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The Catalyst



University at Buffalo The State University of New York

Department of Chemical & Biological Engineering News



Message from the Chair

David A. Kofke

What do chemical engineers do? Boy if I had a nickel for every time I was asked that, I'd have at least, well, a couple dollars by now.

Ok, that's not too impressive; it's hard to make nickels add up to much. But the point is the question, what do chemical engineers do?

I'm reminded of the parable of the blind men and the elephant, where each man feels a different part of the elephant (ear, trunk, tail, leg) and reaches wildly different conclusions about what an elephant is like. Chemical engineering is so diverse that it is hard to describe it accurately in a brief conversation without producing some distortion.

The stereotypical answer involves something about taking new synthesis methods invented by chemists and making them work at large scale, and in the presence of economic, environmental, and safety constraints. But even considering this narrow context, that answer doesn't do justice to all the facets of what chemical engineers do.

A chemical engineering education provides for a highly versatile engineer. Based on core skills in math and chemistry, we add the "chemical engineering sciences" of thermodynamics, transport, and reaction kinetics. We layer on that an understanding of design, systems and control, and we build skills relating to computers, economic analysis, teamwork and communication. After all that you've got someone who can tackle a lot of problems!

Indeed chemical engineers are put to work in a huge variety of areas. There's a growing realization too that a chemical engineering education is well suited for *product* design as much as *process* design. Here *products* are complex materials and devices where chemistry (broadly defined) is an important part of

their function. Think printing ink, paint, drug-delivery patches, batteries, and myriad other items. Leaving these designs to chemists would be like having physicists design iPods. Of course chemists (and others) make key contributions to product design, but the role of chemical engineers in these activities should be more greatly acknowledged, and perhaps expanded. We might revisit the stereotype of chemical engineering as solely process engineering.

As we educators strive to meet the needs of current and potential employers, it becomes a real challenge to know where to put our emphasis. We need a pipeline of communication from industry to shape our curriculum. A major effort to revise chemical engineering education nationwide faltered, in my opinion, for want of this information. So tell us what you do as a chemical engineer. Do you consider your work product design? Process design? What is a day in your professional life like? We have long solicited such feedback on our web site: (www.cbe.buffalo.edu/alumni/ce_do.html). Please drop by there and share your experiences. Your input informs our curriculum, and it also helps us to paint a portrait that answers the perennial question of "what do chemical engineers do?"

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In our previous newsletter I hinted that we would be adding still a couple more faculty to the four that were profiled there. Well it's all done and I am pleased to announce two new hires: **Esther Takeuchi**, and **Chong Cheng**. **Dr. Takeuchi** is a prolific inventor and a member of the National Academy of Engineering. Her expertise is in battery technology and she is leaving her post as Chief Scientist at Greatbatch, Inc. to join us (jointly with Electrical Engineering) at the rank of Professor. **Dr. Cheng** is a very talented polymer chemist who will add greatly to our strength in materials engineering (and yes, product design!); he comes as a new Assistant Professor. I can also announce that **Michael Cain**, the new dean of the UB medical school has been granted an appointment in our department. We will profile all of these additions in our next newsletter. ■

Lund Named SUNY Distinguished Teaching Professor

Carl R. F. Lund, professor of chemical & biological engineering, has been named a *SUNY Distinguished Teaching Professor* by the SUNY Board of Trustees.

The rank of distinguished professor, the highest faculty rank in the SUNY system, is an order above full professorship and has three co-equal designations: distinguished professor, distinguished service professor and distinguished teaching professor.



Carl R. F. Lund The distinguished teaching professorship recognizes and honors outstanding teaching at the graduate, undergraduate and professional levels. It is awarded to full professors who have demonstrated consistently superior mastery of teaching, outstanding service to students and commitment to their ongoing intellectual growth, scholarship and professional growth, and adherence to rigorous academic standards and requirements.

A faculty member since 1986, Lund received the SUNY Chancellor's Award for Excellence in Teaching in 1991, and was named a Lilly Teaching Fellow by the UB Office of Teaching Effectiveness in 1988. In addition, he twice has been named "Chemical Engineering Professor of the Year" by the American Institute of Chemical Engineers' Stu-

dent Chapter at UB, and was selected "Teacher of the Year" by the New York Nu Chapter of Tau Beta Pi engineering honor society.

The recipient of the National Science Foundation's Presidential Young Investigator Award in 1988, Lund's current research interests include heterogeneous catalysis for fuels and chemicals from domestic and renewable resources, mechanistic and quantum modeling of heterogeneous catalytic reactions, methods for the design and development of heterogeneous catalysts and the development and assessment of tools to facilitate active learning in engineering courses.

His research has been supported by the NSF and the Environmental Protection Agency, as well as by other public and private-sector sources.

The author of numerous scientific publications, he also is a reviewer for scientific journals, book publishers and federal granting agencies.

Lund served as Chair of the Department of Chemical and Biological Engineering from June 1997 to January 2006, and as Associate Dean for Research in the School of Engineering and Applied Sciences from January 2006 to September 2006.

He is an honors graduate of Purdue University and received a doctorate from the University of Wisconsin at Madison. ■

Job Hunting?

Alums — do you know that you can still receive **FREE** career advice?

Career Services offers a wide variety of services to engineering and applied sciences alumni, including resume/cover letter critiques, job search and interviewing tips, access to online job postings, resume referral, on-campus interviewing, and individual career counseling appointments. Check out the Meet-A-Mentor program, and get connected to UB alums who are working in various fields!

Contact **Holly Justice**, Engineering Career Counselor, at (716) 645-2232. For more information, log on to www.ub-careers.buffalo.edu

Work with Nanoparticles May Lead to ‘On-the-Spot’ Virus Detector

Chemical engineers from UB have collaborated with scientists from other institutions to solve a critical bottleneck in the transport and capture of virus nanoparticles, making possible a device that could rapidly sample and detect infectious biological agents, such as viruses.

“This advance may pave the way for an ‘on-the-spot’ virus detector, which would be immensely helpful, especially in military and public-health applications,” said **Paschalis Alexandridis**, CBE professor at UB and co-author on the research. A paper describing the results was published in *Langmuir*, 23, 3840 (2007).

The rapid detection of viruses in biological samples is of increasing interest, particularly with the recent emergence of new viruses. But because viral particles are present at such low concentrations in biological samples, such as blood, a device that can quickly and easily detect them has remained elusive.

Typical procedures involve passive diffusion to get the viral particles to bind to an antibody, a slow process that is not feasible for many applications, such as on the battlefield, where quick results are critical.

Scientists at the University of Wisconsin at Madison led by Dr. Nicholas L. Abbott, a co-author on the paper, previously had demonstrated that liquid crystals can amplify signals from low concentrations of viral particles, quickly indicating whether or not a virus is present on a surface.

“The bottleneck was how to transport and capture enough suspected viral particles onto a surface in a timely fashion so that they could be detected,” said Alexandridis. “During the acute phase of an infection, the virus is at a very low concentration and relying on passive diffusion to deposit the viral particles onto the detection surface can be time-consuming.”

The researchers wanted to speed up the collection of viral particles — in this case, of vesicular stomatitis virus, a common animal virus — at the right place on a substrate, while also doing it in media at physiological ionic strength.

The UB researchers used their expertise in a methodology called directed assembly, in which they design external electrical and fluid flow fields in order to

“drive” nanoparticles to specific locations and in specific concentrations on a substrate.

“This paper shows that by using electrodes separated by just a few micrometers together with electrothermally induced fluid flow, we can accelerate the transport of viral particles from aqueous sus-

pensions with physiological ionic strength to specific points on a surface, allowing them to reach local concentrations high enough to allow subsequent rapid detection,” Alexandridis explained. “We achieved this not by accident, but by design. We hypothesized that the application of these external fields would cause the nanoparticles to act in a certain way. We designed electrodes to generate the required forces for the system of interest and then put our design to the test.”

In the research, the UB engineers used directed assembly to tailor dielectrophoretic forces, which act through a nonuniform electric field, overcoming an obstacle that occurs whenever nanoparticles are involved.

“When you work with microscopic objects dispersed in a liquid, gravity is very important,” explained Alexandridis. “But at the nanoscale, gravity doesn’t matter. So when you are trying to manipulate matter at the nanoscale, electrical fields and fluid fields may work best. By using directed assembly, we can tailor the forces acting on the nanoparticles. The ability to use several forces acting in tandem becomes important.”

Electrical fields in particular, he said, are advantageous because by designing the electrodes in a certain way, engineers can control directionality and intensity of electrical forces acting on nanoparticles.

This research was conducted with **Dr. Aristides Docoslis** (PhD/1999), a former CBE student and postdoc at UB, and now the Canada Research Chair of Colloids and Surface Engineering at Queen’s University at Kingston.

The research was funded by a NSF grant in Nanoscale Exploratory Research and by the Gerald A. Sterbutzel Research Fund, administered by the UB School of Engineering and Applied Sciences. ■



Prof. Alexandridis

“We achieved this not by accident, but by design.”

P. Alexandridis

Fred Justice Named Fellow of AIChE

Fred C. Justice (MS, 1966), a respected AIChE member and Business Development Manager at Chemstations, Inc., in Houston, TX, was recently honored for his accomplishments in chemical engineering by being named a Fellow of the American Institute of Chemical Engineers. The title of Fellow identifies chemical engineering professionals who have made a meaningful impact on the profession and the Institute. Nominees must have been in the chemical engineering practice for at least 25 years and a member of AIChE for at least 10 years.

Fellows are named for having made significant accomplishments in chemical engineering — either in process or product development, project leadership, managerial achievement, education, technical publications, patents, theoretical developments, or a combination thereof.

Justice, a member of AIChE's Mid-Michigan local section, was a founding member of AIChE's Marketing Division, and has been involved in a variety of programming activities for AIChE professional and student members. Throughout his career, Fred has specialized in marketing and sales for the chemical process industries and international business. In his current position as Business Development Manager at Chemstations, Inc., he has set sales volume records for chemical process simulation software. Fred received his BChE from the University of Detroit, his MS from the University at Buffalo, and an MBA from Central Michigan University. He also attended the International Marketing Programme at Emmanuel College in Cambridge, UK. Fred currently resides in Saginaw, Michigan. ■



Student Notes

The CBE Department is proud to announce the following student award winners for the 2006-07 academic year.

Eleftheria Antoniou received a *UB GSA Mark Diamond Research Fund Award* and a *GSA Travel Award*.

Christine M. Balonek received an *Honorable Mention at the NSF Graduate Fellowship Competition*, and the *ACS Outstanding Senior Award*.

Krista Brown received *AIChE Outstanding Junior Award*.

Hongyi Dang received a *UB Engineering Graduate School Ambassador Award*.

Jessica James received the *David M. Benenson Memorial Scholarship*.

Daniel Kehoe received a full *Mark Diamond Research Award*.

Chin Giaw Lim received a *Presidential Fellowship*.

Andrew S. Paluch won the *Barry M. Goldwater Scholarship*. (This is a prestigious award given to a rather select group of undergraduate students nationwide).

Stacy Pustulka received *AIChE Outstanding Senior Award*, as well as a *James W. and Nancy A. McLernon SAE Engineering Scholarship*.

Thomas Rosch received a *UB Engineering Graduate School Ambassador Award*.

Indrajit Singh received a *UB Engineering Graduate School Ambassador Award*.

Michael Williams received a *Schomburg Fellowship*.

Christopher L. Wirth received an *Engineering Alumni Association Scholarship*, a *Matthew Grapone Book Award*, a *Senior Scholar Award*, and an *Honorable Mention at the NSF Graduate Fellowship Competition*. ■



Another Awesome Year

By Christina Yacoob

The UB student chapter of AICHE left an amazing impact on the 2006 – 2007 school year. Led by a dynamic and fun group of seniors, AICHE took on new challenges and implemented outstanding ideas that brought the club to higher levels of achievement.

Under the command of **Christopher Wirth**, **Robert Forbes**, **Justin Lawliss**, **Renee Manez**, and **Kimberly Henry**, AICHE was able to have a variety of unique events including everything from speakers in the seminar series and plant tours, to research fairs and dinner with John Chen (president of AICHE). Some guest speakers included recent UB alum who shared their thoughts about the college to industry transition in an interactive panel, as well as experts from companies like *Praxair*, *Babcock & Wilcox*, and *SAMCO*.

The Annual UB Science and Engineering Undergraduate Research fair held in December was a major success. The room was packed with faculty from all areas stretching from the CBE department to the Biology, Physics, Physiology, Chemistry departments and everything in between. Students from freshmen level and up learned about involvement in undergraduate research by

talking one-on-one with the professors and students who conduct research. Next year the club plans to expand this research fair by including more of the science-related departments.

On the fun side, AICHE

continues to show children how to enjoy science at a young age at the Buffalo Science Museum during engineering week. The club showed kids the many “cool” uses of liquid nitrogen by making ice cream and freezing some common objects. AICHE also participates in many community service activities, including clean-ups around the city

of Buffalo and Relay for Life, an American Cancer Society fundraiser. In addition, AICHE admirably narrowed the student/faculty gap by having social

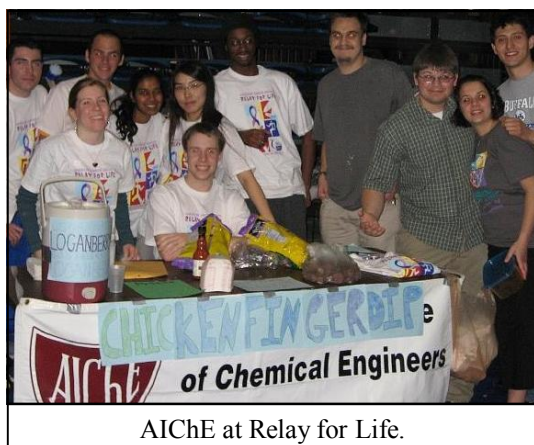
events throughout the year which allowed students and faculty to battle in Lasertron against each other and casually play pool over a potluck dinner.

Last year was also the beginning of the AICHE sister club of the Society of Biological Engineers. Guided by **Stacy Pustulka** (Chair) and **William Frank** (Vice-Chair), this asset to the club allowed more engineering students with a focus on the biological applications of engineering and technology to participate in the club. SBE also collaborated with AICHE on many of the years' events making a strong appearance in its first year at UB and as one of the first nine recognized student chapters in the nation. This upcoming year, SBE will be headed by **Ryan Tomko** (Chair) and **Mike Williams** (Vice-Chair) who have already started brainstorming and implementing plans with the chapter advisor, **Dr. Mattheos Koffas** for SBE next year.

AICHE has many great ideas for the coming year. It will be a challenge to follow in such footsteps, but the new e-board has what it takes. The new e-board for AICHE consists of **Christina Yacoob** (President), **Hiromi Yoshida** (Vice President), **Saurabh Kohli** (Technical Projects Manager), **Carlos Buitrago** (Secretary), and **Ellen Cardone** (Treasurer). The club has already started to network with a few of the nearby industries to have them come in the early fall semester to share their experiences, as well as some of the topics CBE majors should know before heading out into the field. *If you would like to get involved, please see the next page about networking with AICHE.* ■



Kids eagerly await the next batch of liquid-N₂ ice cream while CBE students Hiromi Yoshida and Kim Henry mix it up at the Buffalo Science Museum.



AICHE at Relay for Life.

...With A Little Help From Our Friends

Dear UB Alumni,

Hi, my name is Christina Yacoob, and I am the recently elected 2007-2008 President of the University at Buffalo chapter of the American Institute of Chemical Engineers (AIChE).

In the past couple years, AIChE has been making a strong impact at the University at Buffalo with ChemE Car competitions, factory and industrial tours of local companies, guest speakers from various industries, research fairs, and student-faculty activities. Last year we were proud to add one of the first national sections of the Society of Biological Engineers (SBE) for students with more of a biology or medicinal focus.

Industrial networking is a key component of AIChE. With factory and plant tours, students have the opportunity to witness engineering applications, which maximizes the understanding of the material learned in class. When companies come and talk to students during our speaker series the advantages are tremendous. Students can ask recent grads about the transition from college life to the "real world" and learn from experienced engineers about important topics like sustainability and new technologies. Companies can have free publicity and a choice of the active top-of-the-class engineers for any internship or entry-level position which may be open.

AIChE is always looking for more industries, companies, and alumni who want to be involved with the chemical and biological engineering students at UB. Alums can visit UB as a guest speaker to represent your company, talk about experiences in engineering, and/or give valuable advice to students. Students are eager to hear about the industry and the research world; we are always looking for

new companies in a variety of fields.

Another highlight of AIChE is the ChemE Car team. We compete at the regional and national ChemE Car competitions where students build and race a chemically powered shoebox-sized car. At the race, judges inform the students of a specific distance between 50 to 100 feet which the car must travel to, as well as the amount of additional weight the car needs to carry. Students have one hour to change concentrations of chemicals and make any necessary adjustments to win the race. This year we placed 2nd in Regionals at Bucknell University by mere inches making the team an extremely competitive opponent for the national competition in Salt Lake City in November.

Going to Nationals takes lots of hard work and dedication as well as being a financial burden. If

you or your company would like to help make this trip possible for our group of young determined engineers a donation of any amount makes a difference. In appreciation of your sponsorship we will proudly wear your company's name or logo on our shirts as we compete on the national level.

AIChE is always looking for more industries, companies, and alumni who want to be involved with the chemical and biological engineering students at UB.

If you are interested in becoming involved with the Buffalo Chapter of AIChE by being a guest speaker, facilitating a plant tour or sponsoring our ChemE Car team please feel free to contact me. In addition don't hesitate to contact me with any other questions you may have.

Thank you so much,

Christina Yacoob
AIChE President
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csyacoob@buffalo.edu

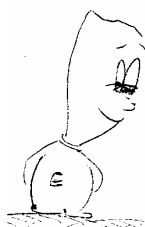


Department News Briefs

Dr. Jeffrey Errington and his wife, Lynn, are the proud new parents of a happy and healthy baby girl. Lauren Elizabeth was born on May 2, 2007.

Dr. Sol Weller celebrated his 89th birthday on July 27, 2007. Dr. Weller was a professor in CBE from 1965 until his retirement in 1989. His field of specialization was in the area of catalysis.

Dr. Tamara Kofke was selected as *Professor of the Year* by the student chapter of the AIChE. Tammy teaches all four of our core undergraduate lab courses. ■



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We are looking forward to seeing you at our Hospitality Reception at the AIChE meeting in Salt Lake City. Watch our website for details.

Praxair Seminar Series — Fall 2007

September 12

Harry Goldsmith
Montreal General Hospital
McGill University
Topic TBA

October 17*

Dennis Prieve
Carnegie Mellon University
“Charging of Solutes and Interfaces in Nonpolar Liquids”

October 24

Thomas K. Wood
Texas A&M University
Topic TBA

October 31

Marc-Olivier Coppens
Rensselaer Polytechnic Institute
“Nature Inspired Chemical Engineering of Porous Materials and Reactors”

November 14

Peter G. Vekilov
University of Houston
“The Two-Step Mechanism of Nucleation of Crystal in Solution”

November 28

Paul R. Van Tassel
Yale University
“Polelectrolyte Adsorption Under an Applied Electric Potential”

December 5

Virginia W. Cornish
Department of Chemistry
Columbia University
“Co-opting Nature’s Machineries for Chemical Discovery”

All seminars to be held at 3:30 pm in 206 Furnas Hall unless otherwise noted. Please see our website for updates and additional seminars.

*October 17 is our tentative Graduate Research Open House. Watch our website for more details.

We would like to thank Ellen Goldbaum, Sue Wuetcher, UB News Services, and Gordon Ellis for contributions to this issue.



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We would like to hear from you to know what you've been up to since graduation! Please take a few minutes to fill out the form below and mail it to us, or reply via the web at: www.cbe.buffalo.edu/alumni. We'll put your news in future issues of our newsletter, unless you indicate otherwise. (Please check one of the boxes below to indicate your preference).

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Address: _____

UB CE degree(s) and years: _____

Spouse's Name and Children: _____

News/Comments: _____

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