A dedication ceremony for Preston M. Green Hall, a new engineering building on the Danforth Campus of Washington University in St. Louis (WUSTL), was held Sept. 23. The keynote speaker at the dedication was Charles M. Vest, PhD, president of the National Academy of Engineering and president emeritus of the Massachusetts Institute of Technology.

Green Hall, the third building in a new engineering complex at WUSTL, provides additional research lab space for the Department of Energy, Environmental & Chemical Engineering; serves as headquarters to the International Center for Advanced Renewable Energy & Sustainability (I-CARES); and is home to the Preston M. Green Department of Electrical & Systems Engineering.
Green Hall LEED Gold rating features

- The building is adjacent to four bus lines and the St. Louis MetroLink station at Skinker Blvd., in addition to bike paths and storage.
- One hundred percent of irrigation is provided by captured rainwater stored in a turn-of-the-century brick sewer converted to a cistern.
- High-efficiency plumbing fixtures reduce overall water use by more than 50 percent.
- High-efficiency systems increase overall energy cost savings at more than 25 percent. Building energy use is regularly measured and verified to maintain peak performance.
- The building incorporates high percentages of recycled content and locally sourced materials.
- More than 50 percent of the building’s wood products came from sustainably managed forests.
- Over 90 percent of the construction waste was diverted from landfill.
- Low-VOC construction components and finishes were used throughout to promote good indoor air quality. HVAC components were protected during construction to safeguard good indoor air quality.
- Lighting and thermal comfort controls are available for building occupant use.

LEED: The Leadership in Energy and Environmental Design Green Building Rating System™ is a third-party certification program and the nationally accepted benchmark for the design, construction, and operation of high-performance green buildings.

www.usgbc.org/LEED

Washington University hosted a symposium entitled “Opportunities & Challenges in Engineering Education & Research,” which was held in conjunction with the dedication of Preston M. Green Hall. The symposium featured the National Science Foundation Director Subra Suresh, DSc (left), Dennis Muilenburg, president and chief executive officer of Boeing Defense, Space & Security (center) and a member of WUSTL’s Board of Trustees; and P.R. Kumar, DSc, professor and College of Engineering chair in computer engineering at Texas A&M University and a WUSTL alumnus (right).

The speakers’ remarks and the questions and answers that followed can be viewed online:

youtube.com/WUSTLEngineering

Greetings from St. Louis! This fall, we welcomed the most diverse and most academically talented student body we have ever seen, with nearly 50 new undergraduate students, 18 new master’s students, and 20 new PhD students.

Earlier this year, we celebrated as Assistant Professor Young-Shin Jun received the prestigious National Science Foundation CAREER award; announced a new joint Master of Engineering/Master of Business Administration program; and launched a new student chapter of the National Organization for the Professional Advancement of Black Chemists and Black Engineers (NOBCChE).

Over the past year, we spent more than $4 million making innovative research discoveries — some of which you can read about in this newsletter — in the areas of energy, advanced materials, and sustainable technologies for environmental health and international development. Our expanding research programs helped us to receive a top ten recognition earlier this year from the National Research Council’s ranking for graduate programs in Environmental Engineering Science.

The School of Engineering & Applied Science is in the midst of revising its strategic plan, and our department is positioned to be a leader in almost every major research area and initiative. A key component of the plan is to expand the size of our faculty from the current 16 tenured and tenure-track members to approximately 20 to 25 in the next five to 10 years. Also as part of the strategic planning effort, we will consider launching a new undergraduate major in environmental engineering.

Next summer, some of our students will travel to Brazil to learn about the success of biofuels in that country, and others will have the opportunity to participate in the University’s summer program in Washington, DC. We are also preparing for the fourth MAGEEP Symposium, December 9-12, 2012, in Mumbai, India.

Of course none of this would be possible without the generous and loyal support of time and money from our more than 2,500 alumni and friends. I am grateful for all that you do to help our Department of Energy, Environmental & Chemical Engineering, and as always, I welcome your feedback and advice. Please write me at pbiswas@wustl.edu and visit our website at eece.wustl.edu for the latest news and events.

Best regards,

Pratim Biswas, PhD
Lucy & Stanley Lopata Professor and Chair, Department of Energy, Environmental & Chemical Engineering

Lucy & Stanley Lopata Professor and Chair
Pratim Biswas, PhD

Message from the Chair

Washington University in St. Louis invites applications for tenure-track faculty positions at the assistant professor level in the areas of metabolic engineering, systems biology and environmental biotechnology for the fall 2012 academic year.

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GSFA co-investigators on the project. Ray Ehrhard and John Murphy are Water Reuse. “Advanced Water Treatment Commission for research titled from the California Energy two-year, $206,433 subaward technologies water treatment fund advanced California Energy

California Energy Commission to fund advanced water treatment technologies research Pratim Biswas, PhD, received a two-year, $206,433 subaward from the California Energy Commission for research titled “Advanced Water Treatment Technologies for Onsite Water Reuse.” Ray Ehrhard and John Murphy are co-investigators on the project. ece.wustl.edu/faculty/biswas

New professorship announcements Pratim Biswas, PhD, is the new Lucy and Stanley Lopata Professor. Chancellor Mark S. Wrighton installed him in a ceremony on Oct. 10. Biswas, chair of the Department of Energy, Environmental & Chemical Engineering (EECE), is one of the world’s leading experts in aerosol science. “Pratim is one of my great friends and colleagues,” Wrighton says, “and we’re thrilled with the leadership he is bringing to our Department of Energy, Environmental & Chemical Engineering.” Richard Axelbaum, PhD, was installed as the new Stifel & Quinette Jens Professor of Environmental Engineering Science on Oct. 31. Axelbaum is currently the Director of the Consortium for Clean Coal Utilization. His present research efforts in synthesis are directed toward producing next-generation battery materials. He also performs research on hydrogen fire safety and combustion in microgravity, and is principal investigator of a combustion experiment that is being prepared for the International Space Station. ece.wustl.edu/faculty/fortner ece.wustl.edu/faculty/williams

Green Labs Initiative kicks off in Brauer Hall A new Danforth Campus Green Labs Initiative kicked off Friday, Sept. 16, in Brauer Hall. The program, which the Office of Sustainability hopes to spread across campus in the near future, was initiated at the School of Medicine in 2009 and reduced energy consumption by an estimated 25 percent. Some of the most common energy offenders were empty freezers (which must be left at minus-40 degrees Celsius) and centrifuges that left chilling samples long after spinning was complete. sustain.wustl.edu

I-CARES career development awards go to Fortner, Williams When Washington University in St. Louis created the International Center for Advanced Renewable Energy and Sustainability (I-CARES) in 2007, it set aside $12.5 million for the endowment and start-up costs of five new professorships in the fields of energy, environment and sustainability. Two engineering faculty have been chosen for career development awards: John Fortner, PhD (left), and Brent Williams, PhD (right), both assistant professors in the Department of Energy, Environmental & Chemical Engineering. ece.wustl.edu/faculty/fortner ece.wustl.edu/faculty/williams

Assistant Professor Yinjie Tang’s research funded by Bill & Melinda Gates Foundation Washington University in St. Louis will receive funding through Grand Challenges Explorations, an initiative created by the Bill & Melinda Gates Foundation that enables researchers worldwide to test unorthodox ideas that address persistent health and development challenges. Assistant Professor Yinjie Tang will pursue an innovative global health research project, titled “Using Fecal Sludge for Butanol Fermentation.” ece.wustl.edu/faculty/tang

Collaborative Initiatives cccu.wustl.edu mageep.wustl.edu parc.wustl.edu

The Nano Research Facility (NRF) at Washington University in St. Louis is one of 14 nationwide sites to cultivate an open and shared research and education environment that brings researchers across disciplines together, particularly in the emerging area of nanomaterials with applications in the energy, environment and biomedical fields. NRF includes a micro- and nano-fabrication lab (clean room), surface characterization lab, particle technology lab and bio-imaging lab. As a member of the National Nanotechnology Infrastructure Network (NNIN), supported by the National Science Foundation, NRF is available to both academic and industrial users nationwide. nano.wustl.edu
International Experience

HONG KONG, CHINA, 2011
The Department’s 2011 international experience concentrated on alternative energy sources and technology, especially solar sources. Twenty-four students and three faculty members studied at the Shenzhen Institute of Advanced Technology and toured DuPont Apollo (Shenzhen), China Light and Power, and Daya Bay Nuclear Power Plant.

Engineers Without Borders travel to Ethiopia
Members of the WUSTL chapter of Engineers Without Borders traveled to the community of Kebelle 05, a small town about 2,000 kilometers north of Addis Ababa, in Ethiopia’s northern region of Tigray. This town is home to the Mekelle Blind School, an institution that houses 96 boys and girls ages 5–16.

The ten-day trip in May served as the initial assessment trip aimed at establishing relations at the school as well as determining the most pressing needs of the area. The interdisciplinary team was led by Robin Shepard and technical advisor John Murphy, both of the Department of Energy, Environmental & Chemical Engineering. Four students took part in the trip: Jennifer Head, Morgan Carlile, Todd Coady and Cory Flanigan. The trip was funded in part by a donation from the Department of Energy, Environmental & Chemical Engineering.

Water Treatment Plant Tour
Associate Professor Dan Gianni’s Physico’

& Chemical Processes for Water Treatment Class visited a St. Louis wastewater treatment plant in October 2011. Curtis Skouby, St. Louis City Director of Public Utilities and Water Commissioner, led the tour.

2011 Student Awards
The St. Louis Section American Institute of Chemical Engineers Award for Academic Excellence
Kai Lee Cassidy
The SS & IMF Marsden Prize
Si Ji Dai
The Procter & Gamble Senior Scholar Award
Nathan Fine
The Klemm Outstanding Junior Award
Francis Doherty IV, Aaron Huang, Phyllis Wang
The American Institute of Chemical Engineers’ Donald F. Othmer Sophomore Academic Excellence Award
Kerry Aldrich, Matthew Ashner, John Beach, Jennifer Head, Katherine Peter, American Association for Aerosol Research Student Poster Award
Tandeep S. Chadha

Department Graduate Awards
Teaching Assistant Awards
Bert Beria, Yandi Hu, Jessica Ray, Ziming Wang
Research Awards
Xueyang Feng, Luis Modesto Lopez, Venkat Ramadesigan, Yanjiao Xie

2011 Student Chapters Executive Committees
AAAR & AWMA
Coordinator: Raul Martinez Advisor: Brent Williams
AICHE
Chapter President: Ben Fu Conference President: Kathleen Hogan Advisor: Cynthia La
WEF
Advisor: Dan Gianni

Scholarship Recipients
Cherryl Walzel-Frick & Alan Frick Scholarship
Tandeep Chadha
August & Ruth Homeyer Scholarship
Stephen Feinberg
James M. Kelcey Scholarship
Lian He
Charles & Marlene Buescher Scholarship
Vrajesh Mehta
ENVIRSAN Scholarship
He Jing
James & Gara Swift Miller Scholarship
Yaping Zhang
Cecl & Bertha Lue-Hing Scholarship
Craig Jacobson
Forrest & Patricia McGrath Scholarship
Peter Mellett
Henry G. Schwartz Jr. Scholarship
Chelsea Neil
Otis Sproul Family Scholarship
Yujian Sun
Jack Stein Scholarship
Jessica Ray
Sverdrup Scholarship
Lin Wang
Charles & Marlene Buescher Scholarship Honoring D.W. Ryckman
Jiewei Wu
Dr. Li Li Abnon Scholarship
Le You
Cecl & Bertha Lue-Hing Scholarship
Qiaoling Liu

Doctoral student earns $10,000 stipend award
The Transportation Research Board selected Neil Feinberg as the recipient of a $10,000 research stipend.

2011 Doctoral Graduates (to date)

2010 Doctoral Graduates
Zeljko Kuzeljevic
Lin Li
Luis Modesto Lopez
Abbas Singh
Yanjiao Xie
Ahmed Yousef

Water Purification project earns WUSTL Social Change Grant
Michael “Mac” Chamberlin, a student majoring in Chemical Engineering was recently awarded one of WUSTL’s Stern Social Change Grants and will receive $6,000 to implement his project. The project, “Water Purification,” took place in Namayumba, Uganda, during summer 2011. Chamberlin was selected as one of six grant recipients out of a large and competitive pool of applicants, following a rigorous proposal process.

2011 Department Award Recipients (Left to right): Jennifer Head, AiChE Local Representative; Phyllis Wang; Matthew Ashner, Katherine Peter, Ziming Wang; Kerry Aldrich, Francis Doherty IV, Kaylee Cassidy, Nathan Fine, Si Ji Dai, Venkat Ramadesigan. Jessica Ray, Xuyang Feng

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In the Aquatic Chemistry Laboratory we are investigating the potential environmental impacts associated with metals in fly ash produced from coal combustion. The project goals are to develop the scientific basis for understanding the fate of metals at different stages of coal utilization and to identify means of mitigating metal releases to the environment (Figure 1). The research is done in collaboration with Professor Jeff Catalano in the Department of Earth and Planetary Science (EPSc) and Professor Ani Dokholyan at the Indian Institute of Technology Bombay (IITB). Lokeshappa B., an IITB Ph.D. student Raul Martinez also made important contributions to this project in 2010. Our research is part of a larger project done in collaboration with Pratim Biswas and colleagues at Tsinghua University that also examines metal capture and gas-particle partitioning during coal combustion and gasification. This project is supported by the Consortium for Clean Coal Utilization.

Fly ash materials were acquired from full-scale and laboratory-scale facilities. Fly ash from five U.S. and three Indian power plants has been investigated, and ashes have also been provided by Professors Richard Axelbaum Professor Biswas for both air-fired and oxy- coal combustion conditions. Ashes were subjected to a sequential extraction procedure that quantifies the fraction of metals in the fly ash that can be mobilized in a series of increasingly aggressive aqueous solutions. All ashes showed considerable mobilization of chromium in the water extraction step, and large proportions of arsenic and selenium were mobilized in the high ionic strength solution. The corresponding step removed a large fraction of the cationic metals such as Zn, Cu, and Mn.

Direct characterization of metal binding mechanisms by X-ray absorption spectroscopy (XAFS) complemented laboratory-based sequential extractions to link solid-phase speciation with potential metal mobilization. XAFS requires the use of focused high energy X-ray sources, and we secured beamtime at the Advanced Photon Source at Argonne National Laboratory to perform our measurements. X-ray absorption near edge structure (XANES) provides information on the oxidation state of the absorbing atom. It is useful because some elements display oxidation state-dependent mobility and toxicity. Selenium is predominately Se(IV) except for some Se(0) in one of the ashes. Extended X-ray absorption fine structure spectroscopy (EXAFS) provided quantitative information about the local structure of As and Zn in the ashes.

A set of long-term aging experiments were initiated with continuously mixed suspensions of a Class I fly ash in synthetic rainwater and with a laboratory-scale ash pond. The synthetic rainwater pH increased from 5.5 to 8.5 in the first 15 minutes of contact with the ash due to the dissolution of the basic components of CaO and a glassy Al2O3 phase. After three weeks the pH slowly decreased due to the uptake of atmospheric carbon dioxide. Analysis of the solid phases indicated an almost immediate dissolution of anhydrite (CaSO4) and a gradual formation of calcite in response to the CO2 uptake. Although most toxic trace elements had minimal (<1% of total amounts) release during aging, appreciable amounts of the total chromium and selenium in the ash were released. Consistent with the continuously mixed aging experiments, the pH of the water in the ash ponds increased in the first weeks of contact and chromium and selenium were among the most readily mobilized elements. Cores of the ash layer were periodically collected and analyzed for metal concentrations during the aging, and newly formed iron oxide nanoparticles were observed within several hours of reaction time. This study provides important fundamental information for designing a more accurate reactive transport model as well as understanding pore clogging in geomaterial systems. Arsenic(As(V)) in all ash samples. Selenium is predominately Se(VI) except for some Se(0) in one of the ashes. Extended X-ray absorption fine structure spectroscopy (EXAFS) provided quantitative information about the local structure of As and Zn in the ashes.

In this report, we would like to introduce our recent findings on the geologic CO2 sequestration project. Understanding the shape, size, location, and phase of secondary minerals during the early time period of CO2 injection in geologic CO2 sequestration (GCS) is crucial, because they could change the permeability and wettability of rocks. In this project, we investigated the mechanisms and kinetics of reactions at supercritical CO2–water/brine–feldspar mineral interfaces at multi-scale. Phlogopite and Biotite served as models for clay minerals [Mg and Fe-containing mica] and Ca-rich feldspar served as a model feldspar. We monitored in situ and ex situ nanoscale morphological evolutions resulting from dissolution of pre-existing clay minerals and precipitation of new mineral phases. The formation of nanoscale amorphous silica precipitation at phlogopite surfaces was observed after short reaction times (as short as 5 h), together with the relocation of these particles, which suggests that the permeability of the reaction rock can be changed by phlogopite dissolution. Secondary mineral formation. Environ. Sci. Technol. 2011, doi: 10.1021/es102695f.

This project is supported by the Consortium for Clean Coal Utilization, DOE Energy Frontier Research Center (EFRC), and U.S. EPA.

By Assistant Professor Young-Shin Jun

The Environmental Nanotechnology Laboratory (ENCL, PI: Young-Shin Jun) research goals are (1) providing a more comprehensive investigation of CO2 sequestration strategies intended to mitigate climate changes; (2) elucidating physico-chemical reaction mechanisms during aquifer storage, treatment, and recovery using water re-use to secure underground sources for drinking water (USDW); and (3) understanding the environmental impacts of human activity through improved understanding of the fate and transport of contaminants and nanoparticles from the nano-scale to macroscale. We have been investigating multiple dimensions to address the above concerns. All the projects have been conducted by researchers of multiple levels, including high school, undergraduate, graduate, and postdoctoral students and they all collaborate with each other. Our group members are Hongbo Shao, Yandi Hu, Jessica Ray, Yi Yang, Daniel Garcia, Chelsea Neil, Anca Timofte, Christian Ronzo, Alejandro Fernandez-Martinez, and Eric Hsu, and the funding sources are the International Center for Advanced Renewable Energy & Sustainability (I-CARES), Consortium of Clean Coal Utilization, DOE Energy Frontier Research Center (EFRC), and U.S. EPA.

By Assistant Professor Daniel Gimmer

Fate of Metals in Coal Combustion Fly Ash: Metal Speciation, Leachability, and Transformations during Ash Reuse and Storage

by Assistant Professor Young-Shin Jun

little attention. This study will provide new information for scientists and engineers concerned with GCS operations for more sustainable GCS.

Relevant References:

Solar power is a renewable and sustainable energy source that has the potential to satisfy global energy needs while mitigating global climate change and minimizing harm to the environment when compared to traditional fossil-based sources of energy. Despite this potential, solar energy has been relatively untapped, making up only 0.066% of the United States’ energy portfolio. Thus, there is a pressing need to efficiently and inexpensively capture, convert, and store solar energy for use in electricity, chemicals, and fuels.

Photosynthesis is nature’s method for converting solar energy to usable fuels; for example, plants convert carbon dioxide and water into sugars using the energy gathered from visible light. It stands to reason that artificial solar cells based on the principles of photosynthesis are a promising approach for utilizing the Earth’s abundant and renewable solar energy resources to produce energy-rich chemicals and fuels. To fulfill this promise, solar cells must not only absorb strongly across the full visible spectrum, but also be robust and inexpensive.

The process of photosynthesis is initiated by peripheral antennas, which contain a large number of pigments relative to a single membrane-bound reaction center, and hence, increase the light harvesting capacity of the photosynthetic complex. These pigments absorb light and funnel the resulting excitation energy by a very efficient cascading mechanism to the reaction center, where charge separation and electron transfer occur to produce fuels.

We are also performing time-dependent density functional theory calculations on the pigments to obtain absorption spectra and energies of the occupied (i.e., ground state) and unoccupied (i.e., excited state) molecular orbitals, in order to calculate rates of excitation energy transfer. We are hopeful that our quantum chemical approach will provide a precise description of energy transfer from the peridinin-chlorophyll-protein antenna complex to the membrane-bound reaction center.

Ultimately, we hope to integrate these photosynthetic antennas with inorganic materials to design solid-state devices capable of robust, low-cost, and efficient solar energy harvesting and conversion. Based on the absorption properties of these pigments, green sulfur bacteria may eventually be used in infrared sensing or night vision devices, while dinoflagellates may eventually be used in photovoltaics that utilize the entire visible spectrum. Many technological challenges must be overcome before these bio-hybrid devices become a reality. Our work is supported by the Photosynthetic Antenna Research Center, an Energy Frontier Research Center funded by the U.S. Department of Energy, Office of Science, and Office of Basic Energy Sciences.

We developed a technique for delivering genes to microorganisms via electrospray of gold nanoparticles. During the electrospray process, charged monodisperse nano-droplets (a mixture of polyethyleneglycol-plasmid and nano-sized gold particles) were accelerated and deposited on a thin layer of non-competent Escherichia coli cells. Via antibiotic selection, transformed cells containing green fluorescent protein appeared on the agar plates after electrospraying with gold NPs. This gene delivery method has the potential to work for many other microorganisms.

This collaborative project was performed in Daren Chen Lab & Yinjie Tang Lab, Washington University in St. Louis. Students involved in the projects were Yishuan Lee and Bing Wu. Currently, Anil Varman and Yi Xiao are improving this technology and applied it for “difficult-transform-bacteria”.


Bio-hybrid solar cells: Tuning biomolecular structure for efficient solar energy conversion

By Sándor Kavács, William Bricker, Kelly Leung, Assistant Professor Cynthia Lo

Solar power is a renewable and sustainable energy source that has the potential to satisfy global energy needs while mitigating global climate change and minimizing harm to the environment when compared to traditional fossil-based sources of energy. Despite this potential, solar energy has been relatively untapped, making up only 0.066% of the United States’ energy portfolio. Thus, there is a pressing need to efficiently and inexpensively capture, convert, and store solar energy for use in electricity, chemicals, and fuels.

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Nanoparticles Facilitate Gene Delivery to Microorganisms

By Assistant Professor Yinjie Tang

We developed a technique for delivering genes to microorganisms via electrospray of gold nanoparticles. During the electrospray process, charged monodisperse nano-droplets (a mixture of polyethyleneglycol-plasmid and nano-sized gold particles) were accelerated and deposited on a thin layer of non-competent Escherichia coli cells. Via antibiotic selection, transformed cells containing green fluorescent protein appeared on the agar plates after electrospraying with gold NPs. This gene delivery method has the potential to work for many other microorganisms.

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Atmospheric Chemistry and Technology (ACT) Lab

By Assistant Professor Brent Williams

The Atmospheric Chemistry and Technology (ACT) Lab is currently under construction in brand new Brauer Hall, where you can still catch a faint hint of that new building smell. We may be able to tell you exactly what chemicals make up that “new building smell” once we complete the construction of our thermal desorption aerosol gas chromatograph (TAG) systems, fully automated in-situ instruments which provide hourly time resolution of the molecular composition of atmospheric semi-volatile and nonvolatile organic material (Williams et al., 2006, 2007, 2010a,b).

These TAG instruments, along with our Aerosol Mass Spectrometer (AMS) which is capable of high time resolution measurements of total organic, sulfate, nitrate, and ammonium aerosol mass concentrations and elemental analysis of O/C, H/C, and N/C ratios (DeCarlo et al., 2006), will be used for a wide range of studies including outdoor air quality and particle source apportionment, indoor air quality and particle source apportionment, and laboratory based studies of direct emissions and photooxidized emissions from various sources such as food cooking, biomass burning, tobacco smoke, fossil fuel combustion, biogenic plant emissions, and coal combustion to name a few.

Current students in the ACT lab include Raul Martinez, a full time second-year graduate student, along with this year’s graduate rotation students: Yaping Zhang, Stephen (Neil) Feinberg, Peter Mallott, and Craig Jacobsen. Mr. Martinez is designing and constructing a new analytical tool that combines the chemical separation strengths of the TAG system with the quantification ability of the AMS system into a single instrument.

Continued on page 13


**Faculty**

**Pratim Biswas**  
Lucy & Stanley Lopata Professor and Chair  
PhD, California Institute of Technology  
Aerosol Science & Engineering, Air Quality & Pollution Control, Energy & Environmental Nanotechnology

**Daniel Giammar**  
Harold O. Kelley Career Development Associate Professor  
PhD, California Institute of Technology  
Aquatic Chemistry, Water Treatment, Environmental Biogeochemistry, Environmental Nanotechnology

**Himadri Paksari**  
Professor of Energy  
The George William & Irene Kewsby Feinberg Professor of Biology  
PhD, University of Missouri-Columbia  
Systemic Biology, Photosynthesis, Metal Homeostasis

**Richard Axelbaum**  
Stifel & Quinette Jens Professor of Environmental Engineering  
Science  
PhD, University of California-Davis  
Combustion, Nanotechnology, Aerosol Science & Engineering, Clean Coal Technologies, Microgravity Combustion

**John Gleaves**  
Associate Professor  
PhD, University of Minnesota  
Heterogeneous Catalysis, Surface Science, Microstructured Materials

**Palghat Ramachandran**  
Professor  
PhD, University of Bombay  
Chemical Reaction Engineering, Applied Mathematics, Process Modeling

**Venkat Subramanian**  
Associate Professor  
PhD, University of South Carolina  
Multiscale Simulation and Design of Energetic Materials

**Daren Chen**  
Professor & Director of Graduate Studies  
PhD, University of Minnesota  
Aerosol Science and Technology, Filtration, Aerosol Instrumentation

**Rudolf Usar**  
Professor  
PhD, University of Minnesota  
Environmental Informatics, Aerosol Science and Engineering

**Young-Shin Jun**  
Assistant Professor  
PhD, Harvard University  
Aqueous Processes, Molecular Issues in Chemical Kinetics

**Yinjie Tang**  
Francis Atkinson Career Development Assistant Professor of Environmental Engineering  
PhD, University of Washington  
Metabolomics, Systems Biology

**John Fortner**  
I-CARES Career Development Assistant Professor  
PhD, Rice University  
Environmental Chemistry of Nanomaterials

**Cynthia Lo**  
Welton E. Browne Career Development Assistant Professor of Environmental Engineering  
PhD, Massachusetts Institute of Technology  
Biocatalysis, Structure and Reactivity at Environmental Interfaces

**Jay Turner**  
Assistant Professor & Director of Undergraduate Programs  
PhD, Washington University in St. Louis  
Air Quality Technology and Policy, Aerosol Science and Engineering, Environmental Reactions Engineering

**Brent Williams**  
Raymond W. Tuttle Distinguished CARES Career Development Assistant Professor  
PhD, University of California-Berkeley  
Composition, Chemistry and Physical Properties of Earth’s Atmosphere

**Ruth Chen**  
Professor of the Practice  
PhD, University of Michigan  
Environmental Engineering

**Bill Darby**  
Professor  
PhD, Carnegie Mellon University  
Environmental Engineering

**Nathan Ravi**  
Associate Professor  
MD, University of Miami  
PhD, Virginia Tech  
Environmental Engineering

**Laboratory Highlight:**  
**Jens Nano & Molecular Scale Laboratory**

Established in 2001, the Jens Environmental Molecular and Nanoscale Analysis Laboratory is located in Brauer Hall. The laboratory is a shared instrumentation facility supported by the core faculty in the Department of Energy, Environmental & Chemical Engineering. The instruments in the laboratory are also made available to all university researchers and the scientific community for performing analysis at the molecular and nanometer scales. Some of the instrumentation include: ICP-MS for elemental analysis at the ppb/ppt levels; a BET Surface Area Analyzer; a TGA system integrated with the FTR, a TDC Analyzer; Mercury Analyzers, AFM and SEM systems. Additionally, a state-of-the-art Time of Flight Mass Spectrometer is used by the Aerosol Research Group for real-time analysis of the composition of nanoparticles.

**EnerCenter**

**Endowed Professorships**
- Francis C. Atkinson Professorship in Chemical Engineering
- Walter E. Browne Professorship in Environmental Engineering
- Laura & William Jens Professorship in Environmental Engineering
- Stifel & Quinette Jens Professorship in Environmental Engineering Science
- Harold D. Jolley Career Development Professorship
- Lucy & Stanley Lopata Professorship
- Elena & William Stokkenberg Professorship in Technology and Human Affairs
- Raymond R. Tucker Distinguished I-CARES Career Development Professorship
- I-CARES Professorships

**Endowed Scholarship Donors**
- Charles & Marlene Buescher Scholarship
- Honoring Dr. D.W. Ryckman
- Charles & Marlene Buescher Scholarship
- Dr. & Mrs. Myron Dmytryszyn Scholarship
- Frank E. Dukowski Memorial Scholarship
- Robert Dobson
- Gaston F. Dubuis Scholarship
- L. Frederick Dubuis
- ENVGAN Friends of the Environmental Engineering Program
- Gloria & Robin Feldman Family Scholarships
- Robin Feldman & Harrison Ehrlich Memorial Scholarship
- Gloria G. Feldman
- Bernard & Ruth Fischlowitz Memorial Scholarship
- Susan Fischlowitz

**Raymond R. Tucker Distinguished I-CARES**
- Afaf Elrefaei Scholarship
- George A. Nicosia Scholarship
- Joseph Puleo Memorial Scholarship
- Joseph Puleo Memorial Scholarship
- John H. L. & Julianne J. Stein Scholarship
- Otis, Dorothy & Bryce Sproul Family Scholarship
- Harold D. Jolley Career Development Professorship
- Raymond R. Tucker Distinguished I-CARES Career Development Professorship
- I-CARES Professorships

**Endowed Scholarship Donors**
- Procter & Gamble Chemical Engineering Scholarship
- Barrett & Norma C. Scarlet Scholarship
- Andrew C. Scarlet Memorial Scholarship
- Barrett & Norma Scarlet Scholarship
- Swedep Scholarship
- H.G. Schwartz, Jr. Scholarship
- Henry D. Schwartz, Jr. Scholarship
- Orr, Dorothy & Byron Family Scholarship
- John L. & Juliane S. Stein Scholarship
- Robert F. & Joyce A. Walton Memorial Scholarship
- *multiple scholarships*
Congratulations to our 2011 graduates!