SPRING 2008

COLUMNS

CHEMICAL AND BIOMOLECULAR ENGINEERING

A. JAMES CLARK SCHOOL *of* ENGINEERING

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A NEWSLETTER FOR ALUMNI AND FRIENDS OF THE DEPARTMENT OF CHEMICAL AND BIOMOLECULAR ENGINEERING AT THE A. JAMES CLARK SCHOOL OF ENGINEERING, UNIVERSITY OF MARYLAND.

IN THIS ISSUE:

ChBE Welcomes 3 New Faculty

The Department of Chemical and Biomolecular Engineering is pleased to welcome its newest faculty members: Drs. **Jeffery Klauda**, **Ganesh Sriram**, and **Chunsheng Wang**. All three have been appointed as assistant professors. Klauda and Wang joined the Clark School in Fall 2007, while Sriram joined us in Spring 2008.

Professor and Chair **F. Joseph Schork** is excited about the faculty's growth. "These hires will allow the department to address some of the critical research areas in chemical and biomolecular engineering today: biomolecular engineering, nanotechnology, and energy."

Klauda received his Ph.D. in chemical engineering from the University of Delaware in 2003. Before coming to Maryland, he was an Intramural Research Training Award (IRTA) Postdoctoral Fellow at the Laboratory of Computational Biology at the National Heart, Lung and Blood Institute, National Institutes of Health (NIH), where he studied lipid forcefield improvements and dynamical behavior of membranes; transport of sugars through the cell membrane via proteins, and enhanced sampling of beta-haripin protein folding. His research interests include cell membrane biophysics, thermodynamics, and molecular simulations.

Sriram received his Ph.D. in chemical engineering from Iowa State University in 2004, then held a postdoctoral position with the Departments of Chemical and Biomolecular Engineering and Human Genetics at the University of California, Los Angeles (UCLA), where he was involved with metabolic investigations of glycerol kinase deficiency, an inherited human disease. His primary research interests are in systems biology and metabolic engineering, including metabolic networks, regulatory networks, and fuel production from biorenewable resources.

Wang was previously an assistant professor at the Center for Manufacturing Research, part of the Department of Chemical Engineering at Tennessee Technological University. He received his Ph.D. in materials science and engineering from Zhejiang University, China, in 1995. His research interests include energy conversion for fuel cells; energy storage systems such as rechargeable batteries, supercapacitors and hydrogen storage; sensors; electrochemistry; and nanostructured materials. Dr. Wang is also a member of the University of Maryland Energy Research Center (UMERC), a multidisciplinary initiative dedicated to advancing the frontiers of energy science and technology, with a special focus on forward-looking approaches for alternative energy generation and storage.

JEFFERY KLAUDA

GANESH SRIRAM

CHUNSHENG WANG

chair's MESSAGE

F. JOSEPH SCHORK

LAST YEAR IN THIS COLUMN, I SAID THAT 2006-07 WAS A SIGNIFICANT YEAR FOR THE DEPARTMENT OF CHEMICAL AND BIOMOLECULAR ENGINEERING AT THE UNIVERSITY OF MARYLAND.

It was my first year here, and it seemed like things were changing so very fast. More likely, all years in the life of an academic department are significant. Certainly 2007-08 was for ChBE. Things are still changing fast, perhaps even faster than last year. Or maybe I'm just getting older!

I have gotten over the feeling of walking in on the middle of the movie. I have learned most of the procedures, and know who to contact and when. I have definitely stopped saying, "Well at Georgia Tech we..." My heartfelt thanks to our faculty and staff for training me.

So what is new this year in ChBE and the Clark School of Engineering? Dean **Nariman Farvardin** is now Provost Farvardin, and we are in the midst of a search for a new dean. While we all miss Nariman's incredible energy and vision, we are glad he is able to put these gifts to work for the University as a whole. Meanwhile, Professor **Herb Rabin** is serving as interim dean for the second time in his career.

The big news in the Department is that we have hired three new assistant professors. You can read about them in our cover story, but I have to say more about them here because I am so very excited that we were able to recruit them. Dr. **Jeffery Klauda** joined us in August after a postdoc at The National Institutes of Health. His Ph.D. is in chemical engineering with Professor **Stan Sandler** at The University of Delaware. We were able to convince him to choose UMD over other opportunities. His research work will focus on molecular and mesoscale simulation as it relates to both cell biophysics, and energy production and storage. He is busy building his computational cluster, working with new graduate students, writing proposals and teaching a course in statistics and experimental design.

Dr. **Ganesh Sriram** joined us in January after a postdoc at UCLA with Professors **James Liao** and **Katrina M. Dipple**. His Ph.D. is in chemical engineering from Iowa State, where he worked with Professor **Jacqueline V. Shanks**. We successfully competed with a number of other universities in order to recruit him to UMD. Their loss is our gain! His research work is in the area of metabolic engineering. He is in the midst of setting up his laboratory and working with new graduate students now, and will begin teaching next Fall.

Dr. Klauda, Dr. Sriram and I were hired to replace those of our colleagues who left for the newly-formed Fischell Department of Bioengineering. Our last new faculty member came to us via another route. The University and particularly The Clark School are establishing the University of Maryland Energy Research Center (UMERC). This center will build on existing strengths at UMD in energy-related fields, and position us to tackle the problems facing the world as we seek new and cleaner sources of energy. At its founding, the Center had four openings for new faculty, two at the senior level, and two at the junior level. A college-wide search committee has been formed to fill these openings. I am very happy to report that the first hire for UMERC is our third new professor, Dr. **Chunsheng Wang**. Dr. Wang received his Ph.D. in materials science and engineering from Zhejiang University, one of the foremost Chinese universities in science and engineering. He has a reputation for significant contributions in the area of electrochemical engineering, and specifically in fuel cell and battery applications. He comes to us from a faculty position at Tennessee Technological University in Cookeville, Tennessee. Since joining the faculty in August, he has been busy setting up his research laboratory and teaching the Chemical Engineering Laboratory course, where he developed an experiment based on a fuel cell. In his short time here he has already secured outside funding for his research work, and organized a workshop on Soldier-Portable Power Systems for the Army Research Office.

As I reported last year, we are very excited that **T.K. "Patrick" Sung** (M.S. '69 and Ph.D. '72, chemical engineering) and his wife, **Marguerite** (B.S. '70, mathematics), have pledged $1.5 million to the Clark School to establish two endowed professorships in chemical and biomolecular engineering, "The Patrick and Marguerite Sung Professorship in Chemical Engineering" and "The Patrick and Marguerite Sung Distinguished Professorship in Chemical Engineering." The first will be fully funded in early 2009, and we will soon establish a committee to select who will hold the position. Current thinking is that the first Professorship will be awarded internally, while the second will be used for an outside hire.

One of the things we are most proud of is our recent track record in placing our Ph.D.s in academic positions. Each year over the past nine years, at least one of our former Ph.D.s has entered a tenure-track academic position. This is a remarkable achievement for a department of our size.

After a year and a half at UMD, I am even more excited about our prospects. We have a great department in a really great college. If we can leverage the momentum of the Clark School, we can be even better in the future. Please help in any way you can or consider a donation to the *Great Expectations* campaign (see p. 12).

I would love to hear from you.

F. Joseph Schork

Joe

CHBE UNDERGRADUATE CURRICULUM CHANGES

Kyu Yong Choi, Professor and Associate Chair, Undergraduate Program

The ChBE undergraduate curriculum will be modernized and realigned beginning in Fall 2009. The curriculum changes are motivated by the significant movement of the chemical engineering profession into the realm of biological science and engineering. Chemical engineering has been traditionally based on chemistry, physics, and mathematics, but biology is rapidly becoming a core science for the field. The new ChBE curriculum will better prepare our students for the scientific and technological challenges of the future. Highlights of the proposed curriculum changes are as follows:

- The name of the undergraduate degree awarded by the Department will be changed from Chemical Engineering to Chemical and Biomolecular Engineering (Requires Campus Senate approval).
- The code for course listings will be changed from ENCH to CHBE.
- Freshman Year: ENES102 (Statics) will be replaced with BIOE120 (Biology for Engineers). ENCH215 (Chemical Engineering Analysis) will be moved to the second semester, renumbered as CHBE101, and renamed Introduction to Chemical and Biomolecular Engineering.
- Sophomore Year: ENCH300 (Chemical Process Thermodynamics) will be renumbered as CHBE301 and moved to the first semester. ENCH400 (Chemical Engineering Thermodynamics) will be renumbered as CHBE302 and moved to the second semester. Course names will change slightly.
- Junior Year: CHEM482 (Physical Chemistry II) will be removed as a requirement and become a senior elective. BCHM463 (Biochemistry of Physiology) or BCHM461 (Biochemistry I) will be added as a requirement and removed from the list of electives. BCHM462 (Biochemistry II) will be a required elective for those opting to take BCHM461. Students may choose to take ENMA300 (Introduction to Materials and Their Applications) or ENMA425 (Introduction to Biomaterials; also offered as BIOE453). The order of ENCH440 (Chemical Engineering Kinetics, currently offered in the second semester) and ENCH426 (Transport Processes III, currently offered in the first semester) will be exchanged. A technical elective will be required in the second semester.
- Senior Year: ENCH442 (Chemical Engineering Systems Analysis) will be moved to the first semester.

KYU YONG CHOI

A transition plan has been developed for moving to the new curriculum starting in Fall 2009. Freshmen in Fall 2009 will enter under the new curriculum, while sophomores, juniors and seniors in Fall 2009 will continue on the current curriculum to graduation. Sophomores may petition to join the new curriculum, subject to all of its requirements. During the transition, some courses will be offered twice during one year.

Any students–incoming or current–who have questions about the transition may contact Professor **Kyu Yong Choi** (choi@umd.edu), Professor **Richard V. Calabrese** (rvc@umd.edu), or Professor and Chair **F. Joseph Schork** (fjschork@umd.edu).

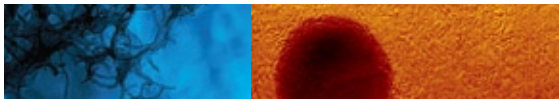
UNIVERSITY, CLARK SCHOOL CONTINUE STRONG SHOWING IN RANKINGS

The University of Maryland jumped from No. 111 to No. 79 in a ranking of universities around the world published by *The Times Higher Education Supplement.* In *The Times Higher QS World University Rankings 2007,* the campus is ranked No. 7 among U.S. flagship campuses, No. 11 among U.S. public colleges and No. 30 among all U.S. colleges.

The Clark School is ranked No. 6 among *The Princeton Review*'s first listing of the Top 20 Graduate Engineering Programs. Programs were ranked using a combination of quantitative criteria, including GRE scores, undergraduate GPA, percentage of applicants accepted and percentage of top undergraduates applying. *The Princeton Review* also named the University of Maryland a "Best Value College."

U.S. News & World Report ranked the Clark School 17th in the nation and 11th among public universities in its listing of top graduate engineering schools in the U.S. for 2009.

The Clark School maintained its place as 13th among engineering schools worldwide according to the Institute of Higher Education at Shanghai Jiao Tong University in China.



SENGERS TOURS EUROPE AS INVITED LECTURER, VISITING PROFESSOR

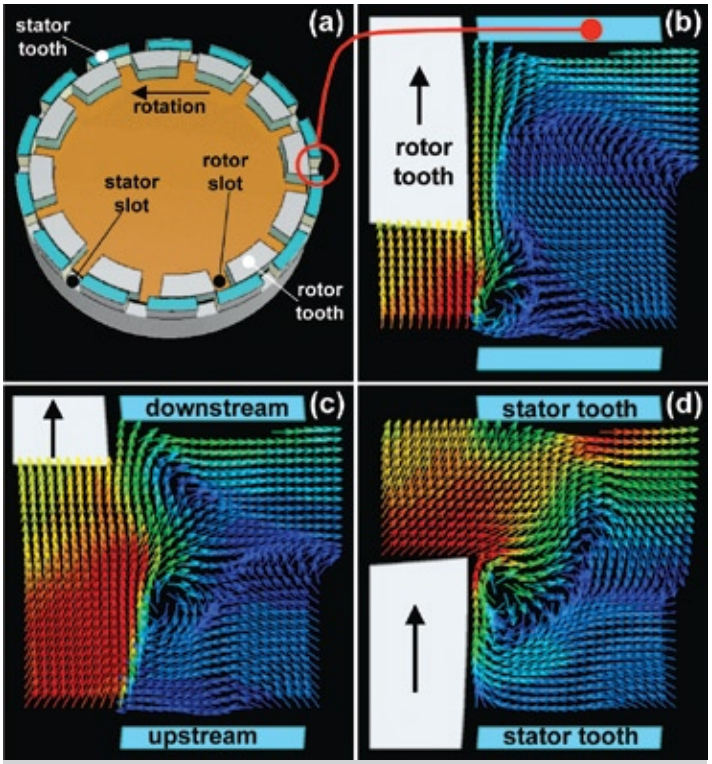
Distinguished University Professor Emeritus **Jan V. Sengers** spent his Fall 2007 semester in Europe as a visiting professor and invited lecturer. Sengers stayed in Madrid, Spain, where he served as a Visiting Professor in Applied Physics at the Complutense University of Madrid until the end of the year. Throughout the semester he traveled throughout Spain, France, and Germany for invited lectures, including "Critical Dynamics in Polymer Solutions" at the Annual Meeting of the Royal Spanish Physical Society, in Granada, Spain; "Mesoscopic Fluctuations in Nonequilibrium Fluids" at a conference on Nonequilibrium Statistical Mechanics in Sevilla, Spain; "Computer Simulations of Critical Dynamics" at a symposium at the University of Vigo, Ourense, Spain; "Thermal Fluctuations in Nonequilibrium Thermodynamics" at a workshop on Statistical Physics of Systems out of Equilibrium at the Institut Henri Poincaré, Paris, France; and "Computer Simulations of Critical Dynamics in Fluids" at a Symposium in memory of UMD Professor Richard A. Ferrell on Strongly Interacting Systems: Past, Present, and Future, at the Max-Planck Institut für Physik Komplexer Systeme in Dresden, Germany.

CALABRESE GROUP FEATURED IN *CEP* HIGH-SHEAR MIXING STORY

Department of Chemical and Biomolecular Engineering Professor **Richard Calabrese** was one of several high-shear mixing experts consulted for a feature story in the November 2007 issue of *Chemical Engineering Progress (CEP),* the flagship publication of the American Institute of Chemical Engineers (AIChE). He discussed his work in advanced simulation of rotor-stator mixers, including the development of the computational fluid dynamics software that drives it.

High-shear mixing, which produces emulsions (mixtures of usually unblendable substances) and dispersions (evenly-distributed particles within a medium), is used to create many products we use every day, including salad dressing, paint, cosmetics, butter, and toothpaste. Although all of these items have long been manufactured commercially, there has been less understanding of how to control the mixing process and predict the outcome. Complex material behavior and interactions, numerous variables, and inconsistent results when scaling a project from a lab to a factory setting make repeated testing a necessity and lead engineers and mixer operators to rely on experience and instinct. Quantifying a result that reflects the more subjective qualities of a product, such as "creaminess" or "spreadability", can be a challenge.

In the *CEP* article, Calabrese describes these issues, as well as his research group's efforts to address them by creating mathematical models that can accurately predict the behavior of materials processed by high-shear mixing equipment. As the director of the university's High Shear Mixing Research Program—a 15-member consortium including equipment manufacturers, software developers, and chemical process operators—he and his colleagues have spent years developing computational fluid dynamics software and methodologies that mixing vendors and end users can use optimize their equipment, production and products at any scale. If successful, the group's work will result in reductions of the time, consumption of materials, and equipment wear typically associated with the repeated testing a high-shear mixing system can require. So far, Calabrese told *CEP,* the results are promising. The consortium is currently developing new experimental techniques for measuring flow fields and droplet sizes that will allow it to validate its models.



ONE OF CALABRESE'S MODELS. VELOCITY VECTORS (RED=HIGHEST; BLUE=LOWEST) ARE SHOWN IN A ROTOR AND STATOR SLOT (A) MEASURED IN A TURBULENT WATER FLOW, VIA 2-D PARTICLE IMAGE VELOCIMETRY, AS THE ROTOR PASSES THE STATOR. THE STATOR SLOT FLOW FIELD CONTAINS AN OUTWARDLY DIRECTED DISCHARGE JET THAT FORMS WHEN THE ROTOR DRAGS FLUID TOWARD THE DOWNSTREAM STATOR TOOTH. THIS INDUCES LOW PRESSURE WHICH RESULTS IN FLUID RE-ENTRAINMENT NEAR THE UPSTREAM STATOR TOOTH (B, C, D). TANGENTIAL VELOCITIES IN THE ROTOR SLOT ARE HIGH RELATIVE TO THOSE IN THE RECIRCULATION REGION OF THE STATOR SLOT (C). THE RESULTING VELOCITY GRADIENTS CREATE A SHEAR LAYER WITH DEFORMATION RATES THAT ARE MORE THAN TWICE THE NOMINAL SHEAR RATE REPORTED BY VENDORS. THUS, FLUID DOES NOT NEED TO PASS THROUGH THE GAP BETWEEN THE ROTOR AND STATOR TEETH TO EXPERIENCE HIGH SHEAR. WITHIN THE SHEAR LAYER, AN OPENING VORTEX FORMS (B, C) AND EVENTUALLY MERGES WITH A ROTOR TIP VORTEX (D).

DENNY ROSS, 75, NUCLEAR ENGINEERING LECTURER

The Department is sad to report the passing of Dr. **Denny Ross** on Sept. 18, 2007. Ross had been a lecturer in the nuclear engineering program at the university since 1990. He received a B.S. degree from Texas Western College, a M.S. degree in nuclear engineering from Southern Methodist University, a M.S. in mathematics from Texas Christian University and a Ph.D. in Engineering from Catholic University. He had a long and distinguished career with the Atomic Energy Commission and the Nuclear Regulatory Commission (NRC), including many years in senior management positions in the NRC Safety Research Office and the Office of Analysis and Evaluation of Operational Data. He retired from the NRC in 1998. He loved teaching and working with students, and in addition to the many years as a lecturer with the nuclear engineering program on the UMCP campus, he also taught mathematics at Montgomery College from 1968-1990.

GREER RECEIVES NSF FUNDING FOR ETHICS COURSES

Professor **Sandra Greer** (Departments of Chemical and Biomolecular Engineering and Chemistry and Biochemistry), along with co-PIs Professor **Robert Dooling** (Department of Psychology) and Professor **Art Popper** (Department of Biology), have won a NSF grant to support the expansion of a program that will develop a series of ethics courses and workshops for graduate students, postdoctoral associates and new faculty to provide training on research integrity and to teach them to mentor others in ethics issues.

The proposal, titled "Maryland Initiative on Research Ethics," outlines a three-year plan that includes developing additional ethics courses and course sections throughout the Clark School, the College of Chemical and Life Sciences (CLFS), and the College of Behavioral and Social Sciences (BSOS); extending the program throughout the University System of Maryland (USM); training postdoctoral associates to teach new ethics courses within the USM and at colleges around the world; and offering an annual Research Integrity Bowl.

Greer and her colleagues are currently developing two new courses for graduate students and postdoctoral associates, designed to accommodate students from different disciplines: Research Ethics, a graduate version of existing undergraduate courses, will include readings, roleplaying, proper handling of data to avoid bias, attribution and citation, plagiarism, engineering practice, intellectual property, under-represented groups in the sciences, mentoring and the philosophy of value systems. Advanced Research Ethics, offered to postdoctoral associates and graduate students seeking a Graduate Certificate in Research Ethics (a program also currently under development), will address ethics training in various settings, and prepare them to teach. The team has also developed a one-day workshop for new science and engineering faculty members.

For Greer, the path to the NSF grant began in 1994, when, noticing a lack of classroom discussion and textbooks on ethics in the sciences, she designed and taught an undergraduate course on the topic for the Department of Chemistry. Called "Ethics in Science and Engineering," it has been cross-listed with the Department of Chemical and Biomolecular Engineering since 1995. Although offered by these two specific departments, it may be taken as a CORE elective, and has been popular with students from all engineering majors.

Only two other science-oriented ethics courses have been offered on campus, including one offered by Greer's co-PIs, professors Dooling and Popper, for students in CLFS and BSOS, and a recently introduced course in the Fischell Department of Bioengineering.

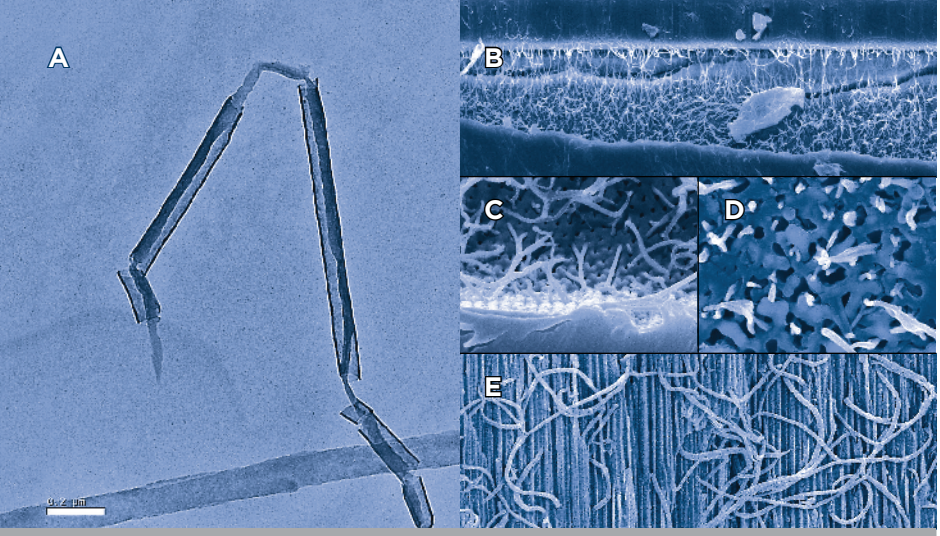
Greer's undergraduate course, she explains, "is not to teach students about right and wrong, but how to recognize an ethical dilemma when they see one, and how to think through it. In some ways ethics is like engineering design…many people are given the same problem, criteria and boundaries, but you get multiple results. With ethics, some don't even realize there is a problem to begin with. Maybe they're most surprised by the fact that there are no hard and fast answers to some of these things—engineers are not used to ambiguity!

"I think the students come out [of the undergraduate class] having their awareness raised about these kinds of issues," says Greer. "I get letters back—mostly from students who go into industry—saying it was one of the most valuable things they ever did, that these things come up all the time in their lives, and that because of the class they have some basis on which to think about them."

WANG WINS FACULTY SERVICE AWARD

ChBE Associate Professor **Nam Sun Wang** was the 2007 recipient of the Clark School Faculty Service Award, which was presented to him at the Clark School's 2007 spring commencement ceremony.

The Faculty Service Award is given to a faculty member whose service to his or her department, to the Clark School, and to the university has been judged outstanding in terms of *esprit de corps,* innovation, committee and advising work, community activities and additional factors. Dr. Wang serves as the main faculty advisor for the Chemical Engineering and Bioengineering Society graduate student organization. He has also served as advisor for the American Institute of Chemical Engineers student chapter, on the Undergraduate Studies Committee and as a liaison to the Professional Masters Program. Dr. Wang was ChBE's director for undergraduate studies for 10 years as well. He has devoted more than 10 years to K-12 outreach—one colleague remarks he has spent "untold hours" talking about engineering at middle schools and high schools. Colleagues note he is an eager volunteer whenever help is needed.



A: TEM IMAGE OF A NANOFIBER INSIDE A SILICA NANOTUBE REACTOR.
B: SEM IMAGE OF THE HOMEMADE MEMBRANE; PORE DIAMETER = 60NM.
C: SEM IMAGE–DETAIL OF B.
D: SEM IMAGE–NANOFIBERS EMERGING FROM PORES, TOP VIEW.
E: SEM IMAGE–CROSS-SECTIONAL VIEW OF THE PORES, SIDE VIEW.

researchFEATURE

POLYMER NANOFIBRILS INSIDE A GLASS TUBE

A new catalytic polymerization reactor called the *silica nanotube reactor* (SNTR) has been developed as the result of a collaboration between the research groups of Department of Chemical and Biomolecular Engineering professor **Kyu Yong Choi** and Department of Chemistry and Biochemistry professor **Sang Bok Lee**.

The project originally focused on the manufacture syndiotactic polystyrene (sPS) nanofibers—a strong, lightweight, heat-resistant material that could be developed for use in electronics and other high-temperature processes—using a high activity metallocene catalyst, supported on a silica coated, porous anodized alumina film as a template. Each pore in the film serves as a tiny, rod-shaped reactor that extrudes a semicrystalline syndiotactic polystyrene nanofibril as it forms.

As work progressed the project produced three significant results: First, that the SNTR is highly effective in customizing polymer properties; second, the discovery by Ph.D. student **Joong Jin Han** (advised by Choi) that the sPS nanofibers synthesized in the reactor have an unusually high molecular weight, which should greatly enhance their strength and thermal resistance; and third, a means of isolating the silica tubes from the film substrate and using transmission electron microscopy to observe of the growth of the polymer nanofibrils inside the catalyst channels—the first time this has been accomplished.

The findings grew out of Choi and Lee's exploration of new techniques for polymer synthesis, the development of new polymers using nanotechnology and catalytic reaction engineering, and their desire to develop a better understanding of polymer growth mechanisms and structural properties.

The professors plan to continue their collaboration. According to Choi, the next step is to produce enough of the sPS nanofibers to test and define their physical, mechanical, and rheological properties. Currently the fibers are produced under very sensitive and controlled conditions, he adds, so if they show promise for industry, the next challenge will be to devise a way to easily mass-produce them.

A paper about the research, "Syndiotactic Polystyrene Nanofibrils in Silica Nanotube Reactors: Understanding of Synthesis with Ultrahigh Molecular Weight" was recently published in the *Journal of the American Chemical Society,* 2008, 130(12): 3920-3286.

facultyNEWS *continued*

ANISIMOV WINS CLARK SCHOOL FACULTY TEACHING AWARD

Professor **Mikhail Anisimov** was the recipient of the 2007 Poole and Kent Company Senior Faculty Teaching Award, which was presented to him at the Clark School's spring 2007 commencement ceremony. Former Clark School Dean (now UMD Provost) **Nariman Farvardin** cited Anisimov's commitment and dedication to teaching, enthusiasm in the classroom, availability to students, and key role in the revision and improvement of the undergraduate thermodynamics curriculum as factors in his selection for the award.

MIKHAIL ANISIMOV

Anisimov, who holds joint appointments with the Institute for Physical Science & Technology (IPST) and the Chemical Physics Program, specializes in mesoscopic and nanoscale thermodynamics, critical phenomena, and phase transitions in soft matter. He is an Elected Fellow of the International Academy of Refrigeration, the American Association for the Advancement of Science, and the American Physical Society; and is an Elected Member of the New York Academy of Sciences. In 2006 he was recognized for outstanding volunteer service to the American Institute of Chemical Engineers (AIChE).

ANDENIRAN

ANISIMOV GROUP MAKES ITS MARK

Throughout 2007, students from the research group of ChBE professor **Mikhail Anisimov** were recognized for their research with funding and opportunities to present their work in dynamic light scattering and supercooled water at conferences and symposia. Anisimov, who holds a joint appointment with the Institute for Physical Science and Technology (IPST), focuses his research on nanoscale thermodynamics, critical phenomena and phase transitions in fluids, fluid mixtures, liquid crystals, surfactant and polymer solutions, and other soft condensed matter systems.

Undergraduate research student **Adedayo Adeniran** won third place for her presentation at the First Annual Louis Stokes Alliance for Minority Participation (LSAMP) Undergraduate Research Symposium, where she discussed the results of the research in which she was involved throughout the previous academic year.

Her project involved using dynamic light scattering (DLS) to discover whether the change in the particle size of a polymer could be observed. DLS is a technique in which a light source with a known frequency—often a laser, as in Anisimov's lab—is used to measure particle or droplet size and distribution at the nanometer or micron scale. When the light passes through a liquid in which particles are suspended, it diffracts (bends, or scatters), resulting in a change of its frequency. Researchers are then able to correlate these changes with specific particle properties.

"The research is important because it will hopefully show that dynamic light scattering can be another analytic tool to observe conformational changes of polymers and other materials," Adeniran explains. "It also may help make dynamic light scattering become a more standard analytical tool."

Graduate student **Kirt Linegar** attended the Gordon Conference on Liquid Crystals in New London, NH, a trip sponsored by the Department. Linegar presented a poster titled "Dynamic Modes in Liquid Crystal Solutions of Cromolyn." The project, which is also rooted in the use of DLS, seeks to quantify the significant fluctuations in the density of liquid crystal particles encountered at the nanoscale, and how long they last. Understanding this behavior could help engineers developing nanoscale technology for use in products such as flat panel televisions and handheld devices.

"It was a big privilege for a first year grad student to be able to attend such a prestigious conference," Linegar says of the experience. "The presentation was very successful, and it was great to represent Maryland."

Graduate student **Daphne Fuentevilla**, who also works for the United States Navy as a civilian engineer, won a Department of Defense SMART Scholarship, which provides support for science, technology, engineering, and mathematics students in exchange for civilian service with the DOD after graduation. SMART scholars receive full tuition, a $1000/year book stipend, a stipend up to $41,000 (based on prior experience and academic degree), and employment with the DOD.

Fuentevilla, who completed her Masters degree in August 2007 and is now pursuing a doctorate in the Department, is very happy about the arrangement, telling us, "I am very thankful for my scholarship because it allows me to maintain my full-time employee status with my job, something that is very important for me for my future career plans, while also giving me more time to spend on my research, something I felt I needed in order to attempt the Ph.D."

FUENTEVILLA LINEGAR

AYAN GHOSH

Fuentevilla and Anisimov attended two international thermodynamic conferences: the 11th International Conference on Properties and Phase Equilibrium, held in Hersonissos, Crete; and the 16th International Conference on Chemical Thermodynamics, held in Suzdal, Russia. Fuentevilla presented a poster in Crete and a talk in Russia, both related to her Masters thesis, "A Scaled Equation of State for a Liquid-Liquid Critical Point in Supercooled Water." The work, which examines the unusual behavior of liquid water at near-freezing and lower temperatures, provides a thermodynamic perspective on the theory that there may be a low temperature critical point at which water shifts from its typical liquid phase into two liquid phases of a different density before freezing. Fuentevilla and Anisimov have published the results of this work in *Physical Review Letters,* one of the most prestigious among international research journals.

GHOSH WINS WELLS FELLOWSHIP FOR POLYMER ELECTROLYTE WORK

ChBE graduate student **Ayan Ghosh** has been awarded the Harry K. Wells Endowed Fellowship, which provides annual support for Clark School graduate students working on energy engineering and alternative energy sources in conjunction with the University of Maryland Energy Research Center.

Ghosh, who is advised by Fischell Department of Bioengineering Professor **Peter Kofinas**, works with polymers that could be used as electrolytes in new, flexible batteries that will be both lighter and safer than the ones we use today.

"If you cut open a battery," he explains, "or if it leaks, it spontaneously

continues next page

GHOSH, continued from page 7

combusts or the electrolyte forms corrosive byproducts when it comes into contact with air or moisture. The idea is to replace this electrolyte with a polymer, something that when exposed to air and moisture simply crumbles." The flexibility and solid nature of the polymer has great design potential for electronics: "Unlike a liquid electrolyte it doesn't need to be encased in a bulky container," says Ghosh. "Suddenly your device is no longer constrained by the size and shape of your battery. Your device coating itself could be the battery!"

Professor Kofinas, who along with ChBE Professor and Chair **F. Joseph Schork** nominated Ghosh for the award, believes it is well deserved. "Ayan is one of my best students," he says. "His performance is outstanding. He's made a flexible polymer electrolyte with superior properties, and is about to submit a paper to the top polymer journal, *Macromolecules,* with his research results."

GORDON SELECTED FOR FUTURE FACULTY PROGRAM

Please join us in extending our congratulations to graduate student **Brad Gordon** (advised by Associate Professor **Sheryl Ehrman**), who was chosen to participate in this year's Future Faculty Program (FFP). Gordon will be part of the program's second cohort of students.

The program, launched in 2007, was created to prepare students for academic careers in top-50 engineering schools by helping them hone their skills in areas such as technical and grant writing, curriculum development, teaching, research, oral presentations, and interviewing. The program includes seminars, a teaching practicum, and a research mentoring practicum, and takes 3-5 semesters to complete. Participants are known as Future Faculty Fellows, and receive a supplementary stipend of up to $10,000 over the course of the program. One half of the funds are reserved for travel to attend professional conferences.

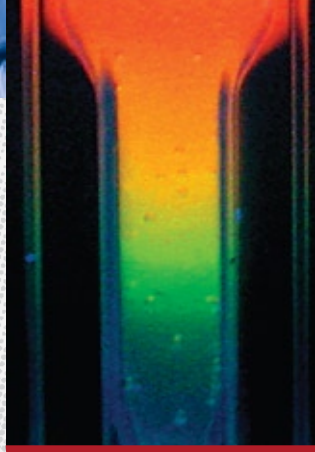
BRAD GORDON

"I applied to the FFP because I thought it was a great opportunity to learn more about a possible career as a professor," says Gordon. "This program is special because it allows graduate students to really know what they might be getting into—and more importantly, should they choose a position in academia, they'll have a greater sense of what it means to be a professor."

STUDENT AWARDS 2007-2008

Congratulations to the following students, who were recognized at the Clark School's 2007-2008 Honors and Awards Ceremony and at a Department ceremony held this spring. They have all demonstrated outstanding academic and research performance, and have made contributions to the Department and field.

- **Leigh Quang:** David Arthur Berman Memorial Award
- **Jeff Fox:** Chairman's Graduating Senior Award
- **Nicholas Levy:** Outstanding Junior Award
- **Marina Feric:** Outstanding Sophomore Award
- **Nicole Dupuy:** Outstanding Sophomore Award
- **Elliot Jones:** AIChE Student Chapter Award
- **Keran Lu:** Finalist in UM's $50K Business Plan Competition



SILICON NANOPARTICLES

CHOI TAKES 4TH IN SAMSUNG COMPETITION

ChBE graduate student and Ph.D. candidate **Jonghoon Choi**, advised by Professor **Nam Sun Wang**, has won 4th place in the annual SAMSUNG Electronics Human-Tech Thesis Prize competition. His paper, titled "Study on the New, Biocompatible Fluorescent Nano Materials: Synthesis, Characterization and Bio Application of Silicon Nanoparticles," competed with over 900 entries submitted by researchers from around the world. Choi received a cash prize of $1000 and a trip to Korea for the award ceremony.

Founded in 1994, the Human-Tech Thesis Prize competition has three goals: to search for creative young students who have the potential to become the future scientific leaders of Korea, to encourage research at the collegiate level, and to emphasize the integral role technology plays in modern society. The competition is open to high school, undergraduate, and graduate students in Korea and abroad.

Choi's paper focused on nanoparticles with unexpected but potentially useful properties. Bulk silicon is unable to emit fluorescence. However, it has been reported that nano-structured silicon can be fluorescent when properly excited. Silicon nanocrystals have received attention not only because scientists do not know exactly why they are capable of fluorescing, but also because of their advantages over fluorescent dyes. Choi's paper summarizes his studies on the synthesis, characterization and bio-applications of fluorescent silicon nanocrystals. and describes many potential bio- and optoelectric applications of new, biocompatible, and fluorescent silicon nanoparticles.

ALUMNI EXCEL IN ACADEMIA, RESEARCH

Three ChBE alumni and former members of Fischell Department of Bioengineering (formerly ChBE) Professor and Chair **William Bentley**'s research group have all recently been recognized as talented young professors and researchers. **Matthew DeLisa** (Ph.D. '00, who was also advised by ChBE Professor **William Weigand** for his M.S.), **Ryan Gill** (Ph.D. '99), and **Andy Hu** (Ph.D. '99) have all earned faculty positions at major universities as well as international awards for their achievements.

DeLisa is an assistant professor at Cornell University's Department of Chemical and Biomolecular Engineering, where his research group engineers bacteria for the discovery, design and manufacture of therapeutic proteins, and for the reprogramming of cellular physiology. His "designer bacteria" and "reconfigurable protein machine systems" could solve a variety of problems in biology and medicine. DeLisa's work as a scientist and educator has earned him almost a dozen honors and awards since 2004, including a National Science Foundation CAREER Award (2005), a National Academy of Sciences "Frontiers of Science" award (2005), a listing as one of *Technology Review*'s Top 35 Innovators Under Age 35 (2005), a National Academy of Engineering "Frontiers of Engineering" award (2006), several Young Investigator awards, and Cornell's Mr. & Mrs. Richard F. Tucker '50 Excellence in Teaching Award (2007).

Gill is the managing director of the Colorado Center for Biorefining and Biofuels and an endowed Patten Assistant Professor in the Department of Chemical and Biological Engineering at the University of Colorado. Currently, his research group develops and applies new genomics and evolutionary tools to engineering microbes for more efficient production of biofuels and biochemicals. Though always interested in a career in academia, he says, he also wanted to try building a startup company. Being faculty has given him the flexibility he needs to do so, and the company he has created, OpX Biotechnologies, focuses on biofuels and biorefining. In 2007, Gill was one of 12 recipients nationwide of the DuPont Young Professor Award, which will provide 3 years of funding to support his research.

Hu is a full professor at National Tsing Hua University, one of the most prestigious in Taiwan, where he studies gene therapy, tissue and cell engineering, vaccine development, and biomaterials. In May of 2007, Hu won one of Taiwan's Top Ten Young Persons Awards, conferred by the Taiwanese Parliament on ten exceptional citizens working in a variety of disciplines. Hu's award was for achievement in technology advancement. He was recognized for his work in developing a virus-like particle (VLP)-based vaccine for the enterovirus 71 (EV71), which can cause neurological complications and death in children; and for demonstrating the use of baculovirus-mediated gene therapy in facilitating cartilage and bone engineering.

CHBE/BIOE TEAM CREATES WOUND-CARE PRODUCTS, TAKES 2ND PLACE IN BUSINESS PLAN COMPETITION

Startup company **Remedium Technologies**, which includes alumnus **Bani H. Cipriano** (Ph.D. '07), ChBE Associate Professor **Srinivasa Raghavan**, and ChBE research associates **Oluwatosin Ogunsola** and **Chao Zhu** took second place in the 2007 $50K Business Plan Competition. The competition, conducted by the Maryland Technology Enterprise Institute (MTECH), encourages the University of Maryland's entrepreneurial thinkers to build their best ideas into a company over the course of a semester. Winners receive funding to help them launch their businesses.

Remedium Technologies is developing two nanotechnology-based active wound care products for the chronic and acute wound and burn healing markets. Both are based on a modification of chitosan, a bipolymer which can be easily and economically derived from the shells of crustaceans such as shrimp and crabs. Chitosan is biocompatible, anti-microbial, and able to stop bleeding.

The first product, a dressing for chronic wounds such as ulcers and burns, works by packaging growth factors (proteins that stimulate cell proliferation) and other therapeutics into nano-containers (liposomes) anchored to a biocompatible matrix (chitosan) by naturally occurring self-assembly. The resulting device can deliver various bioactive compounds for wound healing. The second product is meant to stop bleeding under conditions in which sutures won't work or can't be administered. Chitosan, while known for its blood-clotting ability, becomes saturated and ceases to adhere to tissue after only 30 minutes. Remedium is developing a modified chitosan "sponge" capable of functioning for several hours. The same modified chitosan could also be used in a surgical spray. Both products have the potential to reduce healing time, pain, and costs for patients and hospitals.

Currently, Remedium is in its startup phase as its members work on securing funding and continuing the research while still working on their degrees. Animal studies on the products are being conducted at the University of Maryland School of Medicine.

Remedium's other founding members are **Matthew Dowling** and **Peter Thomas** (Fischell Department of Bioengineering), and Dr. **Akinola Dosunmu**, CFA, CPA.

JAMES P. BYERS, B.S. '84

ChBE alumnus **James P. Byers** (B.S. '84) died September 27, 2007 at the age of 46 in Toledo, Ohio. Byers was an associate professor of pharmacology at the University of Toledo, where he had been on the faculty for eight years. He was known for his work in pharmacokinetics, the study of how the body absorbs, distributes, metabolizes, and excretes drugs; and also his research on diabetes and gene therapy. Byers was considered a demanding but exceptional teacher by his colleagues and students.

WANG BECOMES FACULTY AT TIANJIN UNIVERSITY

ChBE alumnus Dr. **Jingtao Wang** (Ph.D. '06) has been appointed to an associate professorship in the School of Chemical Engineering at Tianjin University, China. Established in 1895, Tianjin University is China's oldest institution of higher learning, one of China's 16 National Key Universities, and one of the largest interdisciplinary engineering schools in the country.

Wang's research focus is on thermodynamics in water phenomena and crystallization. He is also currently working on a project involving numerical calculation in industrial process integration.

While at the University of Maryland, Wang was advised by Professor **Mikhail Anisimov** and worked in Anisimov's joint research group with Professor Emeritus **Jan Sengers**. His dissertation was titled "The Nature of Asymmetry of Fluid Criticality."

Wang explained his goal was to become a professor, and thanks Anisimov and Sengers for being instrumental in helping him prepare for and supportive during the application process.

BRENDA CORNISH-FREEMAN

PHOTO: BUSINESS WIRE

CORNISH-FREEMAN IS NEW MARKETING OFFICER FOR TBS

ChBE alumna and Clark School Women In Engineering (WIE) Advisory Board member **Brenda Cornish-Freeman** (B.S. '87) has been named to the newly created position of chief marketing officer for Turner Animation, Young Adults & Kids Media, part of the Turner Broadcasting System. She will provide overall vision and leadership to all areas of marketing, on-air and trade creative services that support the cable television networks Cartoon Network, Adult Swim and Boomerang, along with their on-line businesses, and the digital enterprises GameTap and Super Deluxe.

Freeman, a veteran brand marketing and promotion executive, previously served as the senior vice president of integrated marketing and promotions for Nickelodeon and MTVN Kids and Family Group, where she oversaw development and execution of all promotions marketing efforts for Nickelodeon channels and publications. She has also been the vice president of affiliate marketing for MTV Networks, president of consumer marketing for VH1, director of marketing and special events for ABC Radio Networks, and has held product development management, financial and marketing positions with Frito-Lay, Pepsi-Cola, and Mobil Oil.

Freeman also holds an M.B.A. in marketing and finance from the University of Maryland and is a board member of Women in Cable and Television (WICT).

ROSENBERG NAMED PRESIDENT OF WIRELESS COMPANY

ChBE alumnus **Alan Rosenberg** (B.S. '83) has been hired by Business Only Broadband, a carrier-class wireless provider for the financial sector and other large enterprise clients. Rosenberg will serve as the company's president as it expands into the New York City market. He was selected for the position for his extensive experience in start-up, global sales, and developing financial extranets for Fortune 1000 companies in the brokerage, healthcare, pharmaceutical, market data, and manufacturing sectors.

Previously, Rosenberg worked at Global Crossing, a communications company providing internet, multimedia, voice and data services; and AT&T, where he was the global sales director of IT outsourcing. He also holds a M.S. in telecommunications engineering from the Stevens Institute of Technology and has completed studies in advanced business education at the London Business School and Carnegie Mellon University.

DUONG PROFILED IN *NEWSWEEK*

ChBE alumna **Anh Duong** (B.S. '82) was recently featured in *Newsweek* magazine's column *The Last Word,* written by Pulitzer Prize-winning author **George F. Will**. The column, titled "Anh Duong, Out Of Debt" describes her desire to give back to her adopted country by helping to fight the War on Terror.

Duong's family fled South Vietnam in 1975 and eventually settled in Maryland, where she attended high school and later earned a degree in chemical engineering from the University of Maryland. She knew exactly how she wanted to apply her knowledge and skills. "I wanted to work for the Defense Department," she tells Will in the article, "because I wanted to pay back the guys who protected us all those years." Will's column highlights the deep impression the kindness of American strangers—both military and civilian—made on Duong, which led her into public service.

In 2001, Duong was designing Navy munitions and explosives. After the attacks on the Pentagon and World Trade Center, she became part of a team of scientists tasked with designing a bomb capable of penetrating the caves in Afghanistan in which members of Al-Qaeda and other enemy forces hid. Sending troops into the caves would result in significant losses, but existing weapons did not have the power to go deep enough to reach entrenched forces. To solve the problem, her team designed a thermobaric bomb whose heat and blast were delivered more slowly, giving them a longer "reach." Her current mission is to design portable forensic labs for use in Iraq that will help identify individuals who build improvised explosives used against U.S. forces.

CHBE ALUMNUS MAY HAVE THE NEXT YOUTUBE

Alumnus **Rama Sreenivasan** (Ph.D. '07) has partnered with two other engineering alumni to create a web site they hope could be the YouTube of how-to videos.

Their site, doFlick (**www.doflick.com**), hosts instructional videos on a variety of topics, from how to bend a tube for a science lab project to making guacamole to demonstrating a drum and bass groove. Users can submit their videos to doFlick and watch those submitted by others at no cost. Advertising sales will support the site.

Sreenivasan's doFlick partners are **Shiva Pandit** (M.Eng '07) and **Luis Corzo** (M.Eng.'05). They met in an entrepreneurship class offered by the Clark School's Professional Master of Engineering program and Maryland Technology Enterprise Institute (MTECH), each looking to create a business they could get excited about and that could benefit people. Their experiences as engineers had shown them that a lot of lab equipment lacks instructions. They thought video could help in labs and other places where seeing how something is done is better than reading about it. Using borrowed cameras, they created doFlick's first how-to offerings by working with professors and students at UMD, then gradually added other kinds of content.

The DoFlick team is currently spreading the word about the site and talking to investors. *The Chronicle of Higher Education* recently featured doFlick in its column *The Wired Campus.*

WISE BECOMES MANAGER FOR BIOTECH/PHARMA COMPLIANCE COMPANY

Bennett Wise (B.S. '97) has been appointed to the position of Manager of South East Operations at JM Hyde Consulting, Inc. The Boulder, Co. company provides engineering, compliance and validation services to biopharmaceutical and pharmaceutical manufacturers. Wise specializes in biotechnology process engineering, GMP facility design, and project management; and is known for implementing cost- and time-saving solutions that still maintain a high level of compliance.

SEND US YOUR NEWS! WE ARE VERY PROUD OF OUR ALUMNI AND ENCOURAGE EVERYONE TO KEEP IN TOUCH! PLEASE SEND YOUR ALUMNI NEWS TO **bioechemmse@umd.edu**. YOU CAN KEEP YOUR CONTACT INFORMATION WITH THE CLARK SCHOOL AND THE UNIVERSITY OF MARYLAND UP-TO-DATE BY VISITING **www.eng.umd.edu/alumni.**



recent DISSERTATIONS

2007 PH.D. GRADUATES

MAY

Mahnaz Chaychian: Radiation-Induced Dechlorization of PCBS and Chlorinated Pesticides and the Destruction of the Hazardous Organic Solvents in Waste Water

Bhaskar Dutta: Time-Series Transcriptomic Analysis of a Systematically Perturbed Plant System—A Systems Biology Perspective

Juchen Guo: Spectroscopic Study of Diffusion In a Glassy Polymer

Harin Kanani: High-Throughput Time Series Metabolomic Analysis of a Systematically Perturbed Plant System

Jun Li: Systematic Investigation of Quorum Sensing in *E. Coli*

David Small: Comparison of Toxicogenomic Effects of Sodium Hypochloirte Hydrogen Peroxide and Peracetic Acid on Pseudomonas Aeruginosa

Ramaswamy Sreenivasan: Combinatorial Experiments Using a Spatially Programmable Chemical Vapor Deposition System

Yechun Wang: Flow and Interfacial Dynamics in Vascular Vessels and Microfluidics

AUGUST

Linden Bolisay: Molecularly Imprinted Polymers for the Recognition of Tobacco Viruses

Xin Fang: Impact of Stochasticity on Gene Regulation Networks

Angela Lewandowski: Assembly of Quorum Sensing Pathway Enzymes onto Patterned Microfabricated Devices

Chen-Yu Tsao: Rewiring Quorum Sensing Circuitry for Enhancing Recombinant Protein Production in *E. Coli*

Shih-Huang Tung: Self-Assembly of Amphiphilic Molecules in Organic Liquids

DECEMBER

Bani Cipriano: Structure of Properties of Nanocomposites Containing Anisotropic Nanoparticles

Heekyong Kim: Analysis of Drug Delivery in the Eye Using Magnetic Resonance Imaging

Yuesheng Ye: Studies on the Step Growth Polymerization of Aromatic Polycarbonates

greatEXPECTATIONS

GHOSH WINS WELLS FELLOWSHIP

ChBE graduate student **Ayan Ghosh** has been awarded the Harry K. Wells Endowed Fellowship. The award was established to provide annual fellowships for Clark School graduate students working on energy engineering and alternative energy sources in conjunction with the University of Maryland Energy Research Center (UMERC). The Wells gift to start the fellowship also benefited the *Great Expectations* campaign.

For the full story behind Ghosh's work on creating polymers for use as electrolytes in thinner, safer, and flexible batteries, see pp. 7-8.

GREAT EXPECTATIONS EVEN GREATER!

The Clark School has raised more than $100 million of its $185 million *Great Expectations* campaign goal. Donations provide funding for scholarships, fellowships, new research programs, professorships, teaching programs, and new facilities. The **Patrick and Marguerite Sung Professorship and Distinguished Professorship in Chemical Engineering**, announced in our last issue, is only one of many gifts that support our faculty and students. Other recent donations include funding for the UMD Solar Decathlon team, programs and endowments for women in engineering, excellence in core engineering education, and nanoscale research.

THE *GREAT EXPECTATIONS* CAMPAIGN

YOU CAN HELP SUPPORT OUR MISSION TO TRANSFORM LIVES THROUGH EXCEPTIONAL EDUCATION AND RESEARCH OPPORTUNITIES WITH A GIFT OF ANY AMOUNT! CONTRIBUTIONS CAN BENEFIT CHEMICAL AND BIOMOLECULAR ENGINEERING INITIATIVES SUCH AS UNDERGRADUATE SCHOLARSHIPS, GRADUATE FELLOWSHIPS, AND NAMED PROFESSORSHIPS. PLEASE CONTACT STU STABLEY AT (301) 405-8289 OR sstabley@umd.edu; OR VISIT www.greatexpectations.umd.edu TO LEARN MORE.

GIFTS MAY BE MADE BY CHECK TO "UNIVERSITY OF MARYLAND COLLEGE PARK FOUNDATION (UMCPF)." PLEASE DESIGNATE "THE DEPARTMENT OF CHEMICAL AND BIOMOLECULAR ENGINEERING" IN THE MEMO LINE, AND MAIL TO:

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ABOUT THE COVER IMAGE

THE BLUE IMAGE USED ON THE COVERS WAS TAKEN WITH A SCANNING ELECTRON MICROSCOPE (SEM) AND SHOWS A POLYMER PARTICLE THAT CONTAINS SMALL MICRON-SIZED PARTICLES PRODUCED HETEROGENEOUSLY INSIDE OF IT BY PRECIPITATION POLYMERIZATION. YUNJU JUNG (PH.D. STUDENT, ADVISOR: PROF. K. Y. CHOI) IS DEVELOPING A NOVEL POLYMERIZATION TECHNIQUE TO SYNTHESIZE MULTIHOLLOW POLYMER PARTICLES THAT CAN BE USED IN ELECTRONICS AND ENERGY APPLICATIONS.

FOR MORE ON THE CHOI GROUP'S RECENT RESEARCH, SEE P. 6.

COLUMNS is published for alumni and friends of The Department of Chemical and Biomolecular Engineering at the A. James Clark School of Engineering. Your alumni news and comments are welcome. Please send them to:

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