Peter Harriott, Pioneer and Champion for Environmental Management
Full Circle: Energy From the Sun
The Heralded Potential of Nanomaterials
Andy Irwin, ChemE: Not On the Traditional Path
FROM THE DIRECTOR

Dear Alumni and Friends of the Department,

In just one year it will be 75 years since chemical engineering emerged from the Chemistry department as a separate discipline at Cornell. At this year’s commencement event, I quoted from our early history to remind the Class of 2012 just how far chemical engineering has come as a discipline and how far we have journeyed as a department. On page 1 of his excellent book, “The School of Chemical Engineering at Cornell – A History of the First Fifty Years,” former Director Julian Smith paraphrased a skeptical chairman of the Chemistry department warning of our fundamental demise: “there is no such thing as a chemical engineer.” I told the class of 2012 that with their graduation, they became the 70th batch of Cornell Chemical Engineers who with the united voice of their actions have helped define our discipline and will shape its future.

As the School approaches its 75th birthday, I am pleased to report that the chemical engineering program at Cornell is healthy and strong. With over 100 rising seniors and nearly as many rising juniors, our discipline is attracting talented students in unprecedented numbers. The class of 2013 stands out in other important ways. Forty three percent are women, fully ten percentage points higher than the average for the College of Engineering (COE) and a leap forward from the essentially all-male classes that defined the School’s early history. Additionally, thanks to the popularity of our Energy Economics and Engineering (EEE) Masters concentration, the M.Eng class of 2013 will be the largest in the School’s history. This theme of growth also extends to the faculty. With the recent addition of two new faculty members, Julius Lucks and Roseanna Zia, a new full-time Industrial Practitioner, Alan Feitelberg, and new searches about to begin for members, Julius Lucks and Roseanna Zia, a new full-time Industrial Practitioner, Alan Feitelberg, and new searches about to begin for one additional faculty member and for a second full-time Industrial Practitioner, the number of full-time faculty overseeing the program will soon rise to 21. The School’s research expenditures in the last year are also at their highest mark historically and are more than double the COE appropriated budget for running all programs in the department. Thus, as we approach our 75th birthday, I am happy to write that the chemical engineering faculty is as involved in the creation and dissemination of new knowledge as in maintaining our strong traditions in teaching students known paradigms.

The cover story for this issue of the Olin Hall News focuses on the department’s commitment to research and education in the area of sustainable energy systems. It is an important testament to the versatility of our discipline that many of the energy-related challenges of our time: technologies that lower mankind’s carbon footprint; engineering strategies for co-opting the biological machinery of living systems for large-scale production of biofuels; processes for making new materials for tomorrow’s solar panels, batteries, efficient membranes for producing clean and safe drinking water in the remote corners of the planet, are problems chemical engineers appear uniquely equipped to solve in innovative ways. On pages 3 and 4, we describe how my colleagues Emeritus Professor Peter Harriott ’49 and Jeff Tester ’66, M.S. ’67, the David Croll Professor of Sustainable Energy Systems, are by their example and scholarship defining the important role chemical engineers must play in finding answers to these questions. This issue also contains contributions by two alumni, Mike Weill ’79 and Andy Irwin ’81, MEng ’82, which nicely capture the range of roles chemical engineers are already playing. On page 16, we report on the impacts Andrew Hunter is having on growing numbers of Cornell students through the School’s masters concentration in energy economics and engineering. This program overlaps economics and engineering principles upon the analysis of energy systems and thereby is preparing students for careers as consultants, engineers, as well as in public policy. These efforts will be strengthened by the addition of Alan Feitelberg (see pg. 19) as a member of the faculty.

In closing, I would like to express my gratitude to all alumni and friends of the School who continue to inspire our students and faculty through your loyalty and generosity in supporting the School and its programs. At this year’s reunion breakfast, I had the special honor of joining Bob Ulrich ’42 and Bob Finn ’42 in dedicating the Director’s office in honor of the Class of 1942. I also had the pleasure of recognizing David, PhD ’69, and Patricia Weaver for naming room 222 Olin Hall in memory of our late colleague and David’s doctoral thesis advisor Robert York. As a final tribute to your generosity in establishing the Raymond G. Thorpe Teaching Professorship in chemical engineering, I joined several of you in unveiling a beautiful new plaque in the Roger K. ’60, PhD ’65, and Mary L. A&S ’63, MS ’65, West foyer in the east wing of Olin Hall that memorializes the names of all alumni and friends of the School who contributed to the Thorpe Professorship endowment. I would like to single out Richard Hauptfleisch ’75, Michael Gibson ’65, and our late friend and loyal alumnus, Charlie Gray ’60, for their steadfast commitment to the Industrial Practitioner program. Their financial support of this program is making it possible to attract new practitioners to bridge to the retirement of the Schools duo of current Industrial Practitioners. (see pg. 25 for the job ad).

I hope you enjoy the stories we have assembled and feel informed after reading this issue of the Olin Hall news. If your travels bring you to the Ithaca area, please visit Olin Hall.

Lynden A. Archer
William C. Hooey Director and Professor
Peter Harriott, Pioneer and Champion for Environmental Management

By Marguerite Spencer, College of Engineering Communications

In the next decade, we should see a significant increase in wind energy installations, which are cheaper and more efficient than other intermittent energy alternatives, such as solar power," says Cornell Emeritus Professor Peter Harriott. In the 1970’s, Professor Harriott established a course in synthetic fuels at Cornell that looked at coal and shale as alternatives to the then threatened shortage and increased prices of petroleum. "But then the price of oil dropped again," he said, "and attention to such alternatives diminished."

Harriott joined Cornell’s faculty in 1953, a few years after gaining his Bachelors in Chemical Engineering from Cornell and ScD from M.I.T. He taught the senior Plant Design course, a graduate course in Chemical Reactor Design and developed an elective in Air Pollution Control taken by chemical and other engineering and science students.

One of Harriott’s research interests was sulfur dioxide removal from the stack gas of coal-fired power plants. He explains that with current technology, 95 percent of the sulfur dioxide and 99 percent of the fly ash can be removed from stack gas, but it is not yet practical to remove the main contributors to global warming, CO₂/CH₄. Switching to natural gas might lower CO₂/CH₄ emissions by 40 percent or more, he says, but the CH₄ escaping from gas wells makes the net effect on climate change uncertain. "We should eventually replace both coal and gas as means of producing electricity, but the switch to wind, solar, and bio fuels will take decades to accomplish," he says.

“I wish government would adopt a carbon tax but I’m pessimistic of change happening fast enough for us to avoid a major climatic crisis caused by CO₂/CH₄," He observes that US emissions rather than going down are in fact going up slightly due to the need for more transportation and air conditioning. Speaking a few days before the recent United Nations Conference on Climate Change in South Africa in November 2011, he says he supports the call for the US to sign the Kyoto Protocol.

Harriott acknowledges that some at Cornell are still skeptical about global warming because they look at records of climate fluctuation and say it’s normal to have significant variations and there have been flaws in some scientific reports. “But we have to look at the fact that 95 percent of scientists say man is causing global warming," he contends.

Harriott continues to be very active since retirement in 2001. He still gives several guest lectures a year and advises M. Eng students and has written two books. One with fellow Cornell Emeritus Professor Julian C. Smith, Unit Operations of Chemical Engineering, is arguably the most popular text book in Chemical Engineering Design. It has sold over 500,000 copies and is now in its seventh edition. A book on Chemical Reactor Design was published in 2005, and his book Process Control published 1964 is still in use today.

To honor his substantial contribution to Engineering Education, particularly related to industrial application, Cornell has established fellowships in his name for students exploring sustainable energy systems in the Masters of Engineering program.

Reflecting on major changes he has seen in Engineering Education, Harriott points to the incorporation of Biology and says, “Chemical Engineers today are very well suited to help solve problems in engineering and the environment, as well as in medicine and health.”

Harriott contributes outside the classroom as well. He has been a consultant on pollution problems to staff at Cornell’s heating plant and shares his expertise through various committees and boards, including the Tompkins County Environmental Management Council. "I enjoy where I live," says the Ithaca native son, whose parents are both graduates of Cornell. "And I want to continue to contribute as long as I am able."
Jefferson W. Tester:  
Transforming our Energy System—  
Opportunities for Chemical Engineering and Cornell

Within Cornell’s 11 endowed and land grant colleges, from the newest freshman to President Skorton, we have enormous capacity for and a strong commitment to achieving a sustainable energy future. This capacity and commitment, combined with our passionate alumni, as evidenced by the generosity of David Atkinson and David Croll, attracted me to “come back home” to Ithaca five years ago.

In this article, I hope to share a few things with you—first, why we should be concerned about transforming our energy system in the coming decades and what our options are; second, why chemical engineering is perfectly poised to contribute in powerful ways to the energy transformation we need to achieve; and third, how Cornell’s efforts in sustainable energy research and education are evolving.

BACKGROUND & CONTEXT:

Central to the question of whether we can achieve a sustainable future is our complex and changing relationship with energy. Events in recent years worldwide, from Japan to the Middle East to North Africa and elsewhere, have provided the wake-up calls we need to refocus attention on energy security for the long term. First and foremost, we need to be much more efficient in the ways we use energy to provide the services needed for the high quality of living the developed world has and the developing world wants. Right now we rely heavily on conventional fossil fuels. In the longer term, unconventional fossil resources (shale gas and oil, oil shale, tar sands, etc.) will undoubtedly be used in increasing proportions. However, to rely on these resources alone is short-sighted because the rates of extraction of these depletable resources far exceed the time required to regenerate them, a geologic, not a generational time scale. For a sustainable future in the long term, we need to transition completely from relying on finite fossil fuels to using renewable resources and nuclear power on a much larger scale. There is uncertainty and legitimate debate over when such a major transformation will be needed and what it will consist of, but few will argue that eventually we will develop and deploy renewable resources on a much greater scale.

While most universities are actively engaged in energy research, Cornell is unique in organizing our efforts in a larger sustainability context. Cornell’s vision focuses on creating new connectivity in three general areas – energy, environment, and economic development – because we can’t solve the energy challenge without looking at the big picture.

When one examines how we provide and use energy today, you come away with some level of appreciation for what engineers have done to provide affordable energy when and where it is needed. The 7+ billion people in the world consume 470 quads or Exa Joules of primary energy per year, equivalent to burning about 240 million bbl of oil per day. With over 85% of that primary demand being met by fossil fuels (gas, oil and coal), followed distantly by hydro and nuclear fissile uranium fuels, you can appreciate the enormity of the required transformation, not only in terms of technology improvements to make renewables (wind, geothermal, solar, and biofuel and bioenergy) perform better and be more affordable, but also the magnitude of the financial investments needed for deploying these alternatives and the infrastructures for converting, transporting, distributing, and delivering them to customers.

ENERGY:

For most of the last century, chemical engineers were instrumental in inventing and deploying new technologies for providing affordable energy from both fossil and fissile fuels resources – from upstream to downstream including feedstock extraction and recovery, to conversion and upgrading in refineries, to distribution and delivery. Unquestionably, chemical engineers have contributed significantly to both energy security and the standard of living most Americans enjoy. Now, at the beginning of the 21st century, things have changed, and chemical engineers have many more professional options, yet the disciplinary
skill set they possess, with thermodynamics, transport and reaction engineering and a process context at the core, is exactly the training needed to tackle the challenges of a major energy transformation. Furthermore, the rules of the game have changed, with the bar set much higher in order to meet new environmental standards and reduce ecological impacts associated with energy. For example, the increasing global greenhouse gas emissions and resulting global warming, along with significant changes to the technological and geopolitical landscapes for oil and gas resources, have changed the way we think about energy. Chemical engineering students who will be future leaders, regardless of career direction, need to be exposed to these issues and are becoming literate in the sustainability challenges facing their generation and those to come, leading to increased awareness of the need for proactive stewardship of the earth’s resources and ecosystems.

The level of CBE faculty and student involvement in energy research today is broad and diverse. In addition to the solar photovoltaics modeling work of Paulette Clancy’s group discussed in a companion article in the issue, Tobias Hanrath is leading an advanced materials synthesis program for photovoltaics devices, and Lynden Archer’s group is developing engineered nanostuctured ionic materials for energy storage and battery applications. Both synthesis efforts are aimed at creating molecular architectures that are designed to achieve high performance in capturing and converting energy. Lynden is also the co-Director of the KAUST multidisciplinary research program that is supporting a wide range of energy-related projects. Susan Daniel and Roseanna Zia have just launched a new research project on algal biofuels being sponsored by the Atkinson Center. I have been collaborating with faculty in CALS for some time on using hydrothermal and ultra-sonic methods for pretreatment and conversion of lignin cellulosic and algal feedstocks. The use of supercritical water to desulfurize crude oils is under investigation by Yong Joo and me, while Don Koch and Abe Stroock are working on methods of characterizing CO2 sequestered in geologic media. I have also continued my interests in geothermal energy, working on geothermal heat pumps, low grade geothermal energy assessment and heat utilization, hydrothermal spallation drilling methods, and collaborative work with Don Koch on reservoir thermal hydraulics.

Chemical engineering has also taken the lead on several fronts in energy education. The department instituted a MEng program in Energy, Economics & Engineering, working closely with colleagues in Earth and Atmospheric Sciences to create an Earth Energy program for graduate students that is currently sponsored by the NSF, and to launch a undergraduate minor in sustainable energy systems. As a part of these efforts we have created a set of 3 core fundamental subjects and 7 energy-specific modules. Many CBE faculty and industrial practioners, including Brad Anton, Paulette Clancy, Don Koch, Abe Stroock, Andrew Hunter, Al Center, and Mike Weill along with visiting faculty Michal Moore, and me, are either leading or participating in many of these initiatives.

During the first part of our core energy course, which develops tools and methods for analysis of sustainable energy systems, the students (seniors and masters of engineering) seem somewhat surprised by the results of several scaling calculations related to energy. For example, in the first problem set that we assign, we ask them to estimate the power passing through their hands when they fill the gas tank on their car. Many of them start on the right path; after all, there are a lot of chemical engineers in the class who appreciate rate processes and energy balances and are aware that there is chemical energy stored in the C–C and C–H bonds of gasoline that is released during combustion.
But almost without exception, they are amazed to learn that 10 to 20 MW of thermal power is moving through the hose while filling the tank. This realization begins the process of thinking about energy storage and alternatives to gasoline in vehicles. Just imagine trying to recharge the batteries in an electric vehicle in only a few minutes with the electrical equivalent of that amount of chemical energy. Other favorite challenges are estimating the land needed to grow dedicated energy crops annually to produce biofuels in sufficient quantity to operate half of our transportation fleet, or what area of photovoltaic cells would be needed to supply New York City with its electricity.

Recently, there have been mandates that impact how fast renewables need to grow: for example, what it would take to provide 20% of our electricity with wind in 20 years, or the impact of adding solar collectors to a million rooftops. Whatever road we decide to take, rational perspectives are called for. With much of the emphasis on producing electricity and transportation fuels, we thought that taking a closer look at how we use energy today would be a good first step. For example, does it make sense to burn fuels at 1,800˚C or higher to produce 35˚C water for a shower? Yet millions of people do this every day, in every city and town in the U.S. and around the world. By ignoring how energy is used to heat our homes and buildings and to provide hot water for everyday necessities like taking showers, cleaning clothes and cooking foods, we might be missing opportunities to create a secure and sustainable energy future.

DIVING A BIT DEEPER.

Over the past couple years, my students and I have analyzed how Americans use energy, evaluating published data from the last 40 years to see just how much energy is consumed as a function of the actual temperature where it is used. The result can be viewed as a “thermal spectrum” of current energy use as shown in Figure 1.

We found that about 25 percent of our total primary energy is used at or below the boiling point of water (212˚F or 100˚C). Notably, most of this demand is met by burning two of our most valuable fuels – oil and natural gas – at much higher temperatures than needed, in hot water heaters and furnaces in virtually every American home or commercial building. The laws of thermodynamics tell us this use of high-temperature combustion energy is inherently wasteful. Quantitatively, this effect is described as a loss in work-producing potential, resulting from a reduction in the availability or exergy of the energy source. A more efficient approach would be to first generate electricity from these hot combustion gases before they are used for heating applications at lower temperatures. This technique is used in co-generation plants, as found at Cornell and many large U.S. universities, which provide both heat and electric power in a distributed network.

Alternatively, finding thermal energy sources closer to the temperature of use would be a big improvement. By expanding our use of the abundant lower grade geothermal, solar thermal and waste heat resources in district heating and combined heat-and-power applications, we could significantly reduce our use of gas and oil. The technology is already here and has been for more than a century. The United States first developed a geothermal district heating system in Boise, Idaho in the late 1800s, but since then the U.S. has lagged far behind other countries, largely because we had abundant, low-cost oil and gas. In contrast, Iceland has utilized its high-grade geothermal resources to generate about 20 percent of its electric power and meet about 95 percent of heating needs. In fact, Iceland has made a total transformation from complete dependence on imported fossil fuels to a renewable energy supply in less than 50 years.

Figure 1:
Estimated thermal energy consumed in America below 260˚C (500˚F)

For further information and documentation of our analysis of low temperature thermal energy use in the U.S., readers are referred to recent documentation, including “opinion” and “analysis” articles in Energy and Environmental Science, 2011 (Tester, 2011 and Fox, Sutter and Tester 2011) and a comprehensive technical report available on the web at www.acsf.cornell.edu/2011Tester-LowTempEnergy
POTENTIAL ROLE FOR CORNELL AS AN ENERGY DEMONSTRATION SITE.

Cornell already uses cold water extracted from a deep section of nearby Cayuga Lake for cooling and air conditioning its buildings, laboratories and dormitories during the summer months. Adding geothermal would complement Cornell’s lake-source cooling by providing hot water for winter heating for Cornell’s community of 30,000 students, faculty and staff, using an advanced co-generation system in conjunction with other renewable resources such as biomass. Fluids produced from an engineered geothermal reservoir extracted at temperatures ranging from 80˚ to 120˚C would be connected to the campus’s district heating network. During warmer periods, geothermal heat could also be used for electric power generation. Figure 2 provides a schematic of the proposed plan.

Also, Cornell’s Climate Action Plan (CAP) calls for the use of low-carbon renewable resources along with deployment of aggressive on-campus energy efficiency measures to substantially reduce and eventually eliminate carbon emissions. Before 2010, Cornell was consuming about 65,000 tons of coal per year in its co-gen plant. A major upgrade to a natural gas fired system for heating and power generation on campus is now operational and has lowered carbon emissions by about 25%. To achieve further reductions will require switching to renewable sources.

High electrical loads and high thermal energy demand for winter heating in the northern latitude regions of the U.S in general would be heavily impacted by future gas and oil supply disruptions and could eventually lead to population losses and declines in regional economic viability. With the limited availability of solar and wind resources in the Northeast, viable alternatives to coal are needed. Eastern geothermal resources are large in terms of their stored thermal energy, but they are at greater depth than those available in the western U.S.

If implemented, Cornell’s approach would result in a meso-scale, publicly-accessible demonstration of enhanced geothermal energy use suitable for replication by any large institution or industry. In its final stage, the EGS system would include multiple production and injection wells reaching to about 4,300 meters (14,000 feet) below ground surface into pre-Cambrian crystalline “basement” rock. Where temperatures could reach 150˚C. Heated geothermal fluids would be brought to the surface to supply energy to a combined heat and power co-generation facility utilizing organic Rankine-cycle engines, direct plate-and-frame heat exchangers, and heat pumps (as needed). Acquired thermal and electrical energy would be directly interconnected to Cornell’s existing district energy system which supplies 30MWe of electricity and 1.8 PJ (1.8 trillion Btu) per year of thermal energy for heating buildings in a community of 30,000 faculty, staff, and students.

ASSESSMENT OF THE GEOTHERMAL POTENTIAL OF THE ITHACA REGION:

For geothermal energy to have a national impact as a major energy supply in the U.S., deployment must approach EJ levels and utilize lower grade hydrothermal or Enhanced Geothermal Systems (EGS) resources. In certain locations, the costs of drilling as a function of depth will limit produced fluids to lower temperatures. This limitation favors applications for direct use and/or co-generation of electricity and heat. The Northeast region of the US where geothermal gradients are low and annual heating loads are areas of special interest. A 2010 paper we presented at the Geothermal Resources Council (GRC) annual meeting in Sacramento, CA highlighted the opportunities. A key objective of study done in collaboration with colleagues at SMU and West Virginia was to explore the potential for geothermal space heating and co-generation using Cornell’s Ithaca campus in upper New York State as a representative Eastern U.S. site. There were two motivating factors for this choice: Cornell’s Ithaca campus has a large heating demand given its northern latitude in upstate New York State, and Ithaca is located in a region that has higher than average geothermal heat flow and gradient.

To quantify the suitability of the Ithaca Site for a low temperature geothermal demonstration, a comprehensive evaluation of regional and local geologic and geophysical data is underway. Key elements include: 1. geology 2. the state of stress, 3. heat flow and geothermal gradients, 4. regional seismicity and seismic risk. The composition and structure of the overlying sedimentary cover above basement rock are known, as are regional stresses. In terms of the geothermal heat resource itself, our immediate focus has been to update existing legacy heat flow and gradient information with new bottomhole temperature data from recent extensive gas drilling activities. In addition, geologic information from the extensive outcrop of basement in the nearby Adirondack Mountains, and seismic reflection data from gas exploration surveys (2D and 3D) are being evaluated. New measurements of thermal properties of basement samples (e.g. from the Adirondacks) and in situ fluids (e.g. magnetotelluric) will be acquired as necessary. Background seismicity, a critical element for assessing of any future induced seismicity, will be calibrated by deployment of a dense surface seismograph.
New York State’s geothermal resource differs from that found in the western states in terms of rock types, heat flow, and resulting temperature gradients. Heat flow measurements for the Adirondack Mountains have typical values of 38 mW/m², somewhat lower than the typical heat flow values for the adjacent Canadian Shield (45 mW/m²). If the basement rocks in the Ithaca area are analogous to those exposed in the Adirondacks, they are likely to have similar heat producing capacity.

Based on earlier assessment data reported by the SMU laboratory, we expect the average geothermal gradients in the immediate Ithaca area to be considerably higher than other regions in the New York as illustrated in Figure 3. As early as 1975, this anomaly had been noted in heat flow and gradient maps of the region. A more extensive database of bottom hole temperatures has become available in the last few years from the drilling of over 1000 holes into the Marcellus and other tight gas shales in Central New York and Western Pennsylvania to depths ranging from about 1.7 to 4 km (4000 to 13,000 feet). Preliminary analyses incorporating these additional data have been performed to develop regional heat flow map and maps of temperatures at depths of 4.5 and 6.5 km. These new data confirm that the geothermal resource under Ithaca is likely to have measurably higher temperature gradients than the surrounding region.
When Andy Irwin (BS’81, MEng’82) began the undergraduate chemical engineering program at Cornell, he was planning to continue on to medical school and to become a pediatrician. Several experiences as a research assistant on the third floor of Olin Hall helped set him on an entirely different path.

He fondly recalls one such experience working under Professor Robert Finn, characterizing metabolic rates for bacteria that were able to degrade pentachlorophenol, a chemical used in treating wastewater from commercial wood processing facilities. Through this work, Irwin recognized that treatment of toxic wastes was as important and as challenging as design and optimization of the core processes of typical interest to the chemical engineer. He also became aware of the significance of the skull and crossbones on the reagent he was using in the lab, which it turned out, was a human teratogen.

Irwin’s second formative experience was working with Professor Michael Shuler on a segment of the Controlled Ecological Life Support System (CELSS) project, a multi-university research program focused on development of environmental systems for space stations. Shuler was studying the use of biological reactors for treatment of human waste, along with use of microporous membranes for separation and recovery of nutrients. As Irwin puts it, the CELSS project, which began in the 1970s, was about “sustainability” before the term was coined.

The apparent limitations of engineering technology to create a truly sustainable system had a profound impact on Irwin. He developed a passion for trying to understand ecosystems, microbiology, toxicology, risk assessment, and the legislative/regulatory framework for environmental protection, as well as engineering technology for pollution control and prevention. Irwin recalls taking the first or second iteration of the Air Pollution Control course taught by Professor Peter Harriott and he remembers exploring courses in other departments, including a course on industrial wastewater treatment taught by one of the contributing technical advisors and authors of the Clean Water Act of 1972.

For Irwin’s MEng thesis, he considered various aspects of reactor design, gas separation and purification to evaluate the feasibility of photobiological production of hydrogen using a photosynthetic purple bacterium that yields hydrogen and carbon dioxide during light-driven metabolism of simple carbohydrates.

**Putting it into Consulting Practice**

After earning his MEng and taking a cross-country bicycle trip from New York to South Dakota with his wife (BA’81), Irwin began his professional career in 1982 with the consulting firm O’Brien & Gere Engineers, Inc. He was the first chemical engineer hired in what had traditionally been a civil engineering firm. A number of other Cornell ChemEs were hired in subsequent years (Cheryll Cundall ’83 and John Rinko ’84, among others) as the consulting practice grew rapidly. He moved on to work with Stone & Webster and with several other consulting firms before starting his own firm, IRWIN Engineers, Inc., in 1996. He is currently a registered professional engineer in Conn., Mass., R.I., N.Y., N.H. and Ga. He and his wife, who is an attorney, work together and co-own the business.

IRWIN Engineers works primarily for private industry clients on source reduction, process safety, industrial hygiene, pollution prevention, pollution-control systems, permitting, environmental and safety compliance programs, multimedia compliance auditing and assessment, and

Andy Irwin lives in Wayland, Mass., and is an avid bicycle touring enthusiast, taking self-supported trips of 300 to 1,900 miles through the United States and Canada with members of his family and anyone else crazy enough to join him.
remediation of hazardous waste sites. Massachusetts has implemented a semi-privatized program that authorizes 450 Licensed Site Professionals (LSPs) from the private sector to oversee site assessment, risk characterization, and cleanup and to render a final cleanup opinion for site closure without requiring regulatory approval. As an LSP, Irwin has closed over 100 sites and in the process has developed cost-effective strategies and methods for enhanced bioremediation of chlorinated solvents, soluble heavy metals, and perchlorate. He says he thrives on the diversity of experience in environmental consulting and engineering—it is never boring, to say the least.

**Giving Back and Professional Involvement**
For the past five years, Irwin has visited campus to contribute to the Senior Design Course with Professor Al Center, giving lectures on environment, health, and safety and holding environmental-footprint review sessions with the design teams. A Fellow of the American Institute of Chemical Engineers, in 2006 he received the Gary Leach Award as a member of the Boston Local Section, which was recognized as “a true model for twenty-first century AIChE local sections.” Irwin has been a regular sponsor of the New England Regional Student Conference and a judge for student papers and the ChemE Car Competition for the past eight years. He has also served as an AIChE Ambassador to ChemE student chapters at schools around New England, giving talks on environment, health, and safety and discussing consulting as a professional career path.

Irwin has been a leader within the LSP Association, working with state regulators on policy and technical guidance, and serving as an instructor for LSP continuing-education courses addressing topics of Conceptual Site Model Development and Remediation Waste Management. He also contributes to his local community, serving for the past 15 years on the local Conservation Commission.

**Mike Weill: Managing Risk in the Oil Industry**

Mike Weill ‘80 grew up in an “Esso” home with a chemistry-major father who spent a career in the downstream (refining) end of the oil and gas industry. When he graduated from Cornell with a degree in chemical engineering and went to work for Shell in the upstream (exploration and production) sector, there were plenty of family discussions about how many “strikes” he had against him. The upstream presented a different, less conventional and unknown career path at the time.

Weill has had the opportunity to guest lecture on fossil fuels in the School’s Energy, Economics, and Engineering MEng Concentration last couple of years. On one visit, Andrew Hunter posed the question “Can you imagine what would happen if fossil fuels went away tomorrow?”

Weill thought about that for a minute. His response, “We take for granted that we can drive down to the local gas station and fill up, heat our homes with natural gas or heating oil, and when we flick the light switch, the lights come on. We love to complain about the price of gasoline, but the general public has very little understanding about where it all comes from.”

Since Weill graduated in 1980, there have been remarkable changes in the upstream industry. During his years as a student he experienced the Arab embargo of 1973 followed by the Iranian revolution in 1979. These events had a dramatic impact on oil prices and caused the first wave of alternative fuel thinking. Less known outside the industry was the impact of the mid-1970’s nationalization of private oil companies in Saudi Arabia, Iran, Iraq, and Venezuela.
The impact of these events was to cut the life blood, oil reserves, of all the major oil companies at the time. There was still plenty of oil to refine, but the source of earnings for most large oil companies had been taken away overnight.

As Weill sees it, the upstream oil and gas business is fundamentally about managing risk. Broadly, these risks are reserve, technical, and political. Reserve risk is about whether there are hydrocarbons in the ground at all and, if so, can they be extracted commercially. Technical risk is about producing those hydrocarbons and the environment in which they are produced (for instance, the deepwater or arctic environments vs. onshore). Fiscal risk can range from countries changing their tax regime to the nationalization of oil companies. According to Weill, oil companies try to avoid managing all of these risks at the same time.

Weill uses deepwater exploration, which involves the merging of ideas and technology, to illustrate what he means by managing risks. In order to find oil in the ground you need to satisfy three basic assumptions: that hydrocarbons exist in that location at all, that the geology allows a mechanism to trap the oil (otherwise it leaks to the surface), and that the hydrocarbons are trapped where they can be produced (i.e., there is porosity and/or permeability). This is an idea game, he says. A geologist will generate an idea about why there should be hydrocarbons in a given location and will test the idea by drilling a well. If they find something, they will drill everything that resembles that idea until it no longer works and then they must come up with another idea. In deepwater exploration, the drilling rig used to test this idea will cost a million dollars a day and the well will cost north of $100 million. At best, Weill says, a well has a one in three chance of finding something and at worst a one in 10 chance.

Of course, all of this exploration is supported by technology, which in this case involves seismic imaging, bouncing sound waves into the earth to determine the shape of structures miles below the earth. In 1980, the industry used 2D seismic data that could reveal only relatively shallow intervals. Today, the standard is 3D data using 500’ vessels streaming multiple 10km cables to image complex structures to 30,000 feet or more below the surface.

Once oil is discovered, it must be produced. The figure below shows how quickly the industry moved from using fixed structures in less than 1000 feet of water to drilling in 10,000 feet and producing from almost that depth. According to Weill, a “moon shot” analogy is helpful when discussing what is required to extract oil from deepwater sources. Think for a moment, he says, about a platform at

the surface that floats, must provide sufficient buoyancy to support a small refining facility, multiple wells, and oil and gas export pipelines to the sea floor more than a mile away. The pipelines must be designed to withstand external pressures of 4,000 psi and temperatures below 32 degrees in an environment that workers cannot reach. The platform also must be able to survive a 1000-year hurricane. And, Weill adds, there are inherent risks to such an operation as the whole world witnessed with the Macondo blowout.

According to Weill, offshore drilling involves reserve and technical risk. Move the facility to West Africa, he says, and suddenly political risk has been added to the equation.

The last 30 years have seen dramatic changes in the upstream sector of the industry. Fortunately, when the nationalizations of the 1970s occurred, a couple of events offset those losses, specifically the discovery of oil at Prudhoe Bay in Alaska and the discoveries in the North Sea.

The other major change was that natural gas became an economic commodity. Previously, natural gas, or “town” gas, had long been used to meet local energy requirements, but much of it was “stranded,” uneconomic to move to market. Outside the United States, says Weill, we saw the development of pipeline infrastructure to move the gas to market, and a new technology, liquified natural gas, where gas was cooled to a liquid and moved to market on a ship. These changes allowed the industry to diversify and move into different areas to survive.

In the mid-1980s Saudi Arabia, the largest (and swing) producer in OPEC, realized it was losing market share at a dramatic pace. It chose to flood the market and prices plunged precipitously. This caused a severe pull back in the industry, and many properties were sold. There were always “independent” oil companies, small producers with limited geographies, but the large wave of sales by the major oil companies caused a whole class of companies to emerge, such as Apache, Anadarko, Devon, and Chesapeake Energy. In the 1990s, the industry moved into deepwater. Basins in the Gulf of Mexico, West Africa, Brazil, and the Far East opened up. In the first decade of the new century, the onshore United States, long thought to be in decline, became the home of a new resource, unconventional gas, and then oil. With names like the Barnett, Haynesville, Eagle Ford, Marcellus, and Bakken, completely new sources of hydrocarbons have been commercialized, and the cycle begins anew. While most consumers have focused on the price of oil at the gas pump, says Weill, the industry has gone through several cycles of reinvention, always with technology at its core.
Imagine having the ability to create materials with electrical and optical properties by design. Access to nanostructured materials with precise control over size, shape, and composition has opened a fertile opportunity to do just that. How can we capitalize on this opportunity to further advance new sustainable energy technologies? This question is driving the research in Tobias Hanrath’s group, which is aimed at discovering and developing nanomaterial-enabled energy technologies. Applied to the design of next-generation solar cells, the ideal nanomaterial would efficiently convert light to electricity and could be produced using high-throughput manufacturing methods. Colloidal semiconductor nanocrystals are particularly attractive material candidates since their large absorption cross-section and tunable energy gaps enable efficient capture of solar emission in thin films, while their colloidal nature permits inexpensive solution-based processing routes.

“The much heralded potential of nanomaterials has fueled a worldwide surge of research activities,” said Hanrath, “but it’s not just a matter of plugging novel nanomaterials into a solar cells. New materials come with new challenges for which we don’t yet have answers, but we have a team of exceptional young students and scientists who have made significant strides towards transforming this potential into technological reality.”

Using a chemical engineering approach to bring the nanocrystals’ promise to technological fruition, Hanrath has organized his research efforts in three thematic areas. First, thermodynamic considerations dictate that the nanocrystals must be integrated into an energy-level landscape favorable for charge carriers to flow from the site of generation to the external contacts. Building on earlier work that revealed the basic relationship between the tunable energy levels of the nanocrystals and photovoltage in a prototype solar cell, Hanrath’s team recently reported the first solution-processed nanocrystal tandem solar cell.

“This work demonstrates how we can use low-cost solution-processing techniques to create complex device structures with size-tuned energy levels optimized for light harvesting in cascaded multilayer films,” said Hanrath. “Importantly, this technical achievement was made possible by the hard work of a team including two exceptionally talented undergraduate researchers, Rachel Hoffman ’11 and Whitney Wenger ’13, led by graduate student Joshua Choi. When we started this project, I advised them that this is a high-risk, high-reward research venture, but their systematic plan and team-based approach allowed them to successfully demonstrate a very important next step in nanocrystal solar cells.”

The second major theme focuses on the kinetic aspects of the photovoltaic process. Photogenerated electrons must be extracted from the nanocrystals to the external contacts before they become trapped or recombine with positive charges. “Since nanocrystal photovoltaics involve a number of kinetically competing processes, we need to identify the rate-limiting step to then focus our efforts on eliminating this bottleneck,” Hanrath said. In collaboration with Professor Frank Wise in Applied Physics & Engineering, Hanrath investigates fundamental relationships between the inter-particle spacing and the rate of charge separation. Insight from these basic studies not only provides valuable guidance to optimize the performance of nanocrystal solar cells, but has also allowed the team to achieve record-breaking infrared nanocrystal light-emitting diodes (LEDs). The electroluminescent powers of the best devices are comparable to those produced by commercial LEDs, and most important, the nanocrystal LEDs can be processed at much lower cost.

Figure 1. Team Tandem submitting their manuscript on solution-processed nanocrystal tandem solar cells for publication (from left): Whitney Wenger (an upcoming chemical engineering senior in Fall 2012), Rachel Hoffman ’11 (currently a graduate student at MIT), and Joshua Choi (graduate student of the Hanrath group). The schematic on the right illustrates the tandem solar cell, which efficiently captures visible and infrared light in the front and back cell, respectively.
The third thematic focus of Hanrath’s group is on creating device structures in which the nanocrystal building blocks can purposefully interact. The design of conventional solar cells is based on a planar “sandwich” junction of materials that transport positive and negative charges. Nanocrystal-based solar cells require a different design because the diffusion length of free carriers is much shorter than in conventional materials like silicon. Accordingly, structures in which light absorption and charge transport are achieved in orthogonal directions are required. “We are inspired by the ability of natural systems to self-assemble into complex functional structures,” said Hanrath. Using X-rays from Cornell’s High Energy Synchrotron Source to image the structures, Hanrath’s team recently discovered how the self-assembly of nanocrystal building blocks can be directed to achieve assemblies with predefined symmetries. “This work can be viewed as process design at the nanometer scale. Since each nanocrystal can act like a small solar cell, we try to create structures in which nanocrystals can synergistically interact, like plant cells in a leaf.”

Collectively, advances from these three areas of research set a promising stage for future discoveries and development of nanomaterial-enabled energy technologies. “It is exciting to be a part of the field during its fast-paced evolution from initial proof-of-principle test structures to solar cell technologies that are rapidly approaching commercial viability,” said Hanrath.

Paulette Clancy:
Full Circle – Energy from the Sun

In the centuries before humans walked the earth, organisms evolved the process of photosynthesis, using the sun to “power” their existence and hence all life on earth. Photosynthesis is an inefficient (<5%), but satisfactory, solution to turn sunlight into glucose using plants. Given eons of time, dead plants, trapped in the earth, were transformed into coal and oil. The rise of fossil fuel production literally fueled the world’s dramatically growing energy needs in the 20th century. These needs were intimately linked to transformations in transportation and the pressure of a rapidly growing human population. How fitting, then, that the currently accelerating global population growth in regions of the world that are dramatically increasing their energy use will ultimately be destined to return to the sun to make possible an “energy balance” of supply and demand.

While conventional oil won’t run out any time soon, there is no doubt that solar energy will eventually play a dominant role in the global energy portfolio. Solar energy efficiency is currently 10-20% and “grid parity” with current electricity costs is on the horizon in some regions. One of the most appealing aspects of solar energy is that everyone on earth has access to it. It is both satisfying and achievable to think that the developing world could be lifted out of poverty by access to low-cost solar energy. As a case in point, the United Nations is currently funding an off-grid solar energy initiative to serve 33 million people in Africa as an anti-poverty initiative.

In the past decade, my own research into semiconductor materials has moved towards trying to narrow the search for new materials for solar cells. While silicon is the dominant player in the solar cell market, the issue for this solution is largely one of cost. Silicon-based solar cells are efficient enough but too expensive. This has led university researchers to turn to ‘small molecule’ organic semiconductors that are low cost, but presently inefficient. Our part in this effort is to provide some guidance to experimentalists regarding not only the choice of molecule best suited to be effective at separating the short-lived “exciton” (electron-hole pair) produced by materials absorbing sunlight, but also the best design to maximize the surface area of the all-important interfaces where exciton splitting into free charges occurs. This type...
of system, though perhaps unconventional for chemical engineers to study, nonetheless calls upon knowledge of thermodynamics, kinetics, reactor design and separation that are the hallmarks of the chemical engineering curriculum. The scale of the system is just different- not distillation towers meters high, but interfaces nanometers wide.

So far, we have produced the first computational insight into the key variables that determine the preferred crystalline morphology of quantum dot superlattices of promising inorganic solar cell materials like PbS and PbSe (J. Comp. Chem., 2012). This is important since morphology is critical in determining the properties of the systems and its ability to conduct charge. We are currently using computational methods to virtually design the best ligand to maximize charge transport across nanocrystals. We have also identified potential problems in manufacturing all-organic prototypical solar cells made from a new class of ordered porous materials (Covalent Organic Frameworks; see picture) that conducts holes, filled with fullerenes that conduct electrons (J. Mater. Chem., 2012). We have been able to provide guidance to experimental studies regarding how to modify the insides of the pores to help fill them with fullerenes. Without effective pore filling, the system will not function effectively as a solar cell. Computational studies will prove increasingly important in materials discovery and virtual manufacturing in the years to come.

Figure 1: PhD candidate Brian Koo, organic chemistry professor William Dichtel, and chemical engineering professor Paulette Clancy will be the cover article in an upcoming volume of the Journal of Materials Chemistry. This paper provides the first classification of the stacking behavior of any sub-class of Covalent Organic Framework materials, here boronate ester-linked COFs. This classification covers a set of over 30 known and as-yet unsynthesized members of the class.
Professor Yong Joo joined Cornell University’s Chemical Engineering department in 2001. After working in the industry in Korea, Joo was drawn to the department’s history with complex fluids. He currently teaches process design and advanced math courses. He also collaborates with the Fiber Science Department.

“Cornell is a really good place to research the environment and energy,” says Joo. “There is a large consensus, shared values, and the opportunity to collaborate. It is one of the best places for engineering and environmental research. The excellent pool of students drives research!”

Outside of teaching, Joo collaborates with partners at his two startup companies involving electrospinning. Electrospinning is a commercial process that uses electrical charges to form mats of ultrafine fibers. In the past, such polymer nanofibers were created from evaporation of a solvent or polymer solutions. Joo and his colleagues have demonstrated that by using temperatures carefully, polymer nanofibers can be mass-produced from the melt, ensuring a more ecofriendly process as no solvents are involved. Based on this research, Joo and his partners cofounded two California-based companies, Axium Nanofibers in 2010 and Bilexys in 2012. Joo hopes these companies are the stepping-stones to finding real world applications that will contribute to a “greener” planet.

Joo says that although there are plenty of “green” materials, the processes used to create products are often overlooked. Axium Nanofibers and Bilexys focus not only on ecofriendly nano-materials, but on green manufacturing processes. Axium Nanofibers manufactures battery materials and membranes using nanofiber technologies. Bilexys uses technology to turn wastewater into useful chemicals, creating an environmental and economic benefit. Admittedly his startups are still relatively new, but his hopes are high that their research will lead to a greener nano-manufacturing process.
Andrew Hunter: Architect of Energy, Economics, and Engineering

By Alessandra Momo ’13

Andrew Hunter is the architect of a one-of-a-kind Masters of Engineering specialization in Energy Economics and Engineering (EEE) at Cornell. EEE specialization uses a combination of classroom and experiential (project-based) teaching devices to educate a new generation of chemical engineers prepared to analyze and grapple with complex systems, design, economics, and policy issues surrounding energy. Offered for the first time in Fall 2007 to a grand total of two students there are currently more than twenty five MEng students enrolled in the program. And, according to Director Archer, the number is expected to rise above 40 this fall when the largest cohort of chemical engineering MEng students is set to arrive on the Cornell campus. As a testament to the uniqueness of the Cornell EEE specialization, even five years after its conception a Google search using the words Energy Economics retrieves the Cornell EEE program as its highest ranked “hit”.

Andrew Hunter’s unique academic and professional background – chemical engineer; energy consultant; economist – in many ways defines the program. His amazing career in the energy sector and in academia began in high school when he landed a scholarship from Caltex Petroleum Corporation to attend Edinburgh University in Scotland. He graduated with a B.S. in chemical engineering and later with a second degree in applied mathematics. Hunter went to work at Caltex corporate headquarters in New York City, where he earned a Master’s degree in economics from the New School. He continued on to the University of Hawaii for a mini-MBA business course. Hunter’s professional career is as remarkable. He worked in the Middle East as a refinery process engineer and then as a project engineer installing refinery units. When his company relocated, Hunter chose to stay in New York and did consulting work with PIRA Energy Group. This allowed him to work directly with U.S. oil and gas businesses. Additionally, he worked with the World Bank conducting energy balances of countries in the Middle East and South America.

It is this knowledge and experience that caught the attention of Senior Lecturer Al Center; both had known each other well at Caltex. In 1999, Center invited Hunter to give a guest lecture on alternative energy. After many guest presentations, Hunter was offered a full-time teaching position in the School of Chemical and Biomolecular Engineering in the fall of 2005. When asked what first brought him to Cornell, Hunter stated that he was simply attracted by the helpfulness of the staff and the nice working atmosphere.

Since 2005, Hunter has also helped put together the weekly Energy Seminar and leads design groups in which teams of chemical engineering seniors produce capstone projects encapsulating their four years of training at Cornell. Additionally, he teaches in the school’s Unit Operations Laboratory. This year he co-authored a paper on the venting of methane during hydrofracing.

In the past six years, student interest in the EEE specialization has grown substantially. Hunter says that this growth “has been heartening to see” and further solidifies his goal of constantly expanding and maintaining interest in energy among Cornell students.

“What I found is that students come with much more information now than when they came three to four years ago. The subject of energy has mushroomed,” says Hunter. “Getting people interested in the content is different, because they already know what hydroplants, wind turbines and solar panels are. Before, no one really knew. Faculty knew, but amongst students subject matter has to change each year because the subject of energy and sustainability is changing each year. It’s a growing and adapting field.”

Hunter finds that students are interested in tackling energy problems because it generally involves system problems. Energy engineering boils down to examining systems, the organization within the systems and the economy of one system compared to another.

According to Hunter, “There is no one single solution, there are many. Therefore, as well as energy engineering you have the subject of energy economics, because economics is the study of things and people and their interaction. In this case, it is the study of energy, the people, and their interaction.”
When Al Center came to Cornell in 1999, he was asked to review the Masters of Engineering curriculum to assess its ability to prepare graduates for jobs as engineers, and ultimately managers, in a corporate environment. One observed gap was the absence of a course that helped students to understand the links between technical solutions that engineers are involved with and business requirements. Success in business can depend on many things. However, a new employee who has an understanding of the processes that go into creating and running an enterprise can have a distinct advantage. Managing New Business Development (MNBD) was created to fill this need.

Designing the MNBD course presented something of a challenge. Business development can cover a wide variety of activities, such as expanding an existing business model, entering a new marketplace, or venturing into a completely new endeavor. Given the varying scope of potential “business development” opportunities, it was necessary to design the course to focus on some of the common issues that arise in the identification, evaluation, and execution of a business venture.

One objective of MNBD is to teach students the fundamentals of financial analysis, negotiation, planning, scheduling, and project management. A second objective is to make students aware of the potential stakeholders within and outside of a company. The analytical techniques they learn are meant to help the student comprehend venture feasibility and economics, identify issues that can cause a venture to fail, and determine which of those issues they can control, such as cost-structure, and those they cannot, e.g. local politics.

An aspect of the MNBD course, which was totally Al’s creation, was to bring in outside experts to lecture on special topics. In addition, he created the concept of a “Board of Directors,” which is convened a couple of times during the course to listen to project presentations and to give students feedback on their business proposals. This unique aspect of the course gives students an opportunity to receive critiques and advice from four to six different experts in addition to their professor. It also provides them with valuable and balanced insight into the world of business and how they would fit into that world.

One measure of the credibility of the course is that recent boards have included company CEOs, senior managers, entrepreneurs, and financial managers. Their diverse backgrounds and responsibilities and their understanding of how businesses work have made it a viable concept.

Over the course of the semester, the students apply what they have learned to three case studies, two of which must be presented to the Board. The first case involves developing and implementing a resource development strategy in competition with other groups. The focus of this exercise is to understand balance sheets, cash flow, and profit and loss.

“Some time ago, after retirement, I was casting around for something to do and an e-mail from Al Center popped up. Al was looking for volunteers to sit on a “Board of Directors” as part of his business development class in the [School of Chemical and Biomolecular Engineering]. Without knowing what I was getting into, I drove up to Ithaca to participate in a review of the students’ foray into selling lipstick in some remote location. The experience was great, particularly as the students actually listened to our comments and seemed appreciative.

Over dinner and a few drinks, Al explained what Cornell was trying to do with the Industrial Practitioner program. Through a number of practical courses the goal was to help the students bridge the gap between theory and the realities of the business world. One of the important elements of this effort is the involvement of experienced alumni and others. For me, the business development course fit the bill, as my technical know-how was out of date, but I saw important opportunities to contribute with fundamental management experience.”

— Member of “the Board” Class of ’65
The second case study involves developing a plan for entering a new consumer-product market. The students develop a business model and a venture plan and present the results to the board.

For the third case study, groups must negotiate for access to a potentially valuable mixed-component feedstock that contains something that each group wants; however, each component is of value to only one of the four groups. Agreeing on a separation plan and the means of distributing the costs requires several class periods of negotiation to arrive at a memorandum of understanding, which is then presented to the board of directors.

Student feedback on Center’s MNBD course has been consistently positive. Several alumni have communicated their gratitude for its positive impact on their careers. The course has also drawn interest beyond the M. Eng. community in Chemical Engineering; enrollment typically includes several ChemE seniors and several students from outside the department. Although students have been stressed by having to give presentations to a room full of strangers, they have generally come away feeling positive about the experience. The comments below are typical of those received from student appraisals.

One of the best aspects of the board meeting was the questions that were asked by the board members. Many of these brought to light problems that we wouldn’t think of due to our lack of experience. Some of these seemed very obvious after they were asked, but mostly they added new things to think about.

Being able to present a business plan in front of a board of directors in such a serious setting was a great experience. I feel that it was conducted in a professional manner, where we were not allowed to get away with mistakes. The board required creative responses to questions that they asked. They also criticized ideas that we had not completely thought out. This is good preparation for post-graduation.

I really learned from this experience. What the board members focused most of their questions on gave me a better idea of the kind of things we needed to highlight in the presentation. I really think that giving these two presentations taught me more than most other projects I have worked on in other classes.

I especially thought that the written feedback which the board gave us was interesting and helped make clear problems that were either brought up in the meeting or issues that we were unable to touch on during the meeting. I felt that, all in all, everything went well. I liked the fact that the board members seemed to be interested in our presentation, and, hence, asked a bunch of questions. They seemed to take our proposal seriously, so it felt like the “real thing,” instead of just an assignment. I really can’t think of anything that needed improving.

The course would not be possible in its present form without the contribution of time from a number of alumni who have served as board members and as guest lecturers. Since nothing endures but change, Al has been working to introduce new instructors to take over the course as he reduces his teaching load. The course has been in transition, with two new instructors picking up the reins in the last five years. Bob Ganz (class of 1969) co-taught and then taught the course for several years. Following that, Jeff Varner started to take over the course and co-taught for the last two years. We expect that Jeff will assume the role of lead instructor for the indefinite future. Each of these recent course leaders has added new dimensions to the course and we expect Managing New Business Development to continue to be a unique and valuable component of the M. Eng. program for years to come.
Paulette Clancy, Samuel W. and Diane M. Bodman Professor of Chemical and Biomolecular Engineering, received the 2011 Mentorship Excellence Award from the American Institute of Chemical Engineers Women’s committee. Clancy was also awarded the James M. and Marsha D. McCormick Award for advising first-year engineering students.

Senior Lecturer Alfred Center (ChemE ’65 M.Eng ’66) presented the 2011 Raymond G. Thorpe Lecture in chemical engineering. In a presentation titled “Lessons Learned”, Center took students and faculty on a world-tour in search of professional lessons from a chemical engineering career that saw him take up positions of increasing responsibility in Japan, Bahrain, England, the Philippines, and the United States.

Alan Feitelberg joins the School of Chemical & Biomolecular Engineering as a Senior Lecturer. Alan is set to begin his appointment in Nov. 2012. Originally from Boston, Massachusetts, Dr. Alan S. Feitelberg received his B.S. in chemical engineering from Worcester Polytechnic Institute in 1984. After earning both his M.S. in chemical engineering practice and Ph.D. in chemical engineering from MIT, Dr. Feitelberg spent 11 years at GE’s Global Research Center in Niskayuna, New York, where his research focused on pollution reduction, pollution prevention, and improving high efficiency power generation cycles. In 2001 he joined Plug Power Inc., a startup fuel cell company, where he was responsible for developing the hydrogen generation technology needed for all of their stationary power generation products. In 2008 he joined Iogen Energy in Ottawa, Ontario, where he led the technology demonstration program for Iogen’s enzymatic process that produces ethanol from cellulosic feedstocks such as wheat straw. Dr. Feitelberg has also been a member of the adjunct faculty at Union Graduate College in Schenectady, New York, and Rensselaer Polytechnic Institute, where he developed and taught several evening courses over a ten year period. He is currently starting his own consulting business. Dr. Feitelberg is listed as an inventor on 9 US patents, has published numerous technical papers, and has chaired sessions at international conferences. He is also a member of ACS, AIChE, and Sigma Xi.

Assistant Professor Susan Daniel was awarded a National Science Foundation Faculty Early Career Award by the Biotechnology, Biochemical, and Biomass Engineering programs. Daniel’s award will support research aimed at elucidating the structure and function of cell membrane species and phases. Her ultimate goal is to determine how chemical, biological, and environmental stimuli in cell membranes influence interactions and activity of biological molecules such as protein drugs. The career award will also support Daniel’s educational efforts focused on development of coaching and other strategies for training the next generation of women graduate students and postdoctoral scientists to become leaders and educators. She most recently won the 2012 Denice Denton Emerging Leader award from the Anita Borg Institute for Women and Technology. Daniel is the first winner from a Chemical Engineering department since the award began in 2007.

Glycobia Inc., a technology start-up company founded by Associate Professor Matthew DeLisa, became the first tenants of Cornell’s McGovern Family Center for Venture Development in the Life Sciences. Glycobia aims to commercialize eukaryotic glycoprotein therapeutics produced by specially engineered E. coli cells that can produce a five-carbohydrate chain—the “core structure” of the eukaryotic carbohydrate sequence—that can be attached to several eukaryotic proteins made in the same cell.

Fernando Escobedo, Marjorie L. Hart Professor of Chemical Engineering, received the 2012 Impact Award from the Computational Molecular Science and Engineering Forum (CoMSEF) of the AICHE. The CoMSEF Impact award recognizes outstanding research contributions in the area of computational molecular science and engineering, encompassing both methods and applications.

Assistant Professor Julius B. Lucks has been named to the editorial advisory board of Synthetic Biology, a new journal published by the American Chemical Society dedicated to research in synthetic biology and systems bioscience. The journal is the first dedicated to the growing field of synthetic biology.

Jefferson Tester (ChemE ’66 MS. ’67), the David Croll Professor of Sustainable Energy Systems, received the Special Achievement Award from the Geothermal Resources Council (GRC) at its 35th Annual Meeting in San Diego. The GRC Special Achievement Award recognizes Tester’s “outstanding contributions to the development of geothermal resources,” over more than three decades. The award citation notes his pioneering work on aspects of enhanced/engineered geothermal systems, including thermal energy conversion and utilization, tracer methods for characterizing reservoir thermal hydraulic behavior, and geothermal systems analysis.

By vote of the Cornell University Board of Trustees, Jeff Varner was promoted to the rank of associate professor with indefinite tenure. Varner was also recently named a Merrill Presidential Scholar advisor in recognition of his research and career mentorship of Eva Huang (2012) who was selected as a 2012 Merrill Scholar, the highest honor Cornell bestows on a graduating senior. Since 1988, the Merrill Presidential Scholars Program has honored Cornell University’s most outstanding graduating seniors, while also recognizing the teachers who have played a significant role in ensuring their success.

Roseanna Zia was hired as an assistant professor of chemical and biomolecular engineering. Zia will begin her appointment in CBE on January 1, 2013. Her presence on the CBE faculty will add to the longstanding strength in fluid mechanics and transport phenomena. Zia received her undergraduate degree in mechanical engineering from the University of Missouri Columbia and her Ph.D. at the California Institute of Technology. Her doctoral thesis at Caltech focused on Brownian dynamics simulations of colloidal suspensions and complex fluids. She is currently pursuing postdoctoral studies at Princeton. Zia’s research interests are in the area of low-Reynolds number fluid mechanics. Her group will develop computer simulations and analytical methods to investigate the motion of active microscale particles in confined, crowded fluid systems—such as the cell interior—and in associative soft matter—such as physical gels and other complex fluids.
Peter Lantos BS ’44 MS ’45 PhD ’50 was profiled in the independent weekly newspaper Chestnut Hill Local. Lantos earned both his BS and PhD degrees in Chemical Engineering from Cornell. Now 87 and retired, Lantos served the plastics and chemicals industries from the research and design end to executive to consulting company owner for over 55 years. It is his unconventional beginning as a Jewish European and blue-collar attitude that continue to inspire. The full story can be found at www.chestnuthill.com.

Robert Langer BS ’70 the David H. Koch Institute Professor at Massachusetts Institute of Technology, has been selected to receive the 2012 Priestley Medal; the American Chemical Society’s most prestigious award. Langer’s award recognizes his sustained and impactful contributions in the areas of tissue engineering and controlled-release therapeutics.

David T. Allen BS ’79 will serve as Editor-in-Chief of The American Chemical Society’s, online journal ACS Sustainable Chemistry & Engineering in January 2013. Allen is a chemical engineering professor at the University of Texas, Austin and also serves as director of the university’s Center for Energy & Environmental Resources. Allen earned his B.S. in chemical engineering in 1979 and Ph.D. in chemical engineering from California Institute of Technology in 1983.

Harvey G. Stenger BS ’79 was named the president of Binghamton University. A native of Skaneateles, Stenger earned his bachelor’s degree in chemical engineering in 1979 and his doctorate from the Massachusetts Institute of Technology in 1983. Stenger served as interim provost and executive vice president for academic affairs at University of Buffalo, SUNY since April and was appointed in November 2011 to become the seventh president of the university.

George Georgiou MS ’83 PhD ’87 was elected to the Institute of Medicine of the National Academies. Georgiou was previously elected to the National Academy of Engineering and is an international authority on application of chemical engineering principles for discovery, development, and manufacturing of protein therapeutics. He is co-inventor of over 45 U.S. patents and patent applications that have been licensed to 16 companies in the biotechnology and pharmaceutical industries.

Karen Chastain Hughes BS ’01 was inducted into Cornell’s Athletic Hall of Fame. Chastain Hughes was a three-time Heptagonal champion in discus (1999, 2000 and 2001) and was a four-time All-East and All-Ivy honoree. As of April 2011, her placement among the top 10 Cornell records is as follows: her discus throw of 163-11 in 2000 remains the second best throw in school history. She also currently ranks fifth in the indoor shot put (46-0 in 2000) and the outdoor shot put (45-5 3/4 in 2000); and sixth all-time in the hammer throw (170-0 in 2001). In the javelin, she currently ranks eighth in the new javelin throw (120-8 in 1999) and 10th place in the pre-1999 (123-3 in 1998). Chastain Hughes was a two-time co-captain (as a junior and senior).

Emily Warren BS ’05 won a Gold Graduate Student Award at the Material Research Society Conference in San Francisco. She was chosen to win this award due to her academic achievements and materials research. Warren’s research focuses on the fabrication and characterization of Si microwires grown from the vapor-liquid-solid process.

Erica Schlesinger BS ’07 joined Genentech immediately following graduation in May 2007. She later joined the Peace Corps in 2009 and served as a high-school chemistry teacher in a remote village in Mozambique until late 2011. In September 2012, Schlesinger will join the UCSF/Berkeley joint bioengineering PhD program.

Noreen Rizvi BS ’09 won first place in the 2012 ISPE Boston Graduate Student Poster Competition. The winning poster titled “Transcriptional Regulation of Alkaloid Biosynthesis in Catharanthus roseus Cultures” awards Rizvi the opportunity to present her research at the ISPE International Poster Competition held in San Francisco, California on November 11-14, 2012.
On May 5th 2011, the Olin Hall community awoke to the sad news of the untimely passing of Brock Anthony Tuczynski ’02. In his short life, Brock embodied the spirit of generosity and commitment to excellence that have defined the School and its students. On April 27, 2012 Brock’s family (from left to right) father Buck Tuczynski, wife Julia Tuczynski, son Brock Jr., daughter Bess, and mother Kathy) joined faculty, students, alumni, and friends of the department in a ceremony celebrating Brock’s life and dedicating room 246 Olin Hall to his memory.

We are sad to note the passing of a number of alumni this past year. They live on in our memories.

In Memoriam

We are sad to note the passing of a number of alumni this past year. They live on in our memories.

On September 14, 2012 Peter Wright ’75 was recognized as a Foremost Benefactor of Cornell. The Foremost Benefactor recognition is bestowed, with the approval of the Board of Trustees, to alumni and friends of the University who follow Ezra Cornell’s example of extraordinary generosity in supporting Cornell and its programs. Peter was specifically recognized for his able leadership of and generous contributions to fund raising campaigns that established the Raymond G. Thorpe Teaching Professorship in the School of Chemical & Biomolecular Engineering and the Alumni Professorship in Asset Management at the Samuel Curtis Johnson Graduate School of Management. He has also given generously of his time and resources in supporting the Unit Operations Laboratory Modernization project underway in the School of Chemical & Biomolecular Engineering. Peter was joined by his children (from left to right) Max, Zach ’13, Jake ’16, Zara, and Rebecca in the recognition event.

Richard Hauptfleisch ’75

Richard Hauptfleisch ’75 has been a consistent, generous supporter of the Industrial Practitioner (IP) program in the School of Chemical and Biomolecular Engineering. For over two decades, the IP program has brought chemical engineers with significant experience in engineering practice to the Cornell campus to teach seniors and masters of engineering students. Richard is pictured at his Bellaire Texas home in May 2012 with Director Archer after pledging a gift that will help support the School’s plan to hire new practitioners to transition to the retirement of the School’s current duo of IPs.

In Memoriam

We are sad to note the passing of a number of alumni this past year. They live on in our memories.

John C. Tallman, BS ChemE, 1939, 8/25/2011, Wilmington, DE.
Warwick McCutcheon, B ChemE, 1940, 6/8/2012, Akron, OH.
Edward A. Wardwell, B ChemE, 1940, 5/28/2012, Queensbury, NY.
Gordon Kiddoo, B ChemE, 1942, 2/25/2012, Hilton Head Island, SC.
Frederick G. Schumacher, BS ChemE, 1942, 8/29/2011, Glen Mills, PA.
Austen W. Boyd, BS ChemE, 1943, 9/19/2011, Chatham, NJ.
William J. MacRitchie, B ChemE, 1943, 2/4/2012, Westfield, NJ.
Harold S. Wood, B ChemE, 1944, 1/7/2012, Tulsa, OK.
David R. Higin, Sr., BS ChemE, 1945, 5/25/2012, Wilmington, NC.
Frank K. Hoover, BS ChemE, 1945, 9/22/2011, Evanston, IL.
William P. Barber, B ChemE, 1949, 5/1/2012, La Cañada, CA.
Joseph W. Calby, B ChemE, 1951, 9/5/2011, Yarmouth, ME.
T. Frank Decker, B ChemE, 1951, 3/18/2012, Rydal, PA.
William J. Strack, B ChemE, 1951, 2/9/2012, Midland, MI.
William J. King, MS ChemE, 1953, 10/21/2011, Nashville, TN.
Robert W. Stevens, B ChemE, 1953, 5/14/2012, Newark, DE.
Martin H. Wohl, B ChemE, 1956, 5/8/2012, Saint Louis, MO.
Leonard A. Barnstone, PhD ChE, 1965, 11/19/2011, Morristown, NJ.
Bryan Jolley
(MEng ‘07)

Bryan Jolley used the opportunity as an undergraduate to line up his classes and co-enroll in the MEng program during his senior year. He says, “I was interested in using this opportunity to get more in depth in my studies and to make myself more marketable beyond graduation. Cornell’s convenient co-enrollment option made this feasible for me without costing me much more time or money.”

Bryan began the program intending to focus on biotechnology and drug delivery, but quickly discovered he enjoyed the problems from Energy Economics and Engineering. “I just connected more to that aspect of Chemical Engineering, and it led me to focus my final semester in that direction and led to my current job as a Senior Reservoir Engineer for Royal Dutch Shell.”

He finds his career to be rewarding and in the last 18 months he’s had the unique opportunity to lead a $60 million well from concept to production. “It was rewarding to be involved in all steps of the process, from the initial negotiations between our partner companies, to the technical review of all aspects of the plan, and to the fiscal management of the project. It reminded me of many of the lessons I learned both from my senior project and my MEng project at Cornell, and I’m sure my education there helped provide a base for just knowing how to get stakeholders involved and keep them informed throughout a major project.”

Jolley currently lives near New Orleans, Louisiana with his wife. In his free time he plays the trombone and is active in the Society of Petroleum Engineers.

Koenraad Beckers earned his BS from Katholieke Universiteit Leuven located in Belgium in 2007, and knew he wanted to continue his education. He says, “I chose Cornell because of its strong academic reputation; the unique MEng program in Energy-Economics and Engineering and the large variety of courses offered at the department and across campus.”

Koenraad Beckers (MEng ’11)

The MEng program allowed Koenraad the opportunity to perform further research and to travel. During a two-week field trip to the Southwest he says, “I went to Idaho and Nevada doing geographical research such as seismic and resistivity surveys and visiting geothermal energy-related companies. This trip was very rewarding in terms of learning beyond the classroom and exploring a part of the country I hadn’t visited before.”

Koenraad successfully completed the MEng program in 2011. The University, the department and the MEng program made such a positive impression on him that he decided to pursue his PhD at Cornell as well. He recalls, “Although my initial goal was to do a 1-year master’s degree, I arrived here and found it was so nice and I loved the campus, the faculty, and the students. At that point, I decided that maybe I should stay a couple more years and that’s how I ended up in the PhD program.”

Koenraad joined Professor Jeff Tester’s research group and currently works in Snee Hall at the Cornell Energy Institute. When he’s not working he spends his time outdoors running, hiking, or cycling. Koenraad says, “The good cycling possibilities in the scenic Finger Lakes Region also brought me to Cornell!”
MEng Alums: Exploring New and Exciting Career Paths Thanks to Energy, Economics, & Engineering

Mohsen Almajnouni (MEng ’00)

Mohsen Almajnouni was born in the Makkah province of Saudi Arabia. When one of his older brothers became a Saudi Royal Air Force pilot and another studied in France, Mohsen sought to find his own way in the world. “From high school on, I was keen to pursue my education in the U.S.,” he says.

To achieve his goals he joined Saudi Aramco in 1988, which offered a college degree program. Under Aramco’s sponsorship, Mohsen earned his BS in chemical engineering at King Fahd Univ. of Petroleum and Minerals.

In 1998, five years out of school and with a young family to support, Mohsen was accepted into the chemical engineering master’s degree program at Cornell. The experience was a personal revelation. Mohsen says, “I was competing with the cream of the crop, and that made me determined to succeed,” he says. Overcoming the educational and personal challenges of this period, he adds, gave him the confidence and know-how to be a competent international engineer.

His crowning achievement is hosting the 2011 MEPEC (Middle East Process Engineering Conference). Mohsen envisioned, “a forum where the Middle East oil and gas industries could share innovative ideas and build on them to come up with the best technical solutions and strategies in the field of process engineering.” As conference chair, he took the responsibility to succeed personally, immersing himself in supervising every detail. Mohsen views his experience organizing MEPEC as an example of how managerial skills can be gained through dedication to a cause.

Excerpted from CEP (Chemical Engineering Progress), June 2012. Copyright 2012 American Institute of Chemical Engineers (AIChE). Used with permission.

Taniya Thomas (MEng ’11)

Taniya knew from the start that she wanted to pursue a career in the energy industry. It was the certificate in Energy, Economics, and Engineering that spiked her interest and drew her to Cornell. She began her undergraduate work at Binghamton University in the chemistry department while keeping in mind that in order to break into the energy industry she needed a degree that focused on energy. To Taniya, “The MEng program was the perfect transition.”

Since completing the MEng program Taniya has joined US Polychemical Corporation as a Staff Scientist in Spring Valley, NY. Recently, she has been working as an Energy Systems Analyst for R3 Energy Management Audit & Review LLC in Tarrytown, NY. She claims, “I had a really good time in the MEng Program… It was the best choice for my future.”

In her free time she likes to hike, travel, and dabble in cooking. Although she admits the latter is a work in progress!
On August 28th, faculty, staff, and friends of the department gathered at Heights Café to celebrate the retirement of Facilities & Building Coordinator, Brian Ford. Brian has been with the department for 32 years and prior to that worked for Gulf Oil and Agway Petroleum in Ithaca, NY and for the family business, Finger Lakes Marine in Myers, NY.

Professor’s Archer, Clancy, and Anton shared fond personal and professional experiences with Brian. His knowledge of the building, and his commitment to excellence and integrity will be a great loss to the department. Brian plans to keep busy during his retirement and travel, hunt and fish, spend more time with family and his granddaughter. He also plans to volunteer for the USO and local organizations.

We wish you the best Brian and thank you for your years of service!

On October 31, 2012, Al Center, senior lecturer in the School, presented an inspiring lecture titled, “Lessons Learned.” In it he shared experiences from his career.

In addition to teaching at Cornell, Al Center (ChemE ’65 M.Eng ’66) is also an executive consultant with Pathfinder LLC, a project management consulting company. In the last few years, Center has provided consulting advice via Pathfinder to Petrobras in Brazil, Repsol in Bolivia, Lyondell and Citgo in the United States, and VALE in Canada. He has also produced expert witness reports on project execution methods for two confidential clients in the Middle East.

Center was most recently an Erskine Fellow, teaching plant design and process control, at the University of Canterbury in New Zealand.

On April 16 and 17, Jim Liao, the Ralph M. Parsons Foundation Professor of Chemical and Biomolecular Engineering at UCLA, presented lectures on “A Tale of Two Butanols: Exploring Metabolism for Fuels and Chemicals,” and “Carbon, Nitrogen, and the Sun: Exploring Biotechnology for Sustainability.”

Jim Liao received his B.S. degree from National Taiwan University and Ph.D. from the University of Wisconsin-Madison. After working as a research scientist at Eastman Kodak Company in Rochester, NY, he started his academic career at Texas A&M University in 1990 and moved to UCLA in 1997.

Elected as a fellow of the American Institute for Medical and Biological Engineering in 2002, Liao has received numerous awards, including the NSF Young Investigator Award (1992); Merck Award for Metabolic Engineering (2006); Food, Pharmaceutical, and Bioengineering Division award of American Institute of Chemical Engineers (AIChE) (2006); Charles Thom Award of the Society for Industrial Microbiology (2007); Marvin Johnson Award of American Chemical Society (2009); Alpha Chi Sigma Award of AIChE (2009); James E. Bailey Award of the Society for Biological Engineering (2009); and the Presidential Green Chemistry Challenge Award, academic category (2010).
REUNION 2012

On June 9, 2012, classes from years ending in 7 and 2 gathered on Cornell’s campus. In keeping with tradition, the School of Chemical and Biomolecular Engineering welcomed close to 100 alumni for breakfast. Ranging from 1942 to 2007, classmates shared reminiscences of beloved faculty and fun times with classmates, and learned what’s new in the School.

Lynden Archer, director of the School, welcomed the group. Other items on the agenda included a dedication of the Director’s Office by the Class of 1942 and the unveiling of the Raymond G. Thorpe Professorship Donor Plaque. Several School faculty were present to welcome our honored returnees, including Michael Duncan, Brad Anton, Paulette Clancy, and Jeff Tester.

Professor Archer, Robert Ulrich ’42 and Robert (Bob) Finn ’42

Raymond G. Thorpe plaque unveiling in the east wing of Olin Hall

2011 WILLIAM C. HOOEY OUTSTANDING STAFF AWARD

The award was established in 2011 to recognize a member of the staff, who through his or her committed service and resourcefulness enabled the School and its faculty to execute all aspects of CBE’s mission.

This year’s recipient, Breana Soule, was recognized for initiative and leadership. Soule was hired as the assistant to the director in 2010 and in the short space of one year has proven herself an invaluable member of the CBE team and an effective force in advancing the School’s programs. Her contributions to the 2011 Olin Hall News and her willingness to go well beyond the call of duty in assisting the faculty with implementation and maintenance of the School’s new website were singled out for special mention by Director Archer in presenting the award.

Breana Soule

Breana has been with the university for five years. She lives in Watkins Glen and her free time is spent with her five-year old daughter, Julian. She says, “Joining the CBE team was the best decision I’ve made in my career. The knowledge I’ve gained here has been instrumental to my success and I look forward to what the future holds.”

Senior Lecturer, Industrial Process and Product Design

The School of Chemical and Biomolecular Engineering at Cornell University seeks applications for the position of Lecturer in Industrial Process and Product Design. Requirements for the position include a B.S. in chemical engineering or the equivalent and a minimum of 5 years of industrial experience, preferably not limited solely to activities in research and development. Appointment at the level of Senior Lecturer will be considered for candidates with exceptional credentials.

A successful applicant will be expected to lead a senior level capstone course in process and product design while working with other members of the faculty and with graduate teaching assistants. Duties in this capstone course include lecturing on core course concepts, including engineering economics, developing and managing design projects, and interacting with student teams, other faculty and TAs in weekly meetings. We also encourage the successful applicant to develop elective courses, based on the applicant’s own industrial experience, for upper-level undergraduate and Master of Engineering students. The applicant should be skilled in leadership, management, and written and oral communication and should strive to have a lasting pedagogical impact on our students.

Lecturers and Senior Lecturers in the College of Engineering at Cornell University are expected to (i) excel in classroom teaching; (ii) contribute to the development of courses, both syllabi and teaching materials; and (iii) participate in advising of students as well as their academic and honorary societies. Additionally Senior Lecturers are expected to (iv) make substantial contributions to course design, syllabi, organization and lasting teaching materials; (v) provide leadership in supervising and training teaching assistants and new Lecturers; and (vi) provide educational contributions and leadership in areas of importance to the department, college and, where appropriate, to the university and nation.

Interested applicants should go to the following link to submit their curriculum vitae, and a brief cover letter outlining their interests and plans for the position: https://academicjobsonline.org/ajo/jobs/1363. This position can be filled as soon as 16 August 2012, and applications will be accepted until the position is filled. For Lecturers, appointments are for 3 years and renewable; for Senior Lecturers they are for 5 years, also renewable.

Applications should be submitted via: https://academicjobsonline.org/ajo/jobs/1363

CBE HAS A NEW ADMINISTRATIVE DIRECTOR

Heidi Hart-Gorman joined Cornell as the director of administration for Chemical and Biomolecular Engineering and Materials Science and Engineering. She comes from Harvard University’s Kennedy School of Government where she was associate director of finance and administration in the Center for Public Leadership as well as ombudsman for the school.

Her prior experience includes a position as administrative manager for the Center for Health and Policy Research at the University of Massachusetts Medical School. Hart-Gorman holds a B.A. in psychology from LeMoyne College and an MBA and a Master of Social Work from Boston College.

Heidi Hart Gorman

Cornell University is an equal opportunity, affirmative action educator and employer.
Austin O’Hooey Graduate Research Excellence Recognition Award

The Austin Hooey Graduate Research Excellence Recognition Award is the highest award given to a graduate student by the School of Chemical and Biomolecular Engineering. It recognizes outstanding contributions to scholarship and research towards a Ph.D.

The award was presented to Praveen Agarwal in the Archer Research Group and Jeremy Luterbacher in the Walker Research Group for the fall 2011 semester, and to Nathaniel (Nate) Hansen in the Joo Research Group and Ananth Kaushik in the Clancy Research Group for the spring 2012 semester. All four delivered oral presentations on their research as part of the department’s seminar series and received a monetary award and certificate.

The award, established in 2005 by Professor Lynden Archer, then director of graduate studies, honors the late Austin O. Hooey (1922–2004). Her father, William Hooey earned his degree in chemical engineering in 1912. Both father and daughter deeply valued higher education and Cornell University. To date, 24 CBE graduate students have been recognized with the award.

ChEGSA: Chemical Engineering Graduate Student Association

ChEGSA, or the Chemical Engineering Graduate Student Association, is open to all graduate students in the department and is advised by Professor Stroock. The group seeks to promote fellowship and professional development within the department, as well as serve a bridge of communication between the graduate students and faculty.

This group had a very successful year continuing activities that proved successful in the past and incorporating new ones as well. This year for the first time, the group invited a student-selected speaker, Prof. Ken Dill from Stony Brook University, to talk about his research during our regular seminar schedule.

The talk had to be moved to one of Olin’s larger lecture halls due to the great number of people attending. The group also hosted the annual Graduate Research Symposium where students presented their research via poster presentations and talks. With the presentations, a new picture competition was introduced where participants entered artistic figures or photographs acquired during their research. There were many great submissions, some of which can be found displayed in Olin Hall. In addition to these events, ChEGSA also organized a variety of mixers and weekly coffee breaks for faculty and students to interact and relax.
CBE Graduate Women’s Group

The CBE Graduate Women’s Group, consisting of female graduate students and scholars in the department and advised by Professor Susan Daniel, enjoyed another very successful year that included professional development workshops, an expanded outreach event for 10th-grade high school students and their parents, and several group fellowship opportunities.

The group is actively working on a new and exciting event scheduled for August 2012 in which four successful female Ph.D. alums, representing industry and academia will return to Olin Hall and participate in a weekend of professional development workshops for current female graduate students. The CBE Women’s Group Alumni Weekend will allow current graduate students an opportunity to network, receive career guidance and advice, and learn more about the career paths some of our recent alumnae have taken since finishing their Ph.D.

Current CBE graduate students welcomed 41 10th-grade high school students and their parents, the largest group so far, to participate in the third annual WOMEN Event at Olin Hall. This outreach program is designed to give female high school students the opportunity to experience the study of engineering first-hand and to provide parents an overview of the college application process and career opportunities for their daughters.
benjamin anapol '12: a passion for international studies

as someone with many interests—in the classroom and the outside world—benjamin anapol took it upon himself to gain as many experiences as possible as an undergraduate. passionate about travel and cross-cultural exchange, the study abroad experience was not something he was willing to miss out on. despite the many hurdles it took to get a curriculum approved by the chemical engineering department, ben became one of the first chemical engineers to go abroad in over 10 years. he studied at queen mary, university of london, completing science electives in biology and physics, and taking liberal studies electives in architecture and environmental studies.

while abroad, anapol was fortunate to travel in europe and north africa, including stops in germany, italy, switzerland, morocco, and france. his interest in food culture, and how it differs from country to country, grew throughout his travels. he says, “i was so impressed by the european travel system; with 2 hours and $50 you could be in a totally different culture, while only traveling 100 miles across a border. the low-cost and flexibility of travel in europe affords one the opportunity to broaden their social horizons and experience new cultures with ease.”

in addition to traveling abroad, anapol was able to find the time to add a minor in applied economics and management. he believes his education was enhanced by blending the technical aspects of an engineering degree with basic business skills from the business minor. “although chemical engineering has many business skills embedded into the curriculum, i felt a general business background would be essential to my future success.”

anapol was also an actively involved in many philanthropy events through his fraternity, alpha delta phi.

after graduation in may 2012, anapol began work in the management development program at brooks instrument. for his first rotation, he is working as a failure analysis engineer. “i’m excited to be working in failure analysis, as it is the perfect field to continue sharpening the critical thinking skills that i developed as an undergraduate chemical engineer at cornell.”

anapol is a huge proponent of reducing the world’s carbon footprint and, as such, is a big supporter of nuclear energy, although he feels further research into nuclear waste processing is necessary. the other key to reducing our carbon output, he believes, is to increase efficiencies, especially in fuel cells and battery storage technology.
Alyssa Kranzmann ’12:

When asked to pick her favorite aspect of her Cornell experience, recent Chemical Engineering graduate Alyssa Kranzmann can’t narrow it down to just one thing. Instead of choosing either her demanding technical curriculum, the friendships she formed in her sorority, or her involvement in one of Cornell’s a cappella groups, she describes the unique balance she found among all three. It is the combination she says that ultimately prepared her for life beyond Cornell.

Coming from a small high school in Southern California, Kranzmann knew she would need to find her niches at Cornell to make campus feel smaller and less daunting. She attended an a cappella meet-and-greet during freshmen orientation week and was most impressed by the powerful sound of Nothing But Treble (NBT), Cornell’s original all-female a cappella group. Ten days and three rounds of auditions later, she was welcomed as one of NBT’s newest members. Her experience as a pianist and member of her high school’s chorus helped her quickly become an important contributor in the group, and she was elected musical director at the end of her sophomore year. “As a leader, I learned a lot about how to accomplish things more efficiently and how to motivate people, and I think that will be really valuable to me in my career,” Alyssa says. Her proudest accomplishment with the group was raising the funds to finish recording a studio album that had been halfway complete for almost five years.

After completing her first year in Chemical Engineering, Kranzmann spent two months working at Tesoro’s Los Angeles refinery in its Project Engineering department. She helped develop energy efficiency reports for process units to identify opportunities for cost savings. The following summer, she returned to the refinery and worked in Process Controls analyzing flow-meter data to help optimize fluid flow throughout the refinery. Her time at Tesoro provided her with valuable hands-on experience and allowed her to apply fundamental technical skills.

Back at Cornell, Kranzmann began acquiring a strong interest in the business development aspects of an engineering career. She knew that the summer before her senior year would be her final opportunity to gain work experience in a different industry before graduation. She worked as an R&D intern for Unilever in Connecticut on a project to correlate the quantitative physical properties of skincare formulations with consumers’ sensory perceptions of the product. In addition, she learned a great deal about what makes a large-scale global business so successful. One important component is sustainability: Unilever recently adopted a 10-year plan to double its business while reducing its overall environmental impact. “I was impressed that even the interns were encouraged to think globally and sustainably,” she says. Kranzmann will begin full-time with Unilever at the end of July 2012.

Since being exposed to the sustainability efforts at Unilever, Kranzmann has attended a dozen energy lectures as part of a one-credit seminar, and she attributes much of her current perspective on energy to what she learned from the speakers in the class. Perhaps most important, she believes that the environmental and economic performances of a business are not mutually exclusive. “It is definitely possible for companies to work towards sustainability without compromising their financial successes,” she says. “The world’s energy issues will only be solved collaboratively, so I think it’s becoming important for large corporations, lawmakers, and individual consumers to all accept some kind of responsibility in working towards the solution.”

Chris Jakobson ’12:

Chris Jakobson grew up in Big Flats, NY, and attended Corning East High School, where his dual interests in engineering and track & field led him to Cornell University. At Cornell, he studied Chemical Engineering, competed in track and field, and worked as a teaching assistant for both Fluid Mechanics and Heat and Mass Transfer.

Following his freshman year, Jakobson began working in Professor Paul Steen’s planar flow melt-spinning lab on developing a process to repeatedly produce sheets of amorphous metal alloys. He worked for two summers in the lab, developing an algorithm to automate the analysis of the 50,000-frames-per-second video footage of the melt-spinning experiments. This experience was a primary reason he chose to pursue a graduate degree in Chemical Engineering.

In addition to his studies, Jakobson competed in the 800-meter run for Cornell’s varsity track and field team for all four years. His athletic experience was a highlight of his time at Cornell, culminating his senior year in Second Team All-Ivy honors in the 4 x 800-meter relay, an IC4A championship in the 4 x 800-meter, and the U.S. number-one time in 4 x 800-meter relay for the 2011–2012 indoor track season.

In the fall, Jakobson will attend the University of California at Berkeley to pursue a Ph.D. in Chemical Engineering. The combination of his research experience at Cornell and his internship at Genentech convinced him that there is a tremendous opportunity for traditional chemical engineering skills to be applied to novel biological problems, specifically in energy and medicine.

“It is becoming evident that no single alternative energy source will replace fossil fuels by itself,” says Jakobson. “So, the chemical engineer’s integrated knowledge of biology, materials science, and chemistry will be central to the solution of the oncoming energy crisis. An intelligent combination of solar, geothermal, wind, and other renewable energy sources will be required, and chemical engineers are uniquely equipped to design integrated implementations of these novel technologies.”
Seventy two Bachelor of Science degrees in chemical engineering were awarded this year. In early May seventeen were seeking employment. Forty nine percent of the Class of 2012 accepted employment among 27 companies. The largest employers were Schlumberger, ExxonMobil, Honeywell, Irwin Engineers Inc., and Shell. The median starting salary was $67,000. These recent graduates are employed largely in the areas of petroleum products and consulting.

The class has twenty continuing their studies in graduate school: 6 began chemical engineering Ph.D. programs, one is pursuing a graduate degree in bioengineering, one has started medical school, another is entering law school, 3 have entered an M.S. program; one in chemical engineering and materials, another in chemical engineering practice and the other in management science and engineering, 9 will enter Cornell’s M.Eng. program; one in engineering management, one in biomedical engineering, and seven in chemical engineering.

Congratulations to our recent graduates!
Alumni-Sponsored Graduate Fellowships

Thanks to the generous support of alumni, the following graduate students were supported last year. Additional graduate student fellowships are needed and strongly encouraged.

Henry L. Mattin Scholarship:
Joseph Carlin

Outstanding TA of the Year Award
Linxiao Chen

Peter Harriott Master of Engineering Fellowship
Jaime Martinez

HN Scholarship Fund
Kaifu Bian

Fred H. Rhodes Scholarship
Lina Aboulmouna
Nathanial Hansen
Kerville Hendrickson
Chih-Yun Hsia
Brian Williams
Wenyu Zhang
Kyle Watters

George Scheele Outstanding Jr Award
Jay Park

McMullen Fellowship
Jiun-Riley Chen
James Stevenson
Mingwei Tian
Kyle Watters

Clyde Mason Award
Joseph Carlin

Robert York Memorial
Not Awarded

Winding Scholarship
Rachel Kenion
Kristina Lenn

Kniskern Fellowship
Kristina Lenn
Rachel Kenion

Edna and William C. Hooey Fellowship
Joshua Choi

Eva Huang (’12) has been selected as a Merrill Scholar, arguably the highest honor Cornell bestows on a graduating senior.

Since 1988, the Merrill Presidential Scholars Program has honored Cornell University’s most outstanding graduating seniors, while also recognizing the teachers who have played a significant role in ensuring their success. This unique program was created by the late Philip Merrill ’55 and is made possible through annual support from the Merrill Family Foundation.

CBE Professor Jeffrey Varner crafted her nomination.
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