MIT CHEMICAL ENGINEERING ALUMNI NEWS

XCurrents

Institute Professor Bob Langer wins top US chemistry award (Page 11)

Letter from *Department Head Klavs F. Jensen*

I am pleased to bring you the latest Course X newsletter to share with you some of the most recent developments in the MIT Chemical Engineering Department, as well as some activities of our alumni outside the MIT campus. Cambridge and Boston experienced an unseasonably warm fall and winter – the trees are already flowering and everyone enjoyed the summer weather over the Patriots' weekend – with the exception of those competing in the Boston marathon.

In the fall we welcomed a new strong incoming class of graduate students. In order to build a community among the students and faculty, we undertook our first ever first-year Outward Bound experience. Incoming Course X graduate students, student office staff, and ChemE faculty bonded over team challenges and a ropes course out on the Boston Harbor Islands. Everyone had fun and it was a great opportunity for the students to meet one another and get to know their new professors – for more to go to page 17. This incoming great group of graduate students had a chance to explore the wide range of research areas in the Department prior to their all-important selection and commencement of thesis research thanks to your generous alumni-sponsored fellowships.

HIGHLIGHTS

find the latest news online:

web.mit.edu/cheme/

MITChemEng MITChemE

Massachusetts Institute of Technology

Letter from the Department Head continued

During Fall 2011, our students, faculty, (and alumni!) continued to be at the forefront of chemical engineering, addressing challenges many of us face, including new energy technologies, biomedical devices and methods, biotechnology for therapeutics and biofuels, and new approaches to pharmaceutical manufacturing. In the latter area, Bernhardt Trout and his team in the Novartis MIT Center for Continuous Manufacturing Center completed the first demonstration of continuous manufacturing of pharmaceuticals from starting chemicals to final pills. This program is reaching its five year anniversary this summer, and Novartis has already committed nearly $45 million to another five years.

We also reached out to the community, through the expanded ACCESS program, in which underrepresented students from across the country spent a weekend on campus learning about graduate studies in chemical engineering. While graduate students invited people onto campus, one of our undergraduates, Nikita Consul, left during January's Independent Activities Period to help a middle school in Oklahoma City start its first science fair (more on page 21).

As always (and as you may remember), our students found time to relax and de-stress through Friday afternoon "TGs" and the annual holiday party skits. As the years have passed, the students' skits have gotten more sophisticated, incorporating video in the performance. This year, the faculty finally caught up with their own video performance – a big hit, especially the vocal performance (see page 24)!

All of our faculty have been busy and enjoyed several national recognitions during the fall. Several professors earned AIChE awards, presented during the annual AIChE conference in Minneapolis in October 2011. These and others can be found on page 23. Professor Daniel Blankschtein was named the new Hermann P. Meissner '29 Professor, continuing Meissner's legacy of world-leading research in thermodynamics and industrial chemistry.

This spring the Institute began establishing of an Institute for Medical Engineering and Science (IMES), which is envisioned as a focal point and platform for research and education in medical engineering and science. Professor Arup Chakraborty was appointed as the Director Designate for the Institute continuing a long involvement of chemical engineering faculty in medical engineering and science going back to Professor Ed Merrill's pioneering graduate subject 10.63: Chemical Engineering in Medicine, which he taught with doctors from the Massachusetts General Hospital.

Professor Klavs Jensen (center) gets ready to climb with incoming first-year graduate students at the first annual Outward Bound event in September 2011.

The hard work of our faculty, students, and staff continues to be recognized. I'm glad to report that the department retained its number-one ranking in the US News and World Report listing of top undergraduate and graduate programs; we have now held the first place position in chemical engineering for the past 23 years. Although such rankings need to be taking with a grain of salt, it is a record to be proud of, and we could not have held it without enthusiastic support of our alumni and friends throughout the years, of which our faculty and students are very grateful.

We could not have held [our position as top chemical engineering department] without the enthusiastic support of our alumni and friends throughout the years.

The warm spring was very busy, with several lectures. Professor Nathan Lewis from Caltech and Principal Investigator of the Joint Center for Artificial Photosynthesis gave the Hottel Lecture on April 13th on "Sunlight-driven hydrogen formation by membrane-supported photoelectrochemical water splitting." John Maraganore of Alnylam Pharmaceuticals was our Michaels Lecturer on Friday, April 27th. He is currently the CEO of Alnylam, which is developing an entirely new class of innovative medicines based on RNA interference, or RNAi. Our Lewis Lecturer this year was George Whitesides of Harvard. On Friday, May 4th, in E14-674 (the new Media Lab wing), he discussed his pioneering work in microfabrication

and nanoscale self-assembly. Webcasts of all these lectures can be found at http://web.mit.edu/cheme/news/webcast.html.

Paula Hammond stepped down in January after three and half years as a very helpful and energetic executive officer to concentrate on her teaching and research. During her tenure she oversaw several major laboratory renovation projects and the development of the plans for the move of four faculty laboratories to new space across the street from Building 66 in E17/18. Moreover, she led the arduous feat of obtain approval for our flexible engineering degree from multiple committees and ultimately the Institute's faculty. The department is grateful for her enthusiastic, diplomatic handling of the teaching and space issues, and we very much appreciate Bill Green for taking on the job as Executive Officer.

Next year will mark the 125th anniversary of Course X... with your help, we look forward to continuing our leadership in the field for the next 125 years.

Bill Deen will be retiring this July, but will fortunately be returning part time to teach 10.50. I would like to take this opportunity to thank Bill for his long and dedicated service to the department. He has for a decade served as a wise, firm, and caring graduate officer. In this capacity he has chaired innovations in our graduate curriculum, overseen improvements in our qualifying procedures, and acted as an exceptional mentor to the graduate body. His door has always been open and everyone has felt comfortable going to him with concerns - knowing that he genuinely cares for each student's education and well-being. We are fortunate that Pat Doyle, who has been co-teaching with Bill, has stepped into the graduate officer position.

I'm sad to report that in December, we lost two former colleagues and alumni of the Department: former professor Harold S. Mickley and Lamotte du Pont Professor Emeritus Adel F. Sarofim. Harold, a former chair of the faculty at MIT, was internationally known as an expert in fluid mechanics, heat and mass transfer, and chemical kinetics — with his research intimately involved in the methods for cooling ballistic missiles and manned space vehicles during atmospheric re-entry.

Adel, who had gone on to be a Presidential Professor at the University of Utah, spent more than 50 years working on combustion science, which led to advances in the reduction of pollutants released from fossil fuel combustion. His research covered radiative heat transfer, furnace design, circulation patterns in glass melts, the freeze process for desalination, nitric oxide formation in combustion systems, combustion-generated aerosols, soot and polycyclic aromatic hydrocarbon formation, and the characterization of carbon structure and reactivity.

More information on the lives and legacies of Harold and Adel are on pages 12 and 13. We will remember their many significant contributions to not only the field of chemical engineering, but to the work and lives of their colleagues, students, families and friends. They are greatly missed.

Next year will mark the 125th anniversary of Course X, the country's first chemical engineering degree program. We are only now in the planning stages for an event to celebrate the occasion. I welcome your thoughts and ideas; as alumni you are part of our history as well as our future. The discipline of chemical engineering has changed and expanded in the last century, and with your help, we look forward to continuing our leadership in the field for the next 125 years.

We hope you enjoy this issue of the newsletter and look forward to your feedback. Thank you for your support and best regards.

On the cover: Bill Green's Research Group poses for a picture during the annual holiday party. For more photos, go to page 22.

Klavs F. Jensen
Department Head
MIT Chemical Engineering Department

Practice School News

Greetings from the MIT Practice School!

Once again, I am happy to be able to bring you the latest happenings of the Practice School and its stations. The David H. Koch School of Chemical Engineering Practice continues to be a dynamic and unique educational opportunity within the Department, attracting top students from around the country and the world. In the past years, we've expanded to India and Brazil, and this past fall, a group of students worked in Belgium. All of our host companies were welcoming and provided projects with outstanding practical opportunities for our students. Thank you to all those to have helped provide the kind of education that only these hands-on real-world challenges can offer. And a hearty thank you to you – our alumni; your gracious and consistent support of the Practice School is vital to its success.

This past summer and fall, we had 17 students attend stations in California, Massachusetts, Minneapolis, Chicago, Belgium, Hull UK, and Corning NY. Although the products and industries varied, the core challenges were similar and ones where the students were able to connect their classroom lessons to very real industrial issues. Let me share with you details from the station directors:

Summer 2011 Stations

Novartis Pharmaceutical Corp., San Carlos CA
Directed by Claude Lupis

This summer, we had our first station at the San Carlos site of Novartis. It was organized by Tom Blacklock, who has been the Novartis coordinator for several of our previous stations in East Hanover, NJ. This fact alone assured us of a successful experience and we certainly were not disappointed.

Novartis at San Carlos specializes in the research and production of pulmonary drugs. Novartis acquired the site in late 2008 from Nektar Therapeutics. Under that deal, Novartis assumed ownership of some pulmonary formulations and manufacturing assets, and oversaw the transfer of some 140 personnel.

The San Carlos site makes abundant use of the spray drying process, which creates fine powders by atomizing and drying emulsion and suspension-based feedstocks; the powders are subsequently delivered to patients through dry powder inhalers. The eight students who attended the station worked on projects which sought to optimize various aspects of production based on the spray drying operation. These ranged from the study of the stability of emulsion and suspension feedstocks, to the uniformity of blended powders, and from the recovery of solvents to the design of a flexible and multipurpose spray drying facility. Issues associated with the filling and sealing of blisters were also investigated. The students' efforts appeared to have been rewarded by a genuine "win-win" situation for Novartis and the Practice School.

The students and director were housed in San Mateo, which is about 5 miles north of San Carlos and 20 miles south of San Francisco. The area is rightfully known for its beauty and there was no shortage of places to visit and enjoy. What, however, continued to surprise were the differences of climate over very short distances: while San Mateo could be sunny and warm, San Francisco could be foggy and cool, but nonetheless most appealing.

Students attending the Fall '11 BP station in Chicago took in some sightseeing, including a self-protrait on the"Bean."

Cabot Corporation, Billerica MA
Directed by William Dalzell

Cabot Corporation has hosted the MIT Practice School for the past six summers. Cabot is the world's leading supplier of carbon black (CB), most of which is used for car and truck tires. The CB is also used as a component of other rubber products and elastomers. Cabot also makes inkjet toners (some use CB), fumed metal oxides, and specialty metals and fluids.

Our collaboration with Cabot over the past few years has been very successful with many challenging educational projects for the students and some interesting and valuable findings by the student teams. Our major contacts at Cabot this year, Angelica Sanchez and Theis Clarke (SM '04), did a great job rounding up projects and encouraging the full participation of the scientists, engineers, and managers within the company. Many of these people had attended MIT and some, the Practice School. The daily encouragement, guidance, and enthusiastic support of the Cabot staff are keys to the success of the projects and the station.

During the month of August, the students worked on three projects that required knowledge of chemical kinetics, reaction mechanisms, non-Newtonian rheology, surface chemistry, flow in porous media, simultaneous heat and mass transfer, and design of dryers and ovens. The projects were 1) deciding if an existing commercial dryer could be used to dry a new, temperature-sensitive product, 2) understanding the possible chemical mechanisms for the attachment of a polymer to small particles, and 3) developing a new device for measuring the compatibility of solid particles with various dispersion media.

The students enjoyed the excellent ethnic food available at restaurants in the Billerica area and, along with the Cabot staff,

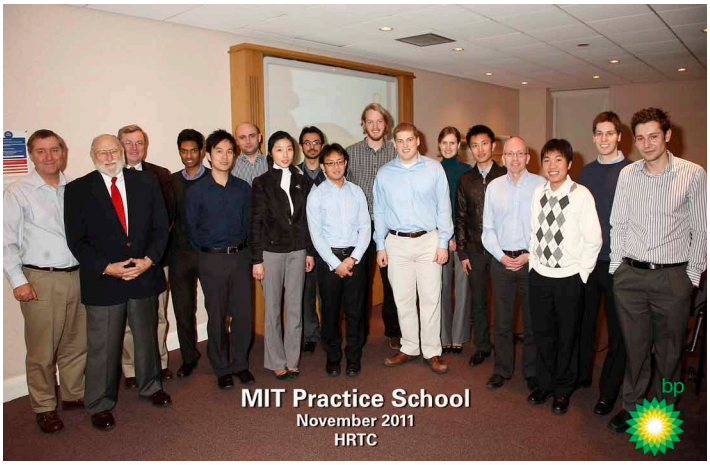
the free fare from the ice cream truck on Fridays in the parking lot. Three of the students had birthdays so more sweets were consumed.

Fall 2011 Stations

General Mills (GMI), Minneapolis MN
Directed by Robert Fisher

To date, a grand total of 102 projects have been sponsored by GMI at various locations, involving bench, pilot and commercial scale processes. These most recent efforts were based at their James Ford Bell Technology Center (JFB TC) in Golden Valley, MN, a suburban area in close proximity to center city Minneapolis, and with the Riverside TC, a Pillsbury facility in downtown Minneapolis on the Mississippi River front. GMI researchers worked closely with the team, and their efforts to make us feel a part of a successful collaboration are greatly appreciated and a testament to the commitment on both sides for this to be a win/win endeavor, both professionally and on a personal level.

Six projects were undertaken. Two of the first session work efforts were extended to refocus and stress different aspects for two particular product lines. Transport mechanisms and appropriate profiles within the multiple components of these food matrices comprised a major effort. The physicochemical characteristics for a major product needed to be evaluated and refined post mixing process steps. Technology assessment and determining mechanisms involved comprised our major emphases. This required understanding material property interactions in a multi-component product and the innate variability in mixing behavior of different/irregularly shaped particulates in a viscous media. The other two-session project was related to early detection of microbial invasiveness into a variety of food matrices. Growth kinetics and separation and identification techniques dominated our efforts. Another project focused on improving the texture and bio-safety of a key vegetable ingredient in multiple food lines. The objectives were to obtain operational conditions that establish desired ranges of product characteristics and improving the energy balance and controllability of this high through-put "early stage, pre-product". The remaining project was related to emulsion formation and entrapment in a macro-scale matrix. Key operational parameters where identified that improve stability and shelf life.



Students attending the Fall '11 BP station in Hull, UK.

All projects are related to GMI's emphasis on nutritional value and customer perceptions of all their product lines by reducing and/or eliminating certain "high profile" ingredients. They involved use of Design of Experiments techniques to determine process control variables along with the development of mechanistic models based on the fundamentals associated with energy input schemes and transport processes. Of course, we were involved with technology assessment and the rheological behavior of both complex media and nano-emulsions. The existence of multiple phases in these systems provided very interesting and challenging problems. The operational principles are confidential; however start-up procedures were critical, as was the establishment of operational maps. Also, design modifications were suggested as a result of extensive simulations using newly developed models which where validated experimentally, and established as robust. Some of the modifications could be implemented during our "residence time" at the station and proved to be successful and/or suggestive of further modifications or processing changes.

BP, Chicago IL
Directed by Robert Fisher

BP is one of the largest energy corporations and is recognized worldwide for its commitment to environmental issues via establishment of a "green attitude". Its business units strive to be good citizens of the global community and therefore take this concept very seriously. All the formal interactions with MIT, which are not limited to Practice School sponsorship, reflect this philosophy. The projects required a thorough understanding and application of fundamental chemical engineering principles. BP made special efforts to acknowledge appreciation for a job well done both during and after each session hosting social events.

This first session focused on major modeling efforts, for three separate divisions, that were highly visible platforms within BP as a corporation. Working with their Global Fuels Technology (GFT) division, physical property characteristics associated phase separation was the major emphasis. This included modeling thermodynamic concepts and separation schemes using unique approaches/applications of ASPEN software and development of user friendly interfaces. Revised/modified thermodynamic models were proposed in conjunction with extensive data bases available through new analytical techniques developed by API and documented by other outside laboratories. A project with the Chemicals (A&A) division focused on process intensification and technology assessment. It involved use of ASPEN (EO & CM) software to predict performance for continuous crystallization. Numerous energy audit models had been developed and testing for their ability to evaluate performance improvement strategies based on design differences at various plants was the main objective. Refining Technology was the third division that supported this session. Our objective was to evaluate the updated versions of the Uncertainty Analysis tools developed at MIT through BP's involvement with our Energy Initiative. This new software package was demonstrated as being successful by using a proprietary process model as a case study that is representative of the platform technologies to be tested in future applications. Development of a user friendly interface was accomplished along with model refinements based upon feed stock characterization data from numerous sources, with recommendations for commercial implementation.

BP, Hull UK
Directed by Robert Laurence

The Hull Research and Technology Center is on the Saltend Chemicals Site in Hull, England. The large site hosts several companies including BP. We arrived in Hull several days earlier than the Station was to begin in order to meet with the sponsors and prepare the way for the students' arrival. The BP staff acceded to three projects and they altered the scopes appropriately. Nine students arrived from the Naperville site, each having taken different routes to use their station break effectively, but they all arrived safely on November 19. We met with the group on Sunday to discuss the events of the next few days and then went to lunch at a nearby Italian restaurant.

On Monday, after a hearty English breakfast, the group left for Saltend. Travel for the next four weeks was to be in a microbus supplied by BP HRTC. The induction took several hours. After lunch, we began the briefings on the three projects, which included kinetic and thermodynamic modeling, and a techno-economic analysis of a chemical reaction process. The three groups began their challenge immediately and by the week's end were well involved. The BP support of each group was outstanding. They met regularly with each group, both monitoring and helping a better problem definition.

The first weekend was largely a working one, although they managed on Sunday a visit to historical York. On Monday after the proposal presentations, the groups entered the work phase. Then only diversion was on the next Saturday. Rugby League is the Yorkshire Game, but there was a local derby between the two major Rugby Union clubs in Hull, Hull Ionians and Hull FC. The match was a very tight one with the Ionian visitors snatching the match in the last 20 seconds.

The first Practice School group to be stationed in Belgium show off their professional looks.

Hull is an old town with a long history. The several museums describe the heritage. Of particular interest was the Wilberforce House, a testament to Wilberforce's efforts for the abolition of slavery. I don't know whether the students took advantage of their opportunity, but they did enjoy the active nightlife and a broad spectrum of public houses in the town. The work at BP, however, occupied most of their time and efforts, and their labor produced results that pleased the sponsors.

By all accounts, the BP station in Hull was a great success for all who participated, including students, sponsors and other BP personnel, and especially the station director!

Our collaboration with Cabot over the past few years has been very successful with many challenging educational projects for the students and some interesting and valuable findings by the student teams. Our major contacts at Cabot this year, Angelica Sanchez and Theis Clarke (SM '04), did a great job rounding up projects and encouraging the full participation of the scientists, engineers, and managers within the company. Many of these people had attended MIT and some, the Practice School. The daily encouragement, guidance, and enthusiastic support of the Cabot staff are keys to the success of the projects and the station.

Schering-Plough Labo NV–MSD, Heist-op-den-Berg, Belgium
Directed by Claude Lupis

This was our first station in Belgium and it was organized by the pharmaceutical company Merck & Co., Inc., which in Europe goes by the name of MSD (Merck, Sharpe and Dohme). It merged with Schering Plough in late 2009. Eight students attended the station, which was located in Heist-op-den-Berg, in the Flemish region of Belgium, about 40 km south-east of Antwerp.

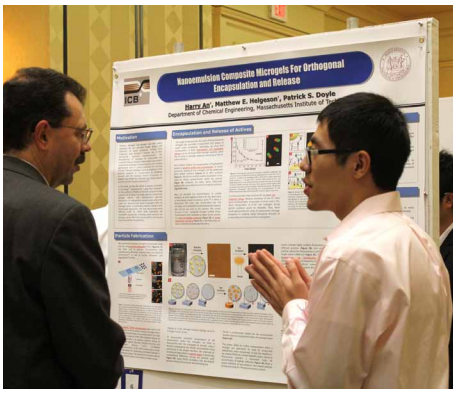
The projects were wide ranging. They addressed subjects such as the optimization and modeling of a fluid bed granulator dryer and of a film coater, the reduction of losses in the packaging of creams and of particulates in sterile injectables, and the identification of possible mechanisms of degradation that can reduce the shelf-life of a drug substance. The students and the projects were very well supported by the company personnel and the results appeared to pleasingly satisfy the sponsors of the projects.

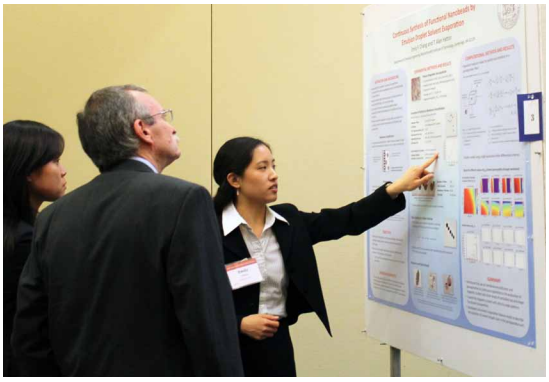
The students and this station director were housed near the small village of Mol, in the Eastern part of Belgium, near the border with the Netherlands, and more than an hour's drive from Heist-op-den-Berg. So, while the location and the accommodations' facilities were less than optimal, they were compensated by the hospitality of our hosts and the relatively easy reach of many wonderful sites such as Brussels, Antwerp, Leuven, Bruges, Amsterdam, Aachen and many more cities. They all provided much enrichment and pleasure.

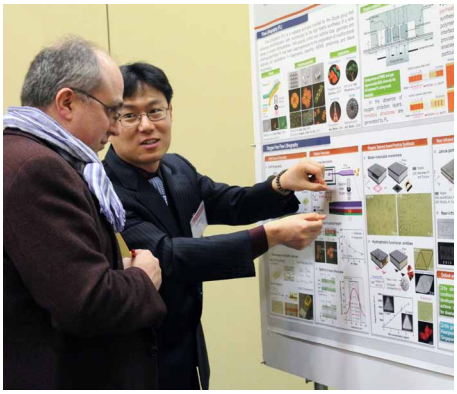
I look forward to sharing with you in the next newsletter that team's work and adventures!

Best regards,

T. Alan Hatton
Director
David H. Koch School for
Chemical Engineering Practice







2011 Practice School Dinner

In October 2011 at the Marriott Hotel in Cambridge, the department held its annual Awards Banquet for the Practice School, attended by industrial sponsors, MIT administration officials, and students, faculty and staff of the department. At the pre-dinner Poster Session, students showed off their research to the industry visitors. Our speaker was John Hemmings, chief technology officer of SGC Energia, who discussed “Entrepreneurship in the Renewable Energy Sector: Opportunities for Engineers.”

2010 Practice School Award Winners

William C. Rousseau Award
Jonathan Gilbert

J. Edward Vivian Prize
Ben Renner

Rosemary Wojtowicz Award
Diviya Sinha and Kyle Hicks

Jefferson W. Tester Prize
Mariah Hoover

We almost died.

MIT Practice School at Corning, Inc., Fall 2011

Bob Hanlon
Station Director

Corning looked solid going into the start of this 21st century, benefitting greatly from their investment in the fiber-optic market, watching their stock rise from around $10/share throughout the '90s to over $100 at high tide in 2002. But then the dotcom bubble burst and their stock plummeted to near $1 in the aftermath.

The Corning group spends some bonding time at Taughannock Falls (215 foot drop; 33 feet higher than Niagara Falls; the highest vertical single drop waterfall in the Northeast) near Cayuga Lake in central New York.

As quoted above, Marc Giroux, Senior V.P., Manufacturing Technology and Engineering and Chief Engineer, relayed this history to us during our first day to help set the context for where Corning is now. As Marc recounted, shortly after that devastating blow, Corning righted itself, held strong to their commitment to R&D as their path out, and started to re-build. Their stock is now back to over $10.

As part of their righting process, Corning committed to revitalizing chemical engineering within the company. While many ChemE's worked at Corning, they were scattered. There was no core to this group. Recognizing this as lost opportunity, Corning established a core competency group around chemical engineering in 2011, with Marc as champion and newly hired Andre Da Costa (formerly Chevron) as manager.

When Professor Alan Hatton and I learned of this new initiative at Corning, we naturally thought, what a great place to establish a new station! In one of the quickest decisions I've ever experienced, Corning agreed. Alan and I traveled to Corning to meet with Marc and Dr. Joseph Miller, Corning's Chief Technology Officer, and propose the station. At the end of the meeting, Joe said "Let's do it." It certainly helped that Marc, as a '77 alum of the program, fully endorsed the program and its potential. And so in mid-October the kick-off group of eight students arrived in upstate New York to open up this new station, one absolutely aligned with Corning's raising-the-bar vision around chemical engineering.

Our experience at Corning was outstanding. It was such a tremendous opportunity for our program to engage with a Fortune 500 firm ($6.8 billion revenue, 26,000 employees) focused on innovation as opposed to acquisition for profitable growth. How many materials companies do you know that invest 10% of sales into R&D? We had the good fortune of being located right at Corning's Sullivan Park R&D Center, the heart of the company. Walking the hallways was like walking through the U.N. Over 50 different nationalities are represented there! Rarely have I seen such diversity in a company. Our international team, composed of students from the U.S., India, Egypt, Singapore, and Indonesia, fit right in.

Andre Da Costa, who served as our company point-person, did a great job working within the Sullivan Park community to identify six projects for our us, each strongly linked to a Corning business objective, each strongly supported by energized and engaged consultants. As part of their real-world education, the students were continually challenged to fully understand the link. How are your proposed actions aligned with (or not) the business objective? How will the completion of that calculation or this experiment help impact the company? Such powerful questions for the students to be exposed to, ones that they'll be asked, or will ask of others, throughout their respective careers.

Corning Inc.'s headquarters building in Corning, NY.

Corning's selected projects provided us a great mix of theory and experimentation, of fundamentals and applications, and of technologies and chemical engineering concepts, ranging, for example, from Corning® Gorrilla® Glass and Celcor® substrates (used in catalytic converters) to mol-sieve drying, surface energy characterization, ion-exchange, and photo-catalysis. The weekly presentations regularly brought strong attendance and active participation from the consultants and other invited guests. As an aside regarding Gorrilla® Glass, while there, Walter Isaacson's biography of Steve Jobs hit the bookshelves, prompting many hallway conversations around the section in the book (p. 470-472) telling the story of Gorrilla® Glass and its inclusion in the iPhone. Quite an enlightening account of how Corning rose to meet Jobs' challenge to manufacture within six months a glass that hadn't

"It was such a tremendous opportunity for our program to engage with a Fortune 500 firm ($6.8 billion revenue, 26,000 employees) focused on innovation as opposed to acquisition for profitable growth."

yet been commercialized.

The Corning people were kind and welcoming throughout, helping to situate us in Corning (right near the wonderful Glass Museum – highly recommended!) and to guide us towards a range of weekend getaway options, which provided the students much-needed decompression from their long weekday work hours. Highlights included a bus tour of the Finger Lake Wine Region, visits to nearby Cornell University and Niagara Falls, and then our traditional long trip between projects, this one to NYC where we experienced two very fun group activities: a Broadway performance of Chicago and a dim sum feast in Chinatown, which benefitted greatly from the presence of our two Mandarin-speaking students. During this time in NYC, one of our students made a significant and emotional decision to return to Egypt to support his home country in its time of turmoil. This moment brought a humbling reality check to those of us who face much simpler decisions in life.

The students and director enjoy a dim sum feast in New York City's Chinatown.

This station provided me the opportunity to improve my own teaching approach towards "learning through practice." The Practice School program uses a sheet of competencies, called the "Student Assessment Form," against which the students are evaluated. I decided to bring urgency – there's no time to dawdle in Practice School! – to using this sheet each day as a valuable teaching tool. I developed the following set of questions which I strove to frequently ask each student individually:

1. What's one area that is not working out for you personally right now in your project? This could be of either a technical or non-technical matter; both are important in your overall effectiveness.
2. Which competency on your "Student Assessment Form" are you missing in this regards? This competency is one that if you had it right now, you would see improved effectiveness right now.
3. What specific actions are you going to take today to improve this competency?
4. Report back to me after you've done the actions identified in Question 3.

This is where the Practice School program delivers, providing a unique learning environment that challenges students to first confront and then overcome their limitations by working through these questions, time and again. The students rose to the occasion, resulting in some very inspiring conversations and subsequent strong actions. I will continue this continuous improvement journey at my next station, challenging myself with these same questions and then reporting back to you in future newsletters, once I've done the actions identified in Question 3, of course. ◊

LaShanda J. Korley PhD '05

Alumna Highlight

For LaShanda Korley the choice to study chemical engineering came not as an epiphany, but through a process of elimination. "I was interested in how molecules work and I was good at math, chemistry and physics, so if you put it all together, it says ChemE," she says. "But the reality is that I went to summer camp and knew I didn't want to do electrical or mechanical engineering." The remainder, chemical engineering, turned out to be a perfect fit.

Today, Korley runs her own lab at Case Western Reserve University. The lab, called "M-cubed" for mechanically-enhanced, multifunctional materials, focuses on materials inspired by natural substances, such as the titin protein or spider silk, that have special strength or toughness or responsiveness to heat or light. She applies her innovations to making protective fabrics, food packaging, scratch-resistant coatings, optical and mechanical sensors, and even drug-delivery and tissue engineering scaffolds.

The MIT culture played a big role in shaping Korley's ideas. "On the campus, in the halls, at symposia, there was this vibrancy. Everybody was excited to talk about what they were doing," she says. "It just opens your mind to start thinking about the next big thing."

2010-2011 Fellowships

Graduate financial support continues to be an essential ingredient for maintaining the quality of our graduate programs. This funding helps MIT Chemical Engineering recruit the very best students by providing support for the first academic year so they can concentrate on core graduate level coursework, free of the demands of teaching and research. The result is a firm base in engineering science on which to build future graduate studies.

Fellowships come from many different arenas: industrial and research organizations, as well as alumni individuals and groups. We are very grateful for this support!

First year John C. Sluder fellows Ben Woolston and Mark Weidman visit with Mrs. Elizabeth Sluder over the winter.

Adel F. Sarofim
Sakul Ratanalert, Cornell

Alkermes Fellow
Anasuya Mandal, IIT Bombay

Arch Chilton Scurlock ('43) Fellow
Sakul Ratanalert, Cornell

ASTAR
Edwin Sze Lun Khoo, Stanford

BP MIT Energy Fellow
Tsai-ta Christopher Lai, NTU

Canada FE
Xiao Su, UWaterloo

Charles and Hilda Roddey Fellow
Sean Hunt, UDelaware
Nathan Wa-Wai Yee, UIUC

Landau ChE Practice School Fellows
Alona Birjiniuk, MIT
Rachel S. Hoffman, Cornell
Shefali Lathwal, IIT Delhi
Lu Yang, Peking U

Dow Fellow
Lucas Foguth, Michigan Tech

Edwin R Gilliland '33 Fellow
Lisa M. Hasenberg, UIUC

Eni MIT Energy Fellows
Giulio Alighieri, U Degli Studi, Federico II
Zachary Buras, UCSB

David H. Koch ('62) Fellows
Giulio Alighieri, U Degli Studi, Federico II
Alexander Bourque, Lehigh
Zachary Buras, UCSB
Lionel Kar Wei Lam, U of Western Australia
Katherine Maass, UT Austin
Karthik Narsimhan, CalTech
David Nicholson, U Virginia
Joel Paulson, UT Austin
Lea Poquerusse, McGill
Barrett Richter, Ohio State
Nopphon Weeranoppanant, Columbia

Frederic A L Holloway '39 Fellow
Zachary Waxman, MIT

George M. Keller ('48) Chevron Fellow
Kendele Snodgrass, GaTech

George M. Keller ('48) Fellow
Renee Benish Roesel, GaTech

Wm. & Margaret Rousseau Fellow
Dongying Shen, CalTech

John C. Sluder ('41) Fellow
Mark Weidman, UDelaware
Benjamin Woolston, Penn State

R. C. Reid ('54) & G. Williams Fellow
Yuquig Cui, UMinn

Haas Family Fellow
Rosanna Lim, UC Berkeley
Helen Luo, CalTech
Raymond Smith, Clemson
Eric Zhu, UC Berkeley

H. ('53) & L. Stern Prac. School Fellow
You Peng, NUS

Jerry ('40) & Geraldine Mcafee Fellow
Jicong Li, Tsinghua

John Henry Grover ('48) Fellows
Adam Beerman, UWashington
Yuqing Cui, UMinn

MITSCEP 1936 Course Xa Fellow
Anchal Jain, Rutgers
Kristen Whaley, MIT

Saudi Aramco MIT Energy Fellow
Karthik Narsimhan, CalTech

Walsh ('37) Memorial Pres. Fellows
Samantha Collins, UPenn
Rachel Hoffman, Cornell

Samsong Fellow
Youngwoo Son, SNU

Robert T. Haslam ('11) ChemE Fellows
Jiyoung Ahn, Yonsei U
Chas Gile Mitchell, Jr., RPI
Youngwoo Son, SNU
Xiao Su, UWaterloo
Lisi Xie, Tsinghua

Robert T. Haslam ('11) Pres. Fellow
Steven Edgar, GaTech
Kevin Kaczorowski, UT Austin
Helen Luo, CalTech
Raymond Smith, Clemson

Rosemary Wojtowicz Fellow
Kimberly Ohn, Purdue

Samsong FE
Jiyoung Ahn, Yonsei U

Tae-Sup Lee Fellowship
Si Won Choi, Carnegie Mellon

Taiwan Ministry of Education Fellowship
Tsai-ta Christopher Lai, NTU

Frank Hall Thorp
Si Won Choi, Carnegie Mellon

Keith & Helen Rumbel Fellow
Dariusz Murokowski, UDelaware

Institute Professor Bob Langer awarded Chemistry's top prize

First chemical engineer since Warren K. Lewis to be recognized.

David H. Koch Institute Professor Robert S. Langer was selected by the American Chemical Society (ACS) to receive the 2012 Priestley Medal, the society's most prestigious prize, for his "distinguished services to chemistry."

Langer was honored for his "cutting-edge research that helped create the controlled-release drug industry and the field of tissue engineering," according to Chemical & Engineering News (C&EN), the journal of the ACS.

"I'm honored — and a bit shocked — to receive the Priestley Medal," Langer told C&EN. "It's a thrill to be included among the prestigious winners of this award, not just for me, but for my lab, my fields of research, and for the chemical engineering community."

The Priestley Medal is generally given to scientists with a traditional chemistry background; this is the first time in 65 years that a chemical engineer has won the medal. Langer's distinguished career as a pioneer in the fields of chemical, biomedical and tissue engineering, as well as his significant contributions to the development of biomedical devices, was referenced as a defining factor in his selection as recipient of this top award.

C&EN's March 26, 2012 edition explained:

"Langer, 63, has shown time and again that he's no one-hit wonder. This serial entrepreneur has cofounded about 25 companies and licensed technology to scores more. All that commercialization is in service of his primary goal - making sure his inventions help improve health." ◊

Alumnus Highlight

Joel Moxley PhD '07

As a chemical engineering graduate student, says Joel Moxley, "I was a maverick." A maverick who started a baseball hedge fund that turned $500 into almost 200 times that in 4 months and who, after chatting with a friend about a business idea over burritos at Ana's Tacqueria in the student center, went on to enter the MIT $100K and won. "This is just what happens at MIT," he says. "When you step on the MIT campus, there is an energy that doesn't exist anywhere else. It's electric."

Since then, he has been named one of Technology Review magazine's top 35 innovators under 35 and has worked for North Bridge Venture Partners. Today, Moxley is CEO of Foro Energy, which has raised over $30 million in venture capital. "I got into chemical engineering because I loved energy and I loved scale," he says. At Foro Energy, he is bringing laser technology into the oil, gas, geothermal and mining industries. "I'm relatively new to lasers," he admits. "But once they get into an industry, they dominate."

Looking back on his short but explosive career, Moxley credits MIT chemical engineering because it touches every industry and builds a quantitative toolbox that is immediately applicable to business strategy, operations and finance. "For an entrepreneur, chemical engineering is the ultimate major," he says. "It makes you dangerous on so many different fronts."

In Memoriam

In December of 2011, the MIT Chemical Engineering community lost two friends and former colleagues: Professor Emeritus Adel F. Sarofim and former professor Harold S. Mickley.

A symposium to honor Professor Emeritus Sarofim will be Friday, May 11, 2012.

Harold S. Mickley ScD '46

Harold Somers Mickley ScD '46, a longtime professor and former chair of the MIT faculty, died Dec. 3, 2011. He was 93.

Born in Seneca Falls, N.Y., on Oct. 14, 1918, Mickley was a child prodigy who taught himself calculus in the fifth grade and graduated from high school at age 14. He attended Caltech, where his adviser was Nobel Prize winner Linus Pauling, a man Mickley highly respected for his quick and inquiring mind. After receiving his BS and MS at Caltech, Mickley went on to receive his PhD in chemical engineering from MIT and was asked to join the faculty. In 1963, he was named chairman of the faculty at MIT and Ford Professor of Engineering.

At MIT, his brainchild was the creation of the Center for Advanced Engineering Studies, which developed educational programs for practicing engineers, scientists and managers in industry, government and educational institutions to attain and maintain the competence needed to exert technological leadership. One of his great strengths was his command of the advanced mathematics required to analyze complex chemical systems. As a result, he was the lead author of the textbook Applied Mathematics in Chemical Engineering, written more than 50 years ago, but still used today in engineering programs around the world.

Mickley was internationally known as an expert in fluid mechanics, heat and mass transfer, and chemical kinetics — with his research intimately involved in the methods for cooling ballistic missiles and manned space vehicles during atmospheric re-entry.

He received numerous awards, including from the American Chemical Society, as well as distinguished alumni awards from both MIT and Caltech.

He is survived by his sons, Steven (Diane) and Richard (Cynthia); his second wife, Edith; seven grandchildren, Brian, Karen, Megan, Dennis, Kim, Lisa and Eric; and eight great-grandchildren. In keeping with Mickley's wishes, there will be no calling hours or memorial services. Interment in Seneca Falls, N.Y., will be private. Those wishing to honor him may donate to MIT, Chemical Engineering Unrestricted Fund, in memory of Dr. Harold Mickley and send it to MIT Office of Alumni Records, 600 Memorial Drive, W-98 Second Floor, Cambridge, MA 02139.

(at left) Undated photo of Mickley and fellow Professor H. P. Meissner (courtesy MIT Museum.

Adel Sarofim SM ’57, ScD ’62

Adel F. Sarofim, a professor emeritus in the Department of Chemical Engineering, died Dec. 4, 2011, in Virginia. He was 77.

Focusing on energy efficiency and pollution reduction, Sarofim spent more than 50 years working on combustion science, which led to advances in the reduction of pollutants released from fossil fuel combustion. His research covered radiative heat transfer, furnace design, circulation patterns in glass melts, the freeze process for desalination, nitric oxide formation in combustion systems, combustion-generated aerosols, soot and polycyclic aromatic hydrocarbon formation, and the characterization of carbon structure and reactivity.

Working closely with MIT colleague Hoyt C. Hottel, Sarofim made important and lasting contributions to the field of radiation heat transfer, as evidenced by more than 1,200 citations of their book, Radiative Heat Transfer, published in 1967.

A particular focus of Sarofim’s work was on energy and the environment and the interdisciplinary research needed to address these issues. As such, at MIT he served on steering committees for three interdisciplinary research centers: the Hazardous Substances Group, the Energy Laboratory and the Center for Environmental Health Sciences. He was also co-founder and director of MIT’s 10-year EPA Center for Airborne Organics (1992-2002).

He received his BA in chemistry from Oxford University in the U.K., and both his SM and ScD in chemical engineering at MIT. Sarofim was named an instructor at MIT in 1958, became a faculty member in 1961, and was named the Lammot du Pont Professor in 1989. He retired in 1996 to join the University of Utah as Presidential Professor, a ranking “reserved for selected individuals whose achievements exemplify the highest goals of scholarship as demonstrated by recognition accorded to them from peers with national and international stature, and whose record includes evidence of a high dedication to teaching.” He has authored or co-authored more than 350 papers.

According to colleagues, Sarofim always said the best indication of scholarship was students and publications. His more than 350 peer-reviewed papers and documents have had almost 5,000 citations. In addition to his teaching responsibilities, he supervised and mentored more than 80 PhD students, many of whom currently hold prestigious academic, industrial and governmental positions.

Sarofim received numerous awards for his work including the Kuwait Prize for Petrochemical Engineering (1983); the Sir Alfred Egerton Gold Medal from the Combustion Institute (1984); the Walter Ahlstrom Environmental Prize of the Finnish Academies of Technology (1993); Senior Thermal Engineering and the Towend-BCURA Awards of the Institute of Energy (1994); University of Pittsburgh Award for Innovation in Coal Conversion (1995); U.S. Department of Energy Homer H. Lowry Award in Fossil Energy (1996); American Society of Mechanical Engineers, Fuels and Combustion Technology Division, Percy Nicholls Award (1996); American Institute of Chemical Engineers, Environmental Division, Lawrence K. Cecil Award (1998); American Institute of Aeronautics and Astronautics, Energy Systems Award (2000); and the American Society of Mechanical Engineers, George Westinghouse Gold Medal (2004). In 2003 Sarofim was elected to the National Academy of Engineering “for advancing our understanding of the mechanisms and modeling of processes that control radiation in and pollution emission from combustors.”

His 1996 U.S. Department of Energy Homer H. Lowry Award citation reflects well the sentiments of his colleagues, students and friends: “Adel Sarofim is a compassionate human being who inspires students and colleagues, and who contributes significantly across the full spectrum from fundamental science through real-world design concepts.”

The family has requested that gifts be directed to the Adel F. Sarofim (1962) Fund at MIT. Those wishing to send checks can mail them to Bonny Kellermann, MIT Memorial Gifts Office, 600 Memorial Drive (W98), 5th Floor, Cambridge MA 02139.

Faculty News

Robert Langer Named ACS Fellow, Wins Two Awards

Robert Langer, the David H. Koch Institute Professor at MIT, has been named one of the winners of the 2011 Warren Alpert Foundation Prize, which annually recognizes researchers for laboratory discoveries with strong promise to improve human health.

Langer shared the $250,000 unrestricted prize with Alain F. Carpentier, head of the Department of Cardiovascular Surgery at the Hôpital Européen Georges Pompidou in Paris.

Langer is the youngest in history (at age 43) to receive this distinction.

"The Alpert Prize was created to reward scientists whose discoveries have made great progress in new therapies for a wide range of diseases," said Harvard Medical School Dean Jeffrey S. Flier, chairman of the foundation's scientific advisory committee.

Langer was also chosen to receive the 2011 Innovation Aard for Bioscience from *The Economist*, for his "pioneering work on controlled-release drug delivery and tissue engineering, which has benefited tens of millions of people."

Finally, the ACS Fellows Oversight Committee and the ACS Board of Directors selected Langer to the distinguished 2011 class of fellows of the American Chemical Society. The ACS Fellows Program was created by the ACS Board of Directors in 2008 "to recognize members of ACS for outstanding achievements in and contributions to Science, the Profession, and the Society." Langer also received the 2012 Priestley Medal, the society's most prestigious prize, for his "distinguished services to chemistry." More on the Priestly Medal can be found on page 11.

Richard Braatz wins IEEE award

The Institute of Electrical and Electronics Engineers (IEEE) Control Systems Society has awarded Professor Richard D. Braatz the 2011 "Control Systems Society Transition to Practice Award" for his "significant contribution to the control of crystallization processes in the pharmaceutical industry."

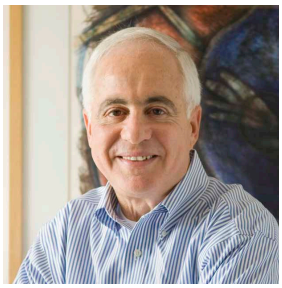
This prize, started in 2009, recognizes outstanding university-industry collaboration that enables the transition of control and systems theory to practical industrial or commercial systems.

K. Dane Wittrup Garners Two Honors

In 2011 Professor Dane Wittrup was elected Fellow of the American Association for the Advancement of Science (AAAS), for the Section on Engineering. An AAAS Fellow is defined as "a Member whose efforts on behalf of the advancement of science or its applications are scientifically or socially distinguished." Examples of areas in which nominees may have made significant contributions are research; teaching; technology; services to professional societies; administration in academe, industry, and government; and communicating and interpreting science to the public.

Wittrup was also among the 66 new members and 10 foreign associates elected to the National Academy of Engineering (NAE) on Feb. 9, 2012. Election to the National Academy of Engineering is among the highest professional distinctions accorded to an engineer. Academy membership honors those who have made outstanding contributions to "engineering research, practice or education, including, where appropriate, significant contributions to the engineering literature." Wittrup was recognized for developments in protein engineering, protein expression and quantitative pharmacology.

Bob Cohen Wins Award

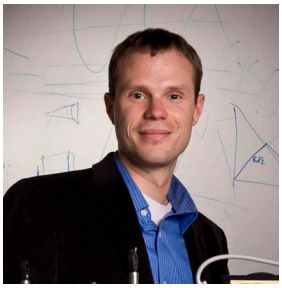


Professor Bob Cohen received the POLY Paul J Flory Polymer Education Award at the 2012 Spring Meeting of the American Chemical Society in San Diego.

Professor Cohen is internationally recognized for his development and leadership of MIT's interdepartmental Program in Polymer Science and Technology (PPST) that has served the educational interests of MIT graduate students in Chemistry, Chemical Engineering, Materials Science and Engineering and Mechanical Engineering for more than 25 years. He is also highly appreciated at MIT for his 40 years of undergraduate laboratory and graduate classroom instruction in polymers, as well as for the research mentoring of more than 70 doctoral students.

The Paul J. Flory Polymer Education Award was established in 1981 and is administered by the Polymer Chemistry Division to recognize, encourage, and stimulate outstanding achievements by an individual or team in promoting undergraduate and/or graduate polymer education. It is presented biennially in even years at the spring meeting of ACS.

Bradley Olsen Named AFOSR Young Investigator



Professor Bradley Olsen has been named an Air Force Office of Scientific Research (AFOSR) Young Investigator, for his research on "Thin Film Self-Assembly of Globular Protein-Polymer Diblock Copolymers for Nanostructured Biofunctional Materials." The grant is over a 3 to 5-year period.

The AFOSR Young Investigator Research Program (YIP) is open to scientists and engineers at research institutions across the United States who received Ph.D. or equivalent degrees in the last five years and show exceptional ability and promise for conducting basic research. The objective of this program is to foster creative basic research in science and engineering, enhance early career development of outstanding young investigators, and increase opportunities for the young investigators to recognize the Air Force mission and the related challenges in science and engineering.

Paula Hammond named POLY Fellow

The American Chemical Society (ACS) has named Professor Paula Hammond a 2012 Division of Polymer Science (POLY) Fellow. This award recognizes members for their achievement and contribution to polymer science and the POLY organization.

Daniel Blankschtein named new Meissner Professor

Professor Daniel Blankschtein has been named the new Hermann P. Meissner '29 Professor of Chemical Engineering. Professor Meissner was a world leader in thermodynamics and industrial chemistry; Blankschtein follows this legacy with his own work in thermodynamics and statistical mechanics, as well as drug delivery and the delivery of active ingredients in pharmaceuticals and consumer products.

Blankschtein has won the Department's "Outstanding Graduate Teaching Award," voted on by the students themselves, eight times. His contributions to several classes, including those covering surfactant science and our core Thermodynamics class, have helped a generation of future chemical engineers understand fundamental principles on which to build their future careers in the field.

Arup Chakraborty Tapped to Lead New MIT Initiative

Professor Arup Chakraborty has been named the director-designate of MIT's new Institute for Medical Engineering and Science (IMES), expected to formally launch on July 1, 2012. In an email to the MIT community, Provost L. Rafael Reif and Vice President for Research and Associate Provost Claude R. Canizares explained that IMES is intended to serve "as a focal point and platform for research and education in medical engineering and science" at MIT. The creation of IMES follows from May 2011 recommendations of the Ad Hoc Committee to Explore Options for the Structure of the Harvard-MIT Health Sciences and Technology (HST) Efforts at MIT.

"We agree with the committee's conclusion that the new institute would greatly increase the visibility and effectiveness of research and education in medical engineering and science, and serve as a robust home for the 'unique and exceptional' HST program at MIT," Reif and Canizares wrote.

IMES will be administratively based in the School of Engineering, but will include participation from across MIT. Chakraborty currently leads a Faculty Advisory Committee on IMES Implementation, reporting to an IMES Steering Committee composed of Waitz, Canizares, and Dean of Science Marc Kastner. He and Waitz will also begin working with HST faculty and leadership to ensure a smooth transition to this new structure.

While acknowledging that "further work is needed to fully define the vision and mission of IMES [and] address its responsibility for the HST program," Reif and Canizares noted that the IMES concept has received strong endorsements from HST faculty and students. They also cited the support of colleagues at Harvard Medical School, other interested faculty at MIT, Engineering Council, the Deans and Academic Council, and the Corporation Visiting Committee for HST.

Michael Strano Heads New Graphene Center

On September 1, 2011, MIT announced the creation of the MIT/MTL Center for Graphene Devices and Systems (MIT-CG). This interdepartmental center, part of the Microsystems Technology Laboratories (MTL), brings together MIT researchers and industrial partners to advance the science and engineering of graphene-based technologies. Professor Michael Strano was named co-director of the center.

Professor Strano said that "this academic-industrial partnership is essential to the advancement of both fundamental graphene science, and of emerging technological applications." ◊

Research Highlights

For more information, go to *web.mit.edu/cheme/news/*

While you're up, print me a solar cell

New MIT-developed materials make it possible to produce photovoltaic cells on paper or fabric, nearly as simply as printing a document.

Article by David L. Chandler, courtesy of the MIT News Office.

The sheet of paper looks like any other document that might have just come spitting out of an office printer, with an array of colored rectangles printed over much of its surface. But then a researcher picks it up, clips a couple of wires to one end, and shines a light on the paper. Instantly an LCD clock display at the other end of the wires starts to display the time.

Almost as cheaply and easily as printing a photo on your inkjet, an inexpensive, simple solar cell has been created on that flimsy sheet, formed from special "inks" deposited on the paper. You can even fold it up to slip into a pocket, then unfold it and watch it generating electricity again in the sunlight.

The new technology, developed by a team of researchers at MIT, is reported in a paper in the journal Advanced Materials, published online July 8, 2011. The paper is co-authored by Karen Gleason, the Alexander and I. Michael Kasser Professor of Chemical Engineering; Professor of Electrical Engineering Vladimir Bulović; graduate student Miles Barr; and six other students and postdocs. The work was supported by the Eni-MIT Alliance Solar Frontiers Program and the National Science Foundation.

The technique represents a major departure from the systems used until now to create most solar cells, which require exposing the substrates to potentially damaging conditions, either in the form of liquids or high temperatures. The new printing process uses vapors, not liquids, and temperatures less than 120 degrees Celsius. These "gentle" conditions make it possible to use ordinary untreated paper, cloth or plastic as the substrate on which the solar cells can be printed.

(at left) Graduate student Miles Barr holds a flexible and foldable array of solar cells that have been printed on a sheet of paper.

Photo: Patrick Gillooly for MIT News

It is, to be sure, a bit more complex than just printing out a term paper. In order to create an array of photovoltaic cells on the paper, five layers of material need to be deposited onto the same sheet of paper in successive passes, using a mask (also made of paper) to form the patterns of cells on the surface. And the process has to take place in a vacuum chamber.

The basic process is essentially the same as the one used to make the silvery lining in your bag of potato chips: a vapor-deposition process that can be carried out inexpensively on a vast commercial scale.

The resilient solar cells still function even when folded up into a paper airplane. In their paper, the MIT researchers also describe printing a solar cell on a sheet of PET plastic (a thinner version of the material used for soda bottles) and then folding and unfolding it 1,000 times, with no significant loss of performance. By contrast, a commercially produced solar cell on the same material failed after a single folding.

"We have demonstrated quite thoroughly the robustness of this technology," Bulović says. In addition, because of the low weight of the paper or plastic substrate compared to conventional glass or other materials, "we think we can fabricate scalable solar cells that can reach record-high watts-per-kilogram performance. For solar cells with such properties, a number of technological applications open up," he says. For example, in remote developing-world locations, weight makes a big difference in how many cells could be delivered in a given load.

Gleason adds, "Often people talk about deposition on a flexible device — but then they don't flex it, to actually demonstrate" that it can survive the stress. In this case, in addition to the folding tests, the MIT team tried other tests of the device's robustness. For example, she says, they took a finished paper solar cell and ran it through a laser printer — printing on top of the photovoltaic surface, subjecting it to the high temperature of the toner-fusing step — and demonstrated that it still worked. Test cells the group produced last year still work, demonstrating their long shelf life.

In today's conventional solar cells, the costs of the inactive components — the substrate (usually glass) that supports the active photovoltaic material, the structures to support that substrate, and the installation costs — are typically greater than the cost of the active films of the cells themselves, sometimes twice as much. Being able to print solar cells directly onto inexpensive, easily available materials such as paper or cloth, and then easily fasten that paper to a wall for support, could ultimately make it possible to drastically reduce the costs of solar installations. For example, paper solar cells could be made into window shades or wallpaper — and paper costs one-thousandth as much as glass for a given area, the researchers say.

For outdoor uses, the researchers demonstrated that the paper could be coated with standard lamination materials, to protect it from the elements.◊

First Year Graduate Students Hit the Ground Running

Fall 2012 welcomed another new strong incoming class of MIT Chemical Engineering graduate students.

This year the department began a new tradition: a team-building day at the Outward Bound Education Center on Thompson Island, part of Boston's Harbor Islands. Incoming Course X graduate students, student office staff, and ChemE faculty bonded over team challenges and a ropes course. Students got to know each other and their professors, while getting a beautiful view of Boston, their new home for the next few years.

It was a fun and educational event that we plan to continue in 2012.

Research Highlights

For more information, go to *web.mit.edu/cheme/news/*

New way to stop the bleeding

Nanoscale biological coating developed at MIT could prevent battlefield deaths.

Article by Anne Trafton, courtesy of the MIT News Office.

MIT engineers have developed a nanoscale biological coating that can halt bleeding nearly instantaneously, an advance that could dramatically improve survival rates for soldiers injured in battle.

The researchers, led by Paula Hammond and funded by MIT's Institute of Soldier Nanotechnologies and a Denmark-based company, Ferrosan Medical Devices A/S, created a spray coating that includes thrombin, a clotting agent found in blood. Sponges coated with this material can be stored stably and easily carried by soldiers or medical personnel. The sponges could also prove valuable in civilian hospitals, says Hammond, the David H. Koch Professor in Engineering.

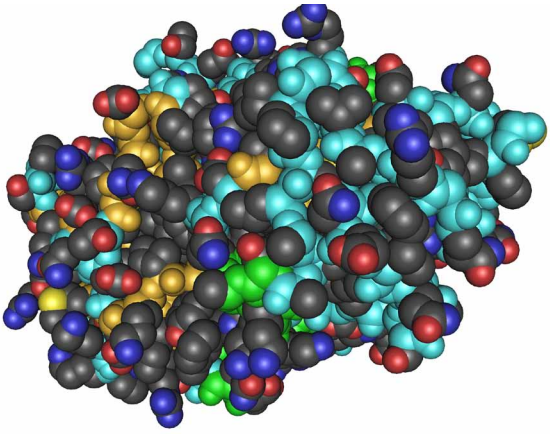
"The ability to easily package the blood-clotting agent in this sponge system is very appealing because you can pack them, store them and then pull them out rapidly," she says.

Hammond and her colleagues described the technology in the Dec. 27, 2011 online edition of Advanced Materials. Lead author of the paper is Anita Shukla PhD '11, who is now a postdoc at Rice University.

Uncontrolled bleeding is the leading cause of trauma death on the battlefield. Traditional methods to halt bleeding, such as tourniquets, are not suitable for the neck and many other parts of the body. In recent years, researchers have tried alternative approaches, all of which have some disadvantages. Fibrin dressings and glues have a short shelf life and can cause an adverse immune response, and zeolite powders are difficult to apply under windy conditions and can cause severe burns. Another option is bandages made of chitosan, a derivative of the primary structural material of shellfish exoskeletons. Those bandages have had some success but can be difficult to mold to fit complex wounds.

Many civilian hospitals use a highly absorbent gelatin sponge produced by Ferrosan to stop bleeding. However, those sponges need to be soaked in liquid thrombin just before application to the wound, making them impractical for battlefield use. Hammond's team came up with the idea to coat the sponges with a blood-clotting agent in advance, so they would be ready when needed, for either military or civilian use.

To do that, the researchers developed a nanoscale biological coating that consists of two alternating layers sprayed onto a material, such as the sponges used in this study. The researchers discovered that layers of thrombin, a natural clotting protein, and tannic acid, a small molecule found naturally in tea, yield a film containing large amounts of functional thrombin. Both materials are already approved by the U.S. Food and Drug Administration, which could help with the approval process for a commercialized version of the sponges, Shukla says.



(at left) MIT researchers have developed a coating of thrombin, shown here, and tannic acid. After being sprayed onto a surface, the material can halt bleeding within seconds.

A key advantage of the spray method is that it allows a large amount of thrombin to be packed into the sponges, coating even the interior fibers, says David King, a trauma surgeon and instructor in surgery at Massachusetts General Hospital who was not involved in this research.

"All of the existing hemostatic materials suffer from the same limitation, which is being able to deliver a dense enough package of hemostatic material to the bleeding site. That's why this new material is exciting," says King, also an Army reservist who has served in Afghanistan as chief of trauma surgery.

Once sprayed, the sponges can be stored for months before use. The sponges can also be molded to fit the shape of any wound. "Now we have an alternative that could be used without applying a large amount of pressure and can conform to a variety of wounds, because the sponges are so malleable," Shukla says.

In tests with animals at Ferrosan, the coated sponges were applied to wounds, with light pressure (from a human thumb), for 60 seconds — and stopped the bleeding within that time. Sponges lacking thrombin required at least 150 seconds to stop the bleeding. A simple gauze patch, applied for 12 minutes (the length of the experiment), did not stop the bleeding.

The researchers have filed a patent application on this technology and on similar sponges coated with the antibiotic vancomycin. Hammond's lab is now working on combining the blood-clotting and antibiotic activities in a single sponge. ◊

Monitoring how T cells respond to HIV

New technology could help AIDS researchers develop new vaccines.

Article by Anne Trafton, courtesy of the MIT News Office.

One of the obstacles to developing an effective AIDS vaccine is the difficulty in measuring how well a potential vaccine primes the body to defend itself against HIV.

Ideally, scientists would like their vaccines to provoke T cells, a critical component of the immune response, to recognize and kill HIV-infected cells. Unfortunately, there is no fast and easy way to monitor whether T cells are actually doing that. Instead, researchers measure the amount of a protein called interferon gamma that T cells secrete when they encounter an infected cell. Studies have shown, however, that this "surrogate" measurement doesn't necessarily predict a T cell's ability to kill HIV-infected cells.

In an advance that could overcome that obstacle, a team of researchers at MIT has developed a new technology that can measure multiple aspects of individual T cells' responses to HIV-infected cells, including their ability to kill them. The technology could make it easier to monitor and design vaccines against HIV, says J. Christopher Love, the Latham Family Career Development Associate Professor of Chemical Engineering and leader of the research team.

The technology, described in a paper published in the Oct. 3, 2011, online edition of the Journal of Clinical Investigation, involves two steps. First, the researchers place single T cells taken from HIV-infected patients into tiny wells on a plate, where they are exposed to HIV-infected cells. The researchers can detect whether the T cells kill the infected cells with probes that glow when the dying cells' nuclei become compromised.

Next, the researchers measure interferon gamma production with a microengraving technique they developed in 2008. Secretions from each cell are imprinted on a glass slide, which can then be tested for the presence of specific proteins. Because each cell has its own "address" on the slide, the secretions can be traced back to individual cells, and their interferon gamma production can be correlated directly to their cell-killing ability.

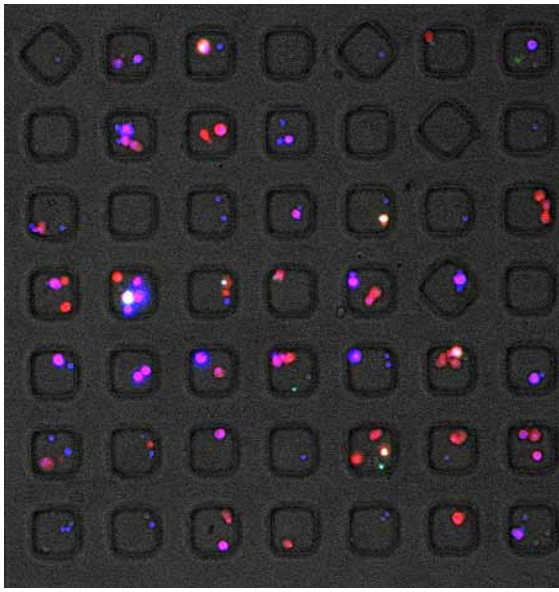
The same technology could be adapted to measure cells' output of any other immune system protein.

In this study, the researchers found that while the percentage of T cells that secrete interferon gamma is similar to the percentage of those that kill infected cells, the populations are not identical. In future studies, the researchers hope to find markers that do correlate with cell-killing ability, making it easier to evaluate a potential vaccine's effectiveness.

"Now that we have a tool to look directly at a variety of different functional activities, you can go in and start to evaluate other markers that may be better predictors of killing. Those then become what you would want to monitor in vaccine trials," says Love, who is also a member of the Ragon Institute of MGH, MIT and Harvard and the David H. Koch Institute for Integrative Cancer Research at MIT.

"The appeal of this technology is that it can help us understand more about what's going on in single cells," says Alan Landay, professor of immunology and microbiology at Rush Medical College. "It helps us rethink what we understand about immunology and immune function."

More research will be needed to develop the technology to the point where it can be used routinely in vaccine trials for large-scale studies of patient samples. ◊



Inside these squares, single T cells taken from HIV-infected patients interact with infected cells. This technology, developed by MIT chemical engineers, offers the first way to study how effectively individual T cells respond to HIV-infected cells.

Image: Navin Varadarajan

Research Highlights

For more information, go to *web.mit.edu/cheme/news/*

How cancer cells get by on a starvation diet

New study shows that tumor cells, deprived of glucose, alter their metabolism to use other sources of sustenance.

Article by Anne Trafton, courtesy of the MIT News Office.

Cancer cells usually live in an environment with limited supplies of the nutrients they need to proliferate — most notably, oxygen and glucose. However, they are still able to divide uncontrollably, producing new cancer cells.

A study from researchers at MIT and the Massachusetts General Hospital (MGH) Cancer Center helps to explain how this is possible. The researchers found that when deprived of oxygen, cancer cells (and many other mammalian cells) can engage an alternate metabolic pathway that allows them to use glutamine, a plentiful amino acid, as the starting material for synthesizing fatty molecules known as lipids. These lipids are essential components of many cell structures, including cell membranes.

The finding, reported in the Nov. 20, 2011, online edition of *Nature*, challenges the long-held belief that cells synthesize most of their lipids from glucose, and raises the possibility of developing drugs that starve tumor cells by cutting off this alternate pathway.

Lead author of the paper is Christian Metallo, a former postdoc in the lab of Gregory Stephanopoulos, the William Henry Dow Professor of Chemical Engineering and Biotechnology at MIT and a corresponding author of the paper. Othon Iliopoulos, an assistant professor of medicine at Harvard Medical School and MGH, is the paper's other corresponding author.

Alternate pathways

Much of the body's supply of oxygen and glucose is carried in the bloodstream, but blood vessels often do not penetrate far into the body of tumors, so most cancer cells are deficient in those nutrients. This means they can't produce fatty acids using the normal lipid-synthesis pathway that depends mostly on glucose.

In prior work, Stephanopoulos' lab identified a metabolic pathway that uses glutamine instead of glucose to produce lipids; the new paper shows that this alternate pathway is much more commonly used than originally thought. The researchers found that in both normal and cancerous cells, lack of oxygen — a state known as hypoxia — provokes a switch to the alternate pathway.

In a normal oxygen environment, 80 percent of a cell's new lipids come from glucose, and 20 percent from glutamine. That ratio is reversed in a hypoxic environment, Stephanopoulos says.

"We saw, for the first time, cancer cells using substrates other than glucose to produce lipids, which they need very much for their rapid growth," Iliopoulos explains. "This is the first step to answering the question of how new cell mass is synthesized during hypoxia, which is a hallmark of human malignancies."

The glutamine may come from within the cell or from neighboring cells, or the extracellular fluid that surrounds cells.

"There's protein everywhere," says Matthew Vander Heiden, the Howard S. and Linda B. Stern Career Development Assistant Professor of Biology at MIT and a co-author of the Nature paper. "The new pathway allows cells to conserve what glucose they do have, perhaps to make RNA and DNA, and then co-opt the new pathway to make lipids so they can grow under low oxygen."

The switch from glucose to glutamine is triggered by low oxygen and allows cancer cells to thrive and proliferate in an environment with minimal glucose, though it is not clear how this is done. "Elucidating the molecular mechanism regulating this switch would be important in understanding regulation of cancer metabolism," Stephanopoulos says. "This could be important not only for cancer cells but also other cells growing in hypoxic environments, such as stem cells, placenta and during embryonic development."

New insights into old models

The researchers are now looking into what other unexpected sources might be diverted into lipid-synthesis pathways under low oxygen. "We had to revise models of metabolism that had been established over the past 50 years. This opens up the possibility for more exciting discoveries in this field that may impact strategies of

"We had to revise models of metabolism that had been established over the past 50 years. This opens up the possibility for more exciting discoveries in this field that may impact strategies of therapy,,"

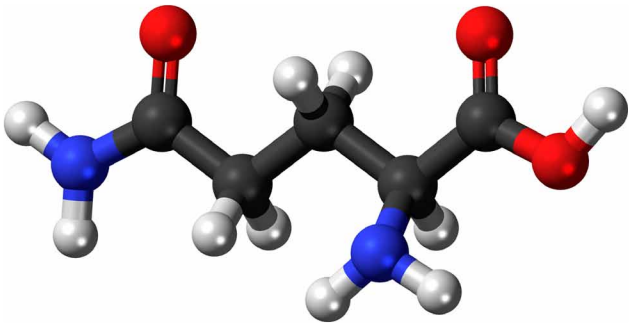
- Christian Metallo, former Gregory Stephanopoulos post-doc and lead author of the study

therapy," Metallo says.

A better understanding of metabolic pathways and their regulation raises the possibility of developing new drugs that could selectively disrupt key metabolic pathways for cancer cell survival and growth. One possible target is the enzyme isocitrate dehydrogenase, which performs a critical step in the transformation of glutamine to acetyl CoA, a lipid precursor.

"While this target is not new, our findings point to a new function and, hence, generate new ideas for drug development," Iliopoulos says. "The better we understand the molecular basis of these phenomena, the more optimistic we can be about efforts to translate these basic results into effective treatments of cancer."

"We've been looking, as a field, for almost 90 years for a metabolic pathway that could truly be used to differentiate malignant tumors from normal tissues," says Ralph DeBerardinis, an assistant professor of pediatrics and genetics at the University of Texas Southwestern Medical Center, who was not involved in this research. He adds that more study is needed, but "if this could be exploited, that could have significant therapeutic potential." ◊



(left) MIT researchers have found that when deprived of oxygen, cancer cells can engage an alternate metabolic pathway that allows them to use glutamine as the starting material for synthesizing lipids.

Course X Junior Nikita Consul

Student Highlight

Even though MIT was on semester break during the month of January, Course X Junior Nikita Consul still made a point of spending time in the classroom.

Over Independent Activities Period (IAP), she and 10 other MIT students served in schools around the country as part of the fifth annual Four Weeks for America Challenge. Through the program, , students have the opportunity to work under the guidance of a Teach For America host teacher to develop projects that will have a long-term effect on the participating schools.

Nikita was matched with Webster Middle School in Oklahoma City because the teacher wanted to start a science fair for her students. Nikita took the time to work directly with the middle school students in their own preparations. Though the students' ideas often took explosive turns toward erupting volcano models, bottle rockets and the like, she always strove to point them to the underlying science — be it the principles of plate tectonics or the physics of flight.

"The science fair was a good way to establish a role for myself in the eyes of the students," Consul says. "The students viewed me as a science expert and always asked a lot of questions."

After graduation, Nikita plans on pursuing a career in medicine and academia. Even though medical school is likely to be a different experience than the middle school classroom, her experience with education through Four Weeks for America only reaffirmed her plans.

"I was able to realize my fondness for using my knowledge to convey information that is useful to another person," She says. "I enjoyed bringing a smile to the students' faces as they realized that their idea for a science project could actually translate into scientific terminology and the steps of the scientific method. This past month was the turning point in my MIT career in which I solidified my desire to study medicine and become a professor of medical school."

DOW-MIT Access Program shows reality and rewards of graduate school

Weekend of activities introduces undergrads to opportunities in chemical engineering, as well as chemistry and materials science.

From Friday, Sept. 30, through Saturday, Oct. 1, 2011, the MIT Department of Chemical Engineering, along with Chemistry and Materials Sciences, hosted its third annual Dow-MIT Access Program, a weekend of educational and informative events introducing talented sophomores, juniors and seniors to the benefits of a graduate education in chemical engineering. Through interactive workshops, hands-on activities, and engaging presentations on MIT's campus, 17 under-represented minority students from around the country were introduced to the life of a graduate student in chemical engineering.

The Access program was first introduced in 2009 exclusively in the MIT Chemical Engineering Department and funded by the Dow Chemical Company. It is modeled after the company's highly successful BEST program which offers a similar experience for graduate students wishing to explore industrial careers in science and engineering. Based on this success in MIT Chemical Engineering, the program was expanded in 2011 to include the other two departments.

Seventeen undergraduates from across the country attended the chemical engineering-focused 2011 Access program.

The mission of the Access program is to increase the diversity of qualified applicants to PhD programs in science and engineering throughout the United States. The goal is not necessarily to prepare students for graduate school at MIT, but rather to introduce them to the advantages of choosing a graduate career path at an institution that best meets each participant's individual needs.

During the two days in 2011, the three departments hosted separate activities geared toward demystifying the application process and graduate student experience. "During [Professor Langer's] presentation I got a sense of excitement that I have never felt before toward academics and research in general," said chemical engineering attendee Mohammed Elzubier from Texas Tech University, "With the help of the Access program, I found out what I wanted to be and how to get there. I feel like my career outlook just took a 180-degree turn and I am very excited for what's to come in the future."

The attendees also spent time with MIT faculty and students. The Chemical Engineering Department held a "What Goes on Behind Closed Doors" question and answer session with MIT Professor Paula Hammond which provided an inside look to how an admissions committee might analyze application materials. They then took interactive tours of the laboratories of Chemical Engineering faculty members Chris Love, Bob Langer, and Hammond.

Third-year Course X graduate student and Love Lab member Tim Politano presents his research and experience to the 2011 Access Attendees.

The students also participated in a Communications Workshop with organization development expert Sheree Galpert. There they learned centering, status interactions, and other skills. Daniela Espinosa Hoyos of the Polytechnic University of Puerto Rico says, "Before doing the program, a graduate career in chemical engineering was appealing to me. But now, I don't see any reason why I wouldn't do it. In a panel of alumni, we were told that if you feel the urge to do research and everything that it entails, then you should do it. This program gave me that."

Applications for the 2012 Access Program, scheduled for October 12-13, are now being accepted and are due Friday, June 15, 2012. More information on the Dow-MIT Access Program can be found at http://access.mit.edu/.◊

Chemical engineering-focused Access attendees learn more about biological engineering in the Langer Lab.

2011 Course X Alumni Reception at AIChE

At the annual AIChE meeting in Minneapolis in October 2011, Course X alumni and friends from around the world gathered to mingle and network, as well as honor the MIT faculty who were recipients of AIChE awards:

Professor Paul I. Barton
Winner of the CAST Computing in Chemical Engineering Award

Professor Klavs F. Jensen
Winner of the William H. Walker Award

Professor Greg Stephanopoulos
Biotechnology Progress Award for Excellence in Biological Engineering Publication

Professor Bernhardt L. Trout
Winner of the CoMSEF Impact Award

2011 Holiday Party

On Friday, December 9, 2011, the faculty, staff, students and their families celebrated the holidays with the traditional day of baking contest, skits, dinner and caroling.













TIM


Verizon
5:00 PM
facebook
Patrick Heider Just passed hour 80 in the lab this week. I think I spend more time here than in my apartment...
33 minutes ago
Klavs Jensen likes this.


MIT

Alumnus Highlight

Bejamin Nicholson MS ’03

Benjamin Nicholson works at a small startup called Micromidas that uses bacteria to turn waste into a kind of modern-day gold: biodegradable plastic. “Most bacteria store excess energy as lipidsor starches. The ones we work with store energy as a polymer thathas properties similar to common plastics,” says Benjamin. The company, a few dozen microbiologists and chemical engineers, hopes to build a demonstration plant in the near future.

Nicholson’s job is to figure out how to make future plants cost effective. “The technology is sexy, but my work is bread and butter chemical engineering,” he says. “I use the parameters coming out of the labto make a process model for commercial scale plants.” Benjamin uses the methods he learned at MIT to size the plant’s energy and chemical requirements, production yield, and operating and capital costs. He also suggests areas of focus for future lab research. “Investors get excited about new technologies, but they want to see the numbers,” he says.

An Alumnus Finds Himself...

John Wilkens PhD ’77 (current photo at right) wrote in to say that, along with the MIT Chemical Engineering Community, he was saddened to learn of the passing of Professor Emeritus Charles Satterfield, his thesis advisor, as reported in the fall 2011 edition of XCurrents.

He then goes on, “A pleasant surprise was that I am the student shown with Prof. Satterfield in the two photographs on the memorial page (at left). I am pleased and honored to be included in his memorial. These photos were taken in Building 43 inside the cement block barricade I built for my catalytic reactor, shown here inside the sand heating bath.”

Blast from the Past

(to the left) Larry Galpin ’67 shares a photo from his Practice School days and writes: This picture was taken October 1967 of XA session at Oak Ridge, TN (US Atomic Energy site operated by Union Carbide). It was a great learning experience and lots of fun. Mrs. Maxwell (center) acted as our “secretary” and “mother”. She was especially helpful with her “black book” of all the single women in Oak Ridge.

Back row left to right: Larry Galpin, Harry Pellow, Peter DiGiovanni, Joe Baron, Jerry Coletta, Saroch Sukia. From row left to right: Hank Cochran (faculty), Sam Fleming (faculty professor), Mrs. Maxwell, Ron Norelli, Ted Trip.

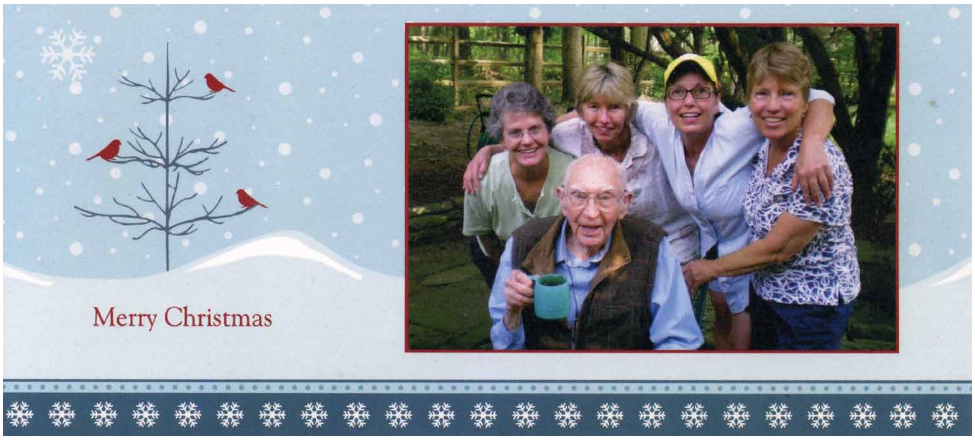
Do you recognize yourself or someone else in these photos or have your own you’d like to share? Email *chemealum@mit.edu*.

Alumni News

We want to hear from alumni like you! Please send us your news and photos.
Please direct news to: ***Melanie Miller, Editor***
Email: ***chemealum@mit.edu***, Phone: ***617-253-6500***, Fax: ***617-258-8992***

Special note: The alumni donor honor roll for the period of July 1, 2011, through June 30, 2012, will be in the Fall 2012 edition of the alumni news. *We sincerely appreciate everyone who has supported us throughout the year!*

From **Bill Hagenbuch BS '40 MS '41**: Here's a copy of my 2011 Christmas card (at right) to share with my fellow alumni. It features a picture of my four daughters and myself at a pre-Christmas celebration. Their visit followed my three-week visit to the hospital for a bunch of age related maladies. This was followed by my 93rd birthday on October 19th. Since then I've recovered very well, but I've stopped driving and use a cane for most of my walking.



NG Ashar SM '58 worked as research associate on MIT's Solar House IV under the guidance of Professor Hoyt C Hottel. On return to India, he joined a fertilizer and sulphuric acid company in 1961 at Mumbai. After 27 years he established his own consultancy. Currently his company has taken consultancy for a 4000 TPY liquid SO2 and 25000 TPY Sulphuric acid plant in Saudi Arabia. They have diversified in constructing Solar Power Plants using PV panels.

PJ Desai SM '64 has been named new CEO of Mark Andy. Desai spent several years of his career in various engineering and manufacturing positions in business units of the Monsanto Company, including an assignment in Europe to design, construct and manage a new plant. During his time at Monsanto he managed several business groups, leading to the positions of CFO, president and CEO. Desai has an MBA from the University of Michigan.

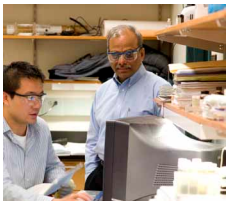
Henry Heines '67's "Patent Update" is published in the February 2012 issue of Chemical Engineering Progress. He does three to four of these a year and will also be publishing a full-sized article in the same journal later in 2012.

After leaving MIT, **Joe Cramer SM '68** received a PhD in Ch.E. from Penn in 1971 and then worked for Stone and Webster, Brown and Root and Bechtel as a project, department program manager for 25 years. More recently, he retired as Director, Technical Programming at AIChE on January 6th, 2012, after holding this position for 17 years but will continue to consult for AIChE as Director, Emeritus.

Jefferson W. Tester PhD '71, MIT Chemical Engineering Professor Emeritus, the Croll Professor of Sustainable Energy Systems in the School of Chemical and Biomolecular Engineering, director of the Cornell Energy Institute and associate director for energy in the Atkinson Center for a Sustainable Future, was honored with the Geothermal Special Achievement Award from the Geothermal Resources Council Oct. 26, 2012 in San Diego. Tester was cited for his "outstanding contributions to the development of geothermal resources" over more than three decades. His most noteworthy contributions are pioneering work on many aspects of enhanced/engineered geothermal systems, including thermal energy conversion and utilization, tracer methods for characterizing reservoir thermal hydraulic behavior and geothermal systems analysis.

Stephen Oliva '80 has been named COO of Nesscap Energy Inc. Oliva has over 25 years of experience in operations and product development in the high-technology and energy technology industries. Throughout his career he has progressed through a series of technical and managerial positions and has held senior management positions for the last 15 years. Most recently he held the position of Vice President of Manufacturing and Materials for a major international control networking company, with responsibility for all manufacturing, purchasing, planning and logistics functions. Leading teams in the United States and the People's Republic of China he was also responsible for all outsourced manufacturing subcontractors and ASIC suppliers. Also active in the company's new product development efforts, Oliva led the commercial release of over 35 new products during his tenure.

"None of this would be possible without the support of Course X faculty (a special thanks to Prof. Armstrong who suggested I continue my education at Georgia Tech!) and my undergraduate training in engineering AND writing from MIT." ***- Akua Asa-Awuku '03***



Rakesh Agrawal ScD '80, was named a National Medal of Technology and Innovation winner. Agrawal is currently the Winthrop E. Stone Distinguished Professor of Chemical Engineering at Purdue University. The award is the highest honor for technological achievement bestowed by the president of the United States. A citation for the award recognizes him for "an extraordinary record of innovations. These innovations have had significant positive impacts on electronic device manufacturing, liquefied gas production and the supply of industrial gases for diverse industries."

David Broecker '85 has been named President, Research Models & Services (RMS), at Harlan Laboratories. Most recently, he was the CEO of BioCritica, a private biotechnology company focused on the development and commercialization of products for the critical care market. From 2001 to 2009, Broecker was a senior executive at Alkermes, including the last three as president and CEO. During his tenure, he led the strategic transformation of Alkermes from a partner-driven, drug-delivery company to an integrated biopharmaceutical company with the capabilities to develop and commercialize proprietary products.

Phillip R. Westmoreland PhD '86 has been elected president of AIChE for the 2013 term. Westmoreland is a professor at North Carolina State University in the Department of Chemical and Biomolecular Engineering and is Executive Director of the NCSU Institute for Computational Science and Engineering. His research focuses on reaction kinetics and engineering, obtained from molecularbeam mass-spectrometry experiments, computational chemistry, and reactive-flow modeling. The main technology driver is clean energy from fossil and biofuels, but he has also been involved with developing fire-safe polymers, hypergolic rocket fuels, and plasma processing of microelectronics.

Akua Asa-Awuku '03 is a recent recipient of an NSF CAREER award and EPA-STAR award (http://www.engr.ucr.edu/news/2012/2012-02-14.html). Akua says, "Of course, none of this would be possible without the support of Course X faculty (a special thanks to Prof. Armstrong who suggested I continue my education at Georgia Tech!) and my undergraduate training in engineering AND writing from MIT.

Nikhil Shenoy '06 is graduating from the University of Chicago Booth School of Business MBA program and is starting at Procter & Gamble in Cincinnati this summer. He and his wife Amy are also proud that Moose, their over-sized black lab puppy, earned an AKC medal for successfully completing basic behavioral training.

Aerodyne Research, Inc. (ARI), a provider of scientific research and development services and advanced instrument and software products in Billerica, MA, is pleased to announce the promotion of **Dr. Oluwayemisi (Luwi) Oluwole PhD '06** to Principal Engineer in ARI's Center for Aero-Thermodynamics. Dr. Oluwole received his BS in chemical engineering from Michigan State University and his PhD in Chemical Engineering from MIT and joined Aerodyne Research, Inc. in 2006.

Heather Stern PhD '06 and husband Nicolas Ortiz MS '02 would like to announce the birth of their son, Samuel Nicolas Stern Ortiz, on October 27, 2011.

Joel Moxley PhD '07 was named a Technology Review top innovator under the age of 35 (TR35). Moxley's team at Foro Energy has been developing long-distance laser transmission technologies that improves upon traditional drilling technologies, hopefully overcoming the technical and economic barriers to reaching the vast quantities of geothermal and other forms of energy that are trapped under ultra-hard rocks.

Mariah Hoover '08 finished the MIT MSCEP degree in December 2011, was married in Orlando, FL to Kehl Mandt from Alexandria, VA a week and a half later, and then moved to Houston, TX with her new husband to work for Shell Oil Company. She now works as a project engineer working on front end LNG plant design in North America and looks forward to coming back to MIT in June 2012 for graduation (again)!

Allen Lin '11 was named a Marshall Scholar Lin will pursue a master's in technology policy at the University of Cambridge, followed by a master's in science and technology studies at the University of Edinburgh. He hopes to eventually complete a PhD in synthetic biology and pursue a career in research and policy advocacy. ◊

In Memoriam

William R. Hawthorne ScD ’39

Sir William Hawthorne passed away on September 16th, 2011. played a crucial role in developing the gas turbine jet engine in Britain during World War II. He was sent, in 1940, on loan from the Royal Aircraft Establishment (RAE) to Power Jets, the company founded by Frank Whittle, to develop the world’s first operational jet engines. During testing Whittle had run into difficulties with fuel combustion and Hawthorne was brought in to solve the problem. He arrived at the disused foundry at nearby Lutterworth that served as Whittle’s base and set to work.

The race to harness the technology was crucial as the battle for the skies looked set to determine Britain’s fate. Hawthorne decided the answer to the fuel issue lay in the work he had carried out previously at the Massachusetts Institute of Technology on the mixture of fuel and air in flames. Using this, he developed a way to ensure that fuel droplets were sprayed in a uniform manner onto compressed air to produce reliable combustion and thrust.

The first of Whittle’s test jet engines took to the skies on May 15, 1941, powering the Gloster E28/39. Take-off for the test flight lasted 17 minutes, with the Gloster soon flying faster than the Spitfire. A second aircraft using the same type of engine was demonstrated to Winston Churchill on April 17, 1943, and the jet-powered RAF Meteor went into service in 1944.

William Rede Hawthorne was born on May 22, 1913, at Benton, Newcastle-upon-Tyne. In 1916, his family moved to London and William was educated at Westminster. He won an exhibition to Trinity College, Cambridge, where he read mathematics before switching to mechanical sciences.

After taking a double First, he worked as a graduate apprentice in Scotland. He also embarked on a lifetime’s hobby of performing conjuring tricks. In 1935, he went on a Commonwealth Fund Fellowship to MIT and joined the chemical engineering department. He studied combustion and, in particular, the effect of turbulence on flame lengths, showing that the rate at which oxygen is mixed with fuel controls the length of the flame.

When war was declared he persuaded the Air Ministry to post him to the RAE, from where was seconded to Power Jets.

In 1951, he returned to Cambridge to be elected a Fellow of Trinity and continued his research on the theory of flow in compressors and turbines.

He was elected a Fellow of the Royal Society in 1955 and knighted in 1970. In 1939, he married Barbara Runkle. She died in 1992, and he is survived by their son and two daughters.

Zhi Fang Li ’41

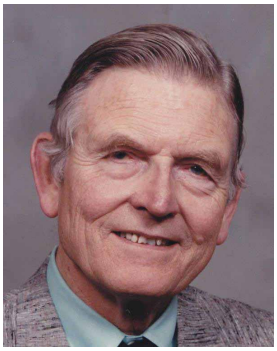
Zhi Fang Li passed away on January 16th, 2012 in Beijing. He was 92 years old. Zhi Fang Li graduated with a BS in Chemical Engineering in 1941. He returned to China in 1946 after World War II where he was in charge of starting up the Shanghai Hong Wen Paper Mill which went into production in 1950. The mill became the largest paper mill in Asia at that time. During the next thirty years, he served in various posts in the Ministry of Textiles and was one of the founders of viscose fibre and synthetic fibre industry in China. He was honored as Master of Engineering—one of the first one hundred in China. Zhi Fang spent his retired years in San Francisco with his wife Wan Zhen. They relocated back to Beijing in 2002. They attended the Class of 41’s 45th, 50th, 55th and 60th reunions. Zhi Fang is survived by his five children and their families. His funeral service was held at Ba Bao Shan Cemetery on January 20th, 2012. Family, friends, former coworkers, and company leaders came to pay their final respect and celebrate his life. He and his wife have now reunited after eight years.

Albert Erickson, Jr. SM ’41

Albert Erickson Jr., 93, of Colonial Beach passed away Monday, Nov. 28, 2011, at Westmoreland Rehabilitation Center in Colonial Beach.

Albert graduated from MIT in 1941, with a master’s degree in chemical engineering. He retired from the U.S. government Naval Sea Systems Command. Albert was a member of the American Chemical Society and American Stamp Collectors.

Albert is survived by a daughter, Patricia Erickson of Lovettsville; a son, Richard Erickson and his wife, Susan, of Belle Vernon, Pa.; and three grandchildren. He was preceded in death by his wife, Marjorie O. Erickson.



Curt Buxton Beck ’45

Curt Buxton Beck, 87, died Saturday, Dec. 3, 2011. Curt was born in Dallas on Aug. 6, 1924, the oldest son of Curt Walter Beck and Anna Nash Buxton Beck. Curt graduated as valedictorian and was admitted to the Massachusetts Institute of Technology. However, he chose to go one year to the prep school Phillips Academy in Exeter, N.H. Then he attended MIT on a scholarship. He was too tall for military service, so he was class F. Due to the war, the classes at MIT went nonstop through the years. Curt graduated with a Bachelor of Science degree in chemical engineering in 1945.

He then started his 40-year career at Cabot Carbon Co. (now Cabot Corp.) working in their Research and Development Division in Pampa. In 1950, he returned to MIT for a master’s degree, which he received in 1952. While working on his degree, he attended the MIT School of Engineering Practice in Oak Ridge, Tenn., and also spent time working for Cabot in Japan and Chester, England, on an exchange program.

In 1957, he married Wilhelmina Paula von Wolzogen Kuhr “Wil” from the Netherlands, whom he had known since they met as children in 1934. Curt’s aunt Viola was married to Wil’s uncle Paul, conductor of the Dallas Symphony at that time. They made their home in Pampa and started their family. Their three children, Curt Emile, Anna Catherine and Paul Buxton were born over the next five years.

Although he had numerous chances to transfer to other cities, Curt never wanted to leave Pampa. He elected to stay and work for Cabot in various capacities (he ultimately became the corporate environmental control officer) until his retirement in 1984. He then opened his own engineering consulting practice, where he applied his environmental and regulatory expertise to the benefit of his many clients. He never officially retired as he loved working and sharing his knowledge through his engineering practice and monthly newsletters until his recent passing.

Curt was a registered professional engineer in several states. He was a member and a Fellow of American Institute of Chemical Engineers, American Chemical Society, Air and Waste Management Association and was a Diplomat of American Academy of Environmental Engineers. He also served as the Texas Panhandle area adviser to his beloved MIT and screened hundreds of area high school senior applicants.

Survivors include his wife of 54 years, Wil; and three children: Curt and his wife Rhenalea and their three children, Kelsi (23), Austen (21) and Kaylen (20); Anna and her husband Kelly and her children, Erin (20) and Sara (18) and stepchildren Carly (21) and Taylor (15); and Paul and his wife Carol and their children Gregory (17), Steven (15), Catie (10) and Jessie (8).

Richard O. Sherman ’58

Richard O. Sherman of Gillette, N.J., passed away peacefully Saturday, Nov. 26, 2011. He was 75.

He was the beloved father of Leslie Rothberg (Jay) and Lisa Sherman. He was the faithful, loving brother of Jon Sherman. He also is survived by his two granddaughters, Nicole and Corrine Rothberg. He was preceded in death by his parents, Helen (Rothenberg) and Max Sherman.

Richard was a chemical engineering graduate of MIT and worked 30 years in the industry. He lived on the east and west coasts in his lifetime, and later returned to his childhood home in Gillette, during his retirement. He loved playing bridge and conversing with family and friends about politics and sports, especially his beloved New York Yankees. Richard also had a deep appreciation for Italian opera and was the proud owner of an extensive collection of CDs, which he listened to with great joy.

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Come visit us on campus June 8, 2012!

You are invited to attend the

Annual MIT ChemE Alumni Reception

Friday, June 8, 2012

1pm *(immediately following Commencement)*

Tent in McDermott Court