratum corneum

A classical problem in transport phenomena concerns coarse-graining of the microscopic transport properties of composite materials. With Dr. H. Frederick Frasch at NIOSH, Elroy Hutch (a.k.a. **Johannes Nitsche**) recently ran into this kind of problem studying how drugs and chemicals diffuse through the top layer of skin, the stratum corneum (A). Molecules often bind reversibly to keratin protein in the cell phase, whereas there's no binding in the lipid phase. So what average binding rate would be measured at the macroscopic scale, at which you don't see any of the microscopic details?

Answering this question leads to quite a theoretical can of worms (B). For two-phase microstructures like that of stratum corneum, the average binding rate turns out to be given by a nifty new explicit formula. Surprisingly, however, for materials in which the microscopic binding rate varies smoothly with position (C), even slightly, the macroscopic behavior can be very strange. Late stages of binding turn out to be significantly slower than anything you'd guess, as explained in detail in a new article written up for *Chemical Engineering Science*.

As Elroy contemplates shrinking to nanometer size to follow a group of fluorescent markers on a *Fantastic Transdermal Voyage*, average binding rate weighs heavily in his planning, as it slows diffusion and directly impacts his residence time (D).

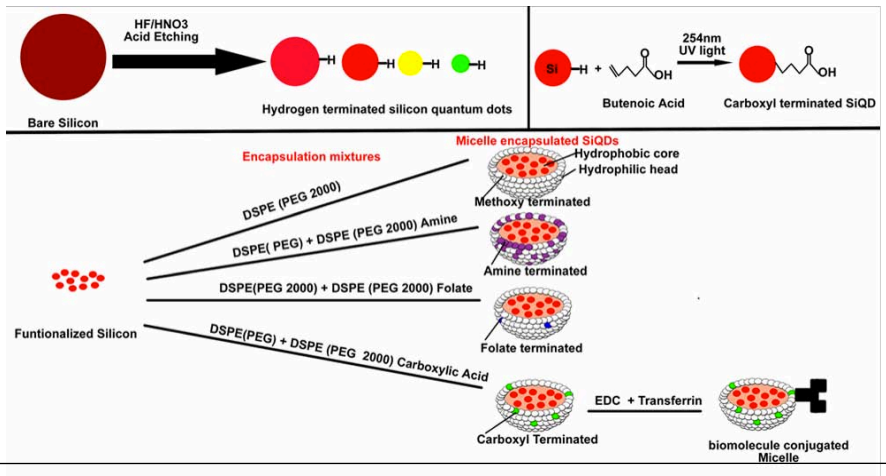


Si quantum dots for *in vivo* applications

Quantum dots (QDs) have optical properties that make them uniquely suited for *in vivo* targeted fluorescence imaging, traceable delivery, and therapy. Use of group II–VI (e.g., CdSe) QDs for these applications is advancing rapidly, but their toxicity limits their *in vivo* applications. So replacing them with a biocompatible semiconductor, such as silicon (Si), is desirable.

Research led by **Mark Swihart** demonstrates that encapsulated biocompatible Si QDs can be used in multiple cancer-related *in vivo* applications. This work overcomes previously insurmountable challenges to *in vivo* imaging with Si QDs through a unique nanoparticle synthesis, surface functionalization, micelle encapsulation, and bioconjugation process that produces bright, targeted nanospheres with stable luminescence and long circulation time *in vivo*.

Si QDs can play an important role in more sophisticated *in vivo* models, by alleviating toxicity concerns, while maintaining the key advantages of QD-based imaging methods.



TExT: A *T*oolkit for *Ex*ceptional *T*eaching

by Carl Lund
SUNY Distinguished Teaching Professor

The lecture is one of the least effective means of teaching. Students learn by thinking and doing, not by taking notes from the blackboard, overhead or a PowerPoint presentation. Nonetheless, a 2001 U. S. Dept. of Education survey found that 87.7% of engineering faculty use lecturing as an instructional approach when teaching, while only 5% indicated the use of methods other than lecture, seminar, lab or field work. *Active learning*, where students are engaged in educational activities in the classroom, has been demonstrated to be a more effective teaching method. So why does the lecture continue to predominate?

There are many reasons, but almost always it comes down to faculty lacking time, know-how, confidence, initiative, and/or incentive. I can't do much about the last factor, but having made the switch to active-learning instruction myself, I'm sold on the idea and I'm working to make it easy for other faculty to do the same.

Oral presentation of the material is important, because not all students learn well by reading, and because some ideas are better conveyed and emphasized by speaking them. But this doesn't need to occupy class time, any more than we need to fill the class time by having the students read silently from a textbook. In principle a good lecture need be done only once, and updated only as often as a textbook.

The key is to enable the lecture to be moved out of the classroom. This is the premise underlying a prototype educational tool I am developing, nicknamed the *KaRE TExT* (Kinetics and Reaction Engineering Toolkit for Exceptional Teaching). It is still under development, but can be examined at *www.eng.buffalo.edu/Research/karetext*.

The *KaRE TExT* is broken down into study units at the lowest level. Each study unit includes:

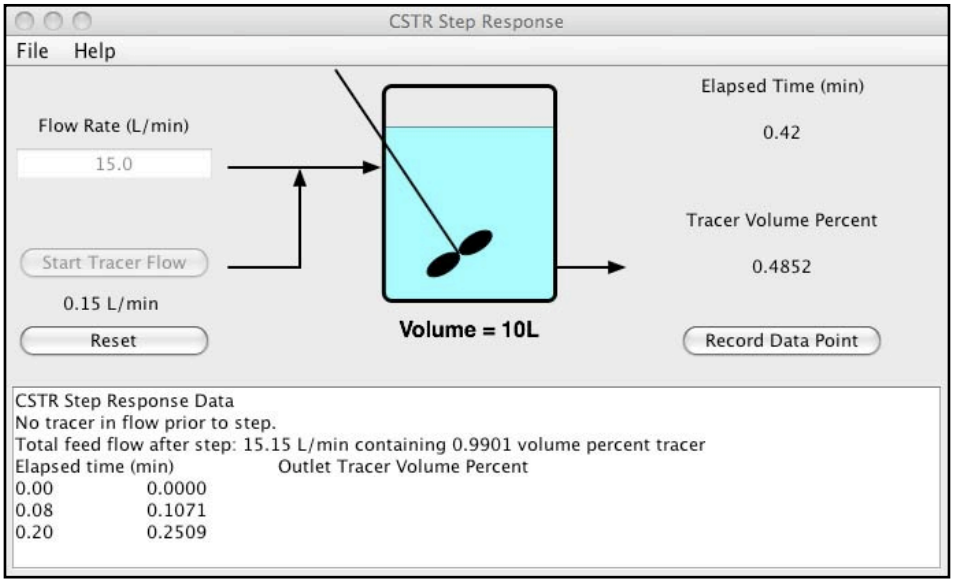
- an information reading (I provide the readings, but they could equally well come from a traditional textbook);
- a corresponding video lecture;
- a statement of learning objectives for the unit;
- a summary of all equations introduced in the unit;
- examples that illustrate how to use the information presented in the unit; these, too, are presented in both written and video lecture format.

Some units provide additional learning tools for the student (how-to's, computer simulators, etc.).
My students are expected to (and do!) arrive at class having read and watched all these materials. Or in other words, they show up ready to participate in active learning. And with the lecture removed, classroom time can be used for learning activities.

OK, with the lecture out of the classroom, what do we do with all that time? The unique and probably the most valuable part of the *KaRE TExT* is the set of teaching tools it provides to answer this question. Each unit includes (1) slides that can be used at the start of class to quickly review the material the students were assigned to read/watch; (2) a choice of three optional quizzes (used either to motivate the students to actually read/watch the assigned materials, or to assess whether they retained anything from them); (3) a choice of in-class learning activities, each with a lesson plan describing how to implement it, along with all the necessary resources for doing so (to the extent practical). A variety of types of activities are utilized over the course of the *TExT* including:

- object lessons;
- one-minute papers;
- 3-slide presentations;
- debates;
- panel discussions;
- simulator sessions; (produced with NSF support)
- case studies;
- problem solving (individual or group, with a variety of implementations).

Student response—-in terms of teaching evaluations and comments—-has been overwhelmingly positive. This semester we are conducting a formal assessment of one learning activity involving the use of a simulator wherein the students plan a kinetics study and gather the necessary data. We plan to report results of that assessment next spring. By that time, we also expect the first three (of four) parts of the *KaRE TExT* to be completed and available online. By providing a comprehensive, fully integrated set of teaching tools, we hope to make it nearly as easy to teach kinetics and reaction engineering using active learning as it is to lecture. This, in turn, should make student learning more effective and efficient.



Product Design added to CBE curriculum

by Paschalis Alexandridis
UB Distinguished Professor

Chemical engineers and the companies that employ them have traditionally focused in the efficient production of commodity chemicals and specialty chemicals, but are increasingly active in the development and production of

- formulated products;
- consumer goods;
- bio-based concepts; and
- devices.

Formulated products are multi-component systems that have been designed and manufactured to meet end-use requirements. They are often multifunctional and microstructured (*i.e.*, their function and perceived value derives significantly from their internal structure in the range 0.1-100 m), and include bulk and shaped solids, semisolids, liquids and gases. *Consumer goods* and *Devices* of interest to chemical engineers offer functionality that is based on physical or chemical transformations. *Bio-based concepts* include biomaterials, drugs, and technologies based on metabolic, cell, or tissue engineering. The various chemical products may have little in common in terms of appearance or performance, however, they share common principles and practices in terms of development and manufacturing. Thus the need and the opportunity for a chemical product design course.

The Chemical Engineering Product Design (CE 404) course at UB, introduced in the undergraduate curriculum in 2009, encompasses:

(1) the general framework for product design and development (identify customer needs, convert needs to specifications, create ideas/concepts, select concept, formulate/test/manufacture product; also intellectual property, safety, environmental, marketing and financial considerations), and…

(2) structure-property relations that guide the search for materials with particular properties, as well as modifications of existing materials that would improve properties. These two main themes are reinforced by…

(3) case studies of successful products with well-documented history of invention, development, production, and marketing. The course material is integrated in…

(4) product design projects that synthesize (i) the market pull for innovations in the development of improved or new products, together with (ii) the technical push from advances in our fundamental understanding of structure-property relations at the atomic, molecular, nano-scale and continuum levels.

Problem-based learning challenges students to utilize their knowledge of chemical engineering principles in order to analyze existing products, and to propose solutions to real-world problems, such as those articulated in "Requests for Proposals" (RFP) published by NineSigma, a company that facilitates solution-provider knowledge searches. Student teams prepare a solution to NineSigma RFPs using the RFP information as a springboard, and following the product design approach discussed in class. The following RFP titles exemplify the types of problems that the students have addressed:

- development of eco-friendly solvents;
- enabling freshness of baked cookie and cracker products;
- peroxide-based sterilants with high sporicidal activity;
- soil conditioning technologies to enhance nitrogen use efficiency;
- natural conditioners for hair and skin;
- water resistant, recyclable packaging stock;
- bio-degradable, compostable oxygen barrier film;
- monomer technologies for imparting strength in hair; and
- high absorbent desiccants for coatings.

The students appreciate the relevance of the course material to every-day life products, and the opportunity for active learning and problem-based learning in a team setting. At the same time, the students view with some trepidation the open-ended nature of the course deliverables. But then, real life is very open-ended!

We look forward to hearing from alumni involved in Product Design. Also from alumni and friends who wish to engage our students' skills and creativity in designing structured products.

Please e-mail (palexand@buffalo.edu) or call (716-645-1183) Prof. Paschalis Alexandridis if you want to contribute.

Alexandridis wins Schoellkopf Medal

Paschalis Alexandridis is the 2010 recipient of the Jacob F. Schoellkopf medal, given by the Western New York chapter of the American Chemical Society. The award is given for his fundamental discoveries on block copolymer thermodynamics, structure, and dynamics, and for his development of functional products utilizing self-assembly methodologies. The Schoellkopf Medal is the oldest local section award in the nation, having been awarded continuously each year since 1931.

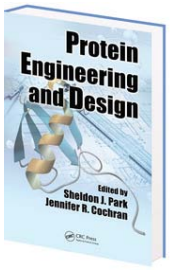
Takeuchi receives Norton Medal at 2010 commencement ceremony

Esther Takeuchi was one of three recipients of the Chancellor Charles P. Norton Medal, UB's highest award, during the university's 164th general commencement on May 9. This medal is presented annually in public recognition of a person who has, in Norton's words, "performed some great thing which is identified with Buffalo...a great civic or political act, a great book, a great work of art, a great scientific achievement or any other thing which, in itself, is truly great and ennobling, and which dignifies the performer and Buffalo in the eyes of the world."

Swihart selected for Exceptional Scholar Award

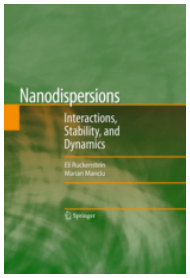
The Exceptional Scholar Award for Sustained Achievement was created by UB in 2002 to honor outstanding professional achievement focused on a particular body of work over a number of years. This award was created to recognize an unprecedented accomplishment in a senior scholar's career, distinguishing a body of work of enduring importance that has gone beyond the norm. **Mark Swihart's** selection for this award recognizes his work in the field of inorganic nanoparticle synthesis and processing, where he is known for the quality of both his experimental and modeling studies.

Park co-edits book



Protein Engineering and Design, a book edited by CBE Assistant Professor **Sheldon J. Park** and Jennifer R. Cochran, was published in Sept 2009. Experimental protein engineering and computational protein design are broad but complementary strategies for developing proteins with altered or novel structural properties and biological functions. By describing cutting-edge advances in both of these fields, Park and Cochran aim to cultivate a synergistic approach to protein science.

Ruckenstein's works, volume 2



Eli Ruckenstein recently published a second collection of his papers, *Nanodispersions: Interactions, Stability, and Dynamics* (Springer, 699 pages) co-authored with Marian Manciu. Each of the 64 papers contributes to a basic understanding of nanoparticle interactions and their role in the thermodynamic or kinetic stability of nanodispersions. This follows the success of vol. 1, *Thermodynamics of Solutions*, co-authored with Ivan L. Shulgin.

Sarkar earns Best Paper Award

CBE grad student **Biswajit Sarkar** is primary author on a research article recognized by the Indian Institute of Mineral Engineers as the *Best Paper Published on Beneficiation*. The article, *Study of Separation Features in Floatex Density Separator for Cleaning Fine Coal*, was co-authored by A. Das and S.P. Mehrotra. The paper evaluates an autogeneous density separator in the beneficiation of low-grade coal fines, improving the value extraction from low-grade natural resources. Sarkar is working on his PhD under the direction of Prof. **Paschalis Alexandridis**.

American Heart Association awards fellowships

CBE graduate students, **Chi Lo** and **Sri Madabhushi**, were awarded pre-doctoral fellowships from the American Heart Association starting this summer. This is a competitive and prestigious award that supports research and training as students initiate careers in cardiovascular disease and stroke. Both are mentored by CBE Professor **Sriram Neelamegham**.

Chi works on the mechanism by which white blood cells bind to blood vessel walls in the human body. Her goal is to identify important reaction pathways that lead to the formation of specific sugar structures on the surface of white blood cells. These carbohydrates regulate critical molecular interactions that contribute to human inflammatory diseases.

Sri's research examines van Willebrand Factor (VWF), the largest protein in blood. Sri is identifying structural changes in VWF that are regulated by fluid shear forces. Such changes aid the binding of human blood platelets to blood vessel walls. Platelet cell adhesion contributes to both the stoppage of bleeding following injury, and cardiovascular diseases like myocardial infarction and stroke.

Sri has also was selected by BMES for a Graduate Student Award, one of only 8 in a competition with over 150 students.

More fellowships

CBE MS student **Alecia Bernard** has won a *Bridge to the Doctorate Fellowship* from the NSF Louis Stokes Alliance for Minority Participation. The award provides two years of support for students starting on a path to a PhD. CBE Junior **Shaun Setlock** was chosen to receive a *Western New York Prosperity Scholarship*, which assists students who are actively preparing for careers that further economic development and growth in the WNY region.

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 23. 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 **Marina Tsianou** as Professor of the Year, and senior **Nikita Petrosyan** as 2010 Student of the Year. Winners were presented with plaques and gift cards.

Student recognitions

Kyle McHugh, WNY AIChE Outstanding Senior Award; **Ryan Barton**, WNY AIChE Outstanding Junior Award; **Emily Leitsch**, ACS Outstanding Student Award; **Ryan Barton**, AIChE Donald F. Othmer Sophomore Academic Excellence Award; **Lye Lock**, **Brett von Groenewoud**, **Michael Langdon**, and **David Galuski**, CBE Academic Excellence Awards; **Kyle McHugh**, Undergraduate Research, Scholarship, and Creativity Award; **Lye Lin Lock**, University Libraries' Undergraduate Research Prize; **Ryan Barton** and **Christopher Owen**, the Robert B. Kleinschmidt Memorial Scholarship; **Kyle McHugh**, AIChE Donald F. and Mildred Topp Othmer National Scholarship Award, and the SBE Outstanding Student Award

Alumni notes

Gary A. Peck, BS '68, MS '72, is an associate of Ronald J. O'Mara, a Williamsville engineering consulting firm.

Michael J. Dray, BS '04, joined ZeroPoint Clean Tech, a startup biomass gasification company. Dray is the Engineering Alumni Association Secretary and chair of two committees.

Dan Matthews, BS '97, works for Borg-Warner, which let him the opportunity to work and live in Germany for a period of time before returning to NY State.

Jim Scinta, PhD '78 is (since 2006) manager of heavy oil R&D at ConocoPhillips Company, and was recently named Chairman of the Industrial Research Institute (IRI) board of directors.

Donald P. Visco Jr., BS '92 PhD '99, was recently recognized with the American Society for Engineering Education's National Outstanding Teaching Award. Visco is currently a CE Professor at Tennessee Technological University. Starting in January 2011, he will move to the University of Akron where he will serve as the Associate Dean for Undergraduate Studies in the College of Engineering.

Piyush Koria, PhD '07, completed a postdoc at Harvard and as of July 2010 is Assistant Professor at U of South Florida in Tampa, in the Department of Chemical and Biomedical Engineering.

Jayant K. Singh, PhD '04, was selected by the Indian National Academy of Engineering for the *Young Engineer Award*, which recognizes outstanding achievements by young engineers in all of engineering. Jayant is now an Asst. Professor of CE at IIT Kanpur, where he conducts research in computational nanoscience. Other recent awards for Jayant include a BOYSCAST fellowship in 2008 from the Indian Dept. of Science and Technology, and a Young Scientist Award in 2006 from the Dept. of Atomic Energy of India.

Raghvendra Singh, PhD '08 is an Assistant Professor of CE at IIT Kanpur. He started in the position in July of 2009.

Hemant Dandekar, PhD '91 is now President and CEO of Porcelain Industries, Inc., a business near Nashville, TN that coats porcelain on steel substrates for power and appliance companies. Even while running the business he has had some time to play with new coating development based on sol-gel materials, so there is still a bit of ChemE left in him!

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.

Xuegeng Li, PhD '04, joined Innovalight, Inc. in 2003, where he led the scale-up of equipment and processes to enable commercial-scale solar cell production, including the first commercially available Si Ink printing technology in the photovoltaic industry. Xuegeng is now VP at Optony, Inc., a solar company operating in both US and China, which is working on high efficiency thin-film solar cells. Xuegeng is in in charge of its first production line in Hangzhou, China.

Zhiyong Gu, PhD '04, received a 3M nontenured faculty award. Zhiyong is an Assistant Professor of CE at UMass, Lowell, where he conducts research in nanomaterials and nanotechnology. He is also Associate Editor of *J. Nanoparticle Research.*

In Memoriam

Edward R. Belmore, MS CE '73
Gary W. White, BS CE '81
Arnold A. Wosilait, MS CE '67

Order of the Engineer

The following CBE students were inducted into the Order of the Engineer (names do not correspond to photo): Tawfiq Afif; Andrew M. Bodratti; Kimberly M. Cryan; Jaime L. Egnaczak; Brett J. Van Groenewoud; Kevin J. Kapuza; Alan L. Knoell; Emily K. Leitsch; Chad D. Lemke; Michael P. Maggio; Diya M. Mathew; Nicholas V. McLasky; Swati Murthy; Nikita Petrosyan; Evan M. Schlaich; Nicholas M. Tojek

NRC report

continued from on page 1

in the top 10 nationally in several key research measures. The report is arguably the most comprehensive and objective analysis of quality of graduate programs ever produced. In 2006 the NRC conducted a systematic process of data collection of doctoral programs across many disciplines, gathering information from departments, individual faculty, students, administrators, and public sources. The data included information on faculty research productivity, institutional support for students, diversity of faculty and students, and more. Twenty specific characteristics were identified, and a rating for each was reported for every program. The NRC also offered composite measures, reported only as ranges and not individual vales, based on subjective surveys of importance of each measure in determining overall quality. The NRC however is rather emphatic in suggesting that no single measure could meaningfully rank program quality.

In the important objective statistics of publications per faculty, and awards per faculty, our program ranked 8th and 9th, respectively, out of a total of 106 measured programs. Moreover, in the four years since these data were collected, one might argue that we've only gotten better — adding two more members of the National Academy of Engineering to our faculty, while adding several junior faculty whose research programs are now coming up to speed.

Regardless, we always strive to be the best we can be. The aim of our graduate program is to produce new knowledge of value to the profession, and to train graduate students to do the same. While pursuing that goal it is however nice to see some objective statistics telling us that we're holding our own in comparison to our peers.

More information about the NRC assessment can be found at nap.edu/rap, or at www.phds.org, which has compiled the data in a form for easy review.

National Medal

continued from on page 1

opment and Chief Scientist at Greatbatch, Inc., where she led a team of scientists and engineers focused on power source research and innovation. There, Takeuchi developed the tiny lithium/silver vanadium oxide battery, helping to bring implantable cardiac defibrillators (ICDs) into production in the late 1980s. Now over 300,000 of these units are implanted every year, the majority powered by the battery system that Takeuchi and her team developed and improved.

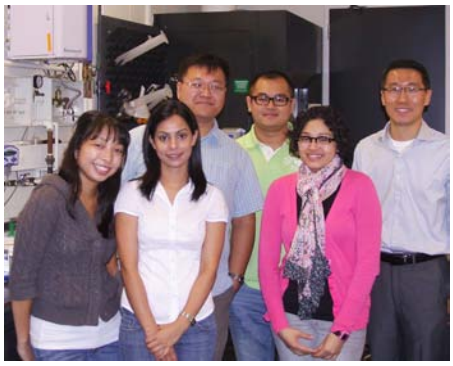
Presently, Takeuchi is researching power sources to improve cycle life, decrease size, and increase longevity for applications such as sensors, satellites, electric vehicles, medical devices, and local storage for intermittent "green" energy sources such as wind and solar. Her current research, with husband SUNY Distinguished Teaching Professor **Kenneth Takeuchi** (Chemistry), and EE and CBE Research Assistant Professor **Amy Marschilok**, involves fine-tuning, at the atomic level, the materials used to power battery systems, with *in situ* generation of silver nanoparticles. Takeuchi explains that by designing the bimetallic material at the atomic level, "the change in its conductivity and performance is inherent to [it]. We didn't add supplements to achieve that – we did it by changing the active material directly." The research is made possible with funding by the National Institutes of Health and the US Department of Energy.

This is the 2nd National Medal awarded in CBE, following Eli Ruckenstein's National Medal of Science received in 1999.

CAREER

continued from on page 1

sign novel proteins and protein interactions for biotechnology and medical applications. In collaboration with his graduate students, he recently developed a technique that uses protein disulfide trapping on the yeast surface to probe protein association in a high throughput manner. Because of the structural con-



straints on cysteine disulfide formation, the technique is useful for probing and designing specific protein-protein interactions. He has tested the validity of the technique in a model system by converting streptavidin homotetramer to a functional heterodimer. The CAREER award further recognizes the potential of the technique by funding his efforts to engineer protein and peptide inhibitors of a kinase (phosphorylating enzyme) implicated in cancer development. The proposed study will have broad implications in the development of future molecular therapeutics and probes, by significantly reducing the complexity involved in engineering targeted interactions.

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.

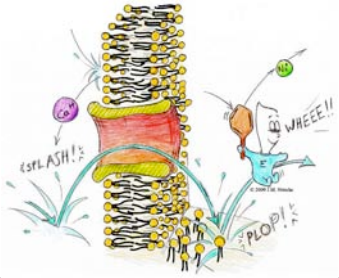
For your gift to have the most impact on CBE, direct it to the department using the attached mailer, or follow the link on our web site at the address given below.

Thank you!

The Lighter Side

Necessity may be the mother of invention, but play is certainly the father

— Roger von Oech



Fall picnic, harbor cruise welcome new students to CBE

Two events were held this Fall to help new CBE students feel at home here, and get old students and faculty back in the groove after the summer. The Fall picnic (right) continues a long tradition started by (Emer.) Prof. Hlavacek, and the Buffalo harbor cruise starts a new one. At left, Prof. Alexandridis (DGS) finds himself at the center of cruise activities.

Biswa Das - UB Intramural Badminton Champion

CBE graduate student, **Biswa Das**, won the Men's Advanced Division of UB's Badminton Intramural League for Fall 2009. The match was played in a round-robin format, with the top two players (based on wins) competing in the finals. Das is a current member of the Amherst Recreational Badminton club and has participated in various tournaments in and around the Western New York area.

Das and former CBE graduate student, **Venkatramanan Ravi**, were also finalists in the Fall 2008 Badminton Men's Doubles Division.

The CBE Cup

Inspired by the 2010 FIFA World Cup, the Department's Graduate Student Association held its first CBE Cup on July 12. Pitting Team Chemical against Team Biological, the battle was waged at the Special Events Field across Putnam Way from the Student Union.

Though the field was demarcated only with tape and orange cones, the sportsmanship was top notch. The ice cream provided for players and spectators alike was pretty good, too, but it could not satiate the hunger for victory. Ultimately, Team Chemical defeated Team Biological 13 to 4, but fun was had by all. I think that we can count on a rematch in 2011!

CBE students earn recognition in photo contest

The theme was *Welcome to my world – Reflections through an international lens*. Students were invited to submit a photo about one of their experiences in the US. CBE undergrad **Lye Lin Lock** took 3rd Place in the Judges Winners category for her photo (left) taken while flying across the North Pacific from her home in Malaysia to Buffalo. She keeps its as a reminder of her family and her privilege to study here. Graduate student **Namita Bhan** tied for 1st Place in the People's Choice category. Namita took her photo (right) while on her way to school — a simple but beautiful shot of leaves that had accumulated in a puddle of water. She sees the shades and colors as a meditation on diversity.

University at Buffalo *The State University of New York*

The Catalyst Fall 2010

Message from the CBE GSA

Kate Shaul

President of the CBE Graduate Student Association

This has been another great year for the Department's Graduate Student Association (GSA). We have been busy, hosting an event almost every month with the help of the Department. Most recently, we partnered with the Department to host the October CBE Graduate Research Symposium. The annual symposium features a poster session in which all CBE grad students have the opportunity to present their research to one other, the larger UB community, and local industry representatives. We have continued the progress made by older students to enhance the event. In addition to improving the food and venue with the help of GSA funding, we moved the date of the event to be earlier in the semester, so that new students could use the poster session to guide their selection of research groups. We were also successful in adding a smaller poster session to the reception following the popular Ruckenstein Lecture held in May.

Beyond these professional events, the CBE GSA does much to strengthen the sense of community the Department enjoys. We have continued great traditions, from simple coffee hours to the Halloween and Winter Parties to the September Welcome Picnic. We also added new events this year, bringing graduate and undergraduate students closer together at the April Bowling Night, and pitting Team Chemical against Team Biological in the July CBE Cup soccer match.

On a personal note, I have thoroughly enjoyed my two years in the CBE GSA, first as a senator and then as president and webmaster. As a transfer student, the experience has helped me feel very much a part of the Department, and it has been an honor to work with such wonderful people two years in a row. I would like to take this opportunity to thank my fellow officers for all of their hard work, as well as the Chair, David Kofke, and the Assistant to the Chair, Darlene Innes, for all of their help.

In September, a new group of great students was elected into the CBE GSA. You can stay informed of their plans for the coming year at the website we debuted in January: gsa.buffalo.edu/cbe/.

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 AIChE

Ryan Barton

President of the Student Chapter of the AIChE

The new e-board members for the student chapter of AIChE have been hard at work trying to get the club ready for the upcoming school year. The club will continue its usual social activities, including the potluck with faculty and students that occurs every semester. We will also participate in E-week in the spring semester. E-week is when all the engineering clubs at UB compete against each other and host other engineering related activities. As part of this, our chapter will continue its tradition of going to the Buffalo Museum of Science and making ice cream using liquid nitrogen.

New this year, our chapter is planning on having a guest speaker from Life Technologies (which is located in Grand Island) come to UB and talk to the students in the CBE department. This is a great opportunity for the CBE students because they will get the chance to learn about the company and see how the material they are studying in class is applied and expanded upon in today's industrial settings. This is an exciting opportunity, and just the first of many guest speaker events that our club hopes to organize this year. We're also looking to set up plant tours to local companies in the future.

Our chapter also plans on going to the national and regional AIChE conferences that are occurring in the fall and spring respectively. Unfortunately, our club's Chem-E car did not qualify for nationals at last spring's regional conference due to a malfunction that prevented our car from competing. There is still a chance that we will get to compete at the national conference in Salt Lake City, but if not, we will still attend to take advantage of the other student-oriented opportunities there. Regardless, our Chem-E car team is going to overhaul our existing car this year with a new body and lower resistance axles. We also need to make a new power source from scratch, which will be a fun challenge.

We've already held our first general meeting, where we had a strong showing of sophomore CBE students. This is great for the club. We are going to make an effort to bring even more underclassmen in this year, because the AIChE March Madness has always been a goal for our club (March Madness is a challenge to have at least 50% of the students in the CBE department join our chapter of AIChE). All in all, this year is going to be very busy and exciting for our chapter of AIChE.