FALL 2014

CBEUPDATE

A Publication from the Department of Chemical & Biomolecular Engineering at the University of Tennessee

Dr. Arthur Ragaukas
Named Second CBE Governor's Chair

CBE Professor Dr. Stephen Paddison
is Gibson Endowed Chair in Engineering

CBE Student Emma Hollmann
is 2014 Goldwater Scholar

CBE Department Initiates Major Renovations and Upgrades

Proposed Design for the New Eastman Unit Operations Laboratory

THE UNIVERSITY of TENNESSEE KNOXVILLE
Department of Chemical & Biomolecular Engineering
COLLEGE OF ENGINEERING

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THE UNIVERSITY of TENNESSEE KNOXVILLE
Department of Chemical & Biomolecular Engineering
COLLEGE OF ENGINEERING

Department Head's Message from Dr. Bamin Khomami

I am happy to report that the Department of Chemical and Biomolecular Engineering (CBE) at The University of Tennessee-Knoxville is currently enjoying a renaissance period in which all phases of our program are undergoing a significant expansion and revitalization. With the generous support of corporate sponsors and private donors, we have been able to make the substantial investments in our students, faculty, and facilities that are necessary for further progress on our roadmap to national prominence. I would like to take this opportunity to share with you a few of the exciting details about recent developments within our department.

I would like to welcome four new faculty members to our department who have joined us within the past two years: Drs. Steve Abel, Joshua Sangoro, Michael Kilbey, Zhanhu Guo, and our second Governor's Chair, Dr. Art Ragauskas. We now have increased our faculty by sixty percent in the past seven years, bringing our total number of fulltime faculty members to sixteen. We are also currently searching for another fulltime faculty position, and a fulltime professor of practice, expanding our faculty even further. With the addition of these new faculty members, our department will continue to play a decisive role in the university's efforts to achieve a higher national profile.

Many initiatives are currently underway or have been recently completed to upgrade our instructional and research laboratories, faculty, student, and staff offices as well as common areas within the Dougherty Engineering Building. In particular, we are vigorously pursuing the renovation and upgrading of our laboratories, with significant financial investment from the department, the college, the National Science Foundation, and corporate and private donors. To date, five thousand square feet of space has been renovated for laboratories devoted to sustainable energy research. Work has also begun on the renovation of approximately four thousand square feet of space on the basement and sixth floors of Dougherty, which will house our new Unit Operations Laboratory as well as new research laboratories with an estimated time of completion of April, 2015.

Having saved the most exciting news for last, let me tell you about our students. In terms of numbers alone, CBE is now the third largest department in the College of Engineering, and also the second largest degree program with a total enrollment surpassing 400 undergraduates for the first time in our history. With a current enrollment of sixty-five PhD and MS students, our graduate program is also experiencing unprecedented growth. Of course, numbers do not tell the whole story. CBE continues to attract the most academically qualified undergraduate students within the entire university, as evidenced by our high percentage of Haslam and University Honors students and the academic achievement awards garnered by our graduates, such as a recent Macebearer Award, NSF Graduate Research Fellowships, a Goldwater Scholarship, several Chancellor's citations for creative achievement and academic excellence, and numerous college awards. Our recent graduates have been accepted into top-ranked engineering programs nationwide, as well as prestigious medical and other professional schools. The diversity of our student body continues to improve, and CBE continues to have the largest percentage of female students of any department within the College of Engineering.

I would also like to take a moment to congratulate Dr. Tsewei Wang on her recent retirement after twenty-eight years of exemplary service to our department. We will miss her energy, enthusiasm, and relentless pursuit of excellence in the classroom. Dr. Wang continues to be active with her research team. Recently, the University of Tennessee Research Foundation (UTRF) presented the B. Otto and Kathleen Wheeley Award for Excellence in Technology Transfer to Dr. Wang and Dr. J. Douglas Birdwell, a professor in the Department of Electrical Engineering and Computer Science, for their joint research. The award is a cash prize given to the member of the UT faculty who has had a major impact on the tech transfer success of the university.

Finally, I would like to sincerely thank all of our wonderful alumni, donors, corporate sponsors, and college administration that have so amazingly supported CBE over the past five years. With your generous help, we have developed and implemented many new initiatives aimed at our primary mission: to educate and nurture leaders and innovators, not just technically skilled specialists. I am happy to report that we are well on our way to national prominence, and I am looking forward to reporting our continued progress to you for years to come.

Bamin Khomami
Granger & Beaman Distinguished University Professor
CBE Department Head

Key Gift from Eastman to Propel Engineering Excellence at UT

The proposed new Eastman Unit Ops Lab.

The new Eastman student lounge.

Another view of the Eastman student lounge.

The University of Tennessee College of Engineering (COE) and Eastman Chemical Company are renovating lab space for the Department of Chemical and Biomolecular Engineering (CBE) in the Nathan W. Dougherty Engineering Building. The funds for the project are part of a gift from Eastman to the College of Engineering totaling $2 million over a five-year period, and it was also used to fund the construction of a new student lounge. The agreement shapes a more robust relationship between Eastman Chemical Company and the college, helps Eastman build a deeper, more qualified, and diverse talent pool, and engages UT engineering students with a Fortune 250 company headquartered in East Tennessee. The conversations building to this agreement have already resulted in many new connections and have further strengthened this key collaboration for the state of Tennessee and the region.

The College of Engineering and particularly the CBE Department drives The University of Tennessee's relationship with Eastman. Renovations to the Unit Operations Laboratory in the CBE Department have been needed for some time but the resources necessary to achieve the renovation were far beyond what the state could provide. The renovation of the lab will enable the department to accelerate its progress, which will also have a positive impact on Eastman.

"Eastman is committed to securing the best and brightest engineering graduates from UT, and the entire region benefits from the economic impact of students graduating with advanced degrees and securing local jobs," said Etta Clark, Eastman's vice president for global public affairs and policy. "When we combine resources it helps both Eastman and UT, resulting in a win for both as well as the state of Tennessee."

Wayne Davis, Dean of the College of Engineering agrees.

"This is a major commitment between Eastman and our college," said Davis. "Eastman has shown its willingness to help us improve the facilities and lives of our students and faculty with its funding of the renovation of the Unit Operations Lab that is in the Nathan W. Dougherty Engineering Building. A gift like this is truly empowering for our college."

CBE Department Head, Dr. Bamin Khomami also is pleased about the improvements the funding from Eastman will bring.

"We have the best students at The University of Tennessee, most of whom come from within the state," said Khomami. "This gift will enable us to continue to build the infrastructure necessary for educating the next generation of leaders and innovators in our discipline, a pursuit that will benefit our state, region and nation. It also enhances our longstanding relationship with the best chemical company in Tennessee, indeed, one of the best chemical companies in the world, as well as enabling our graduates to continue to play an integral role in Eastman."

The lab in 222 Dougherty prior to renovations.

The lab in 222 Dougherty after the renovations.

The lab in 223 Dougherty prior to renovations.

The lab in 223 Dougherty after the renovations.

The lab in 220 Dougherty prior to renovations.

The lab in 220 Dougherty after the renovations.

The new Unit Operations Lab, funded by Eastman, will be located on the ground floor of Dougherty and is slated for completion in 2015. This instructional laboratory will provide state-of-the-art facilities for students to learn process-based chemical engineering.

In addition to the renovation to the Unit Operations Lab, the Dougherty Engineering Building has been the focus of a number of significant upgrades over the last two years, including laboratory renovations funded by a $1.8 million ARA grant from the National Science Foundation (NSF) in addition to $350,000 in funding from the UT Central Administration for the Sustainable Energy Laboratory. Renovations include the laboratories for the research team of Governor's Chair for Electrical Energy Storage Tom Zawodzinski, Department of Mechanical, Aerospace, and Biomedical Engineering (MABE) department head Matthew Mench for fuel cells research, EcoCAR3 challenge projects supervised by MABE professor Dr. Butch Irick, and projects related to the development of improved rotor/turbine blades for energy and transportation uses by MABE professors Hans DeSmidt and Kivanc Ekici.

Another important laboratory project that will be completed at about the same time as the Unit Operations Lab involves the entire sixth floor of Dougherty, leveraging proximity to the roof to create almost five thousand square feet of upgraded space that can accommodate the installation of chemical fume hoods and other "wet lab" facilities in safe and highly functional space. The new space will house the research laboratories for CBE and MABE, and just as importantly undergraduate instruction laboratories for the Department of Materials Science and Engineering (MSE).

Finally, Dougherty 324/325 is being converted into new wet lab space for the College of Engineering's newest Governor's Chair Art Ragauskas, whose work focuses on the role of lignin in new technologies related to bioenergy and biomaterials manufacturing.

New Faculty

Dr. Steve Abel

Dr. Abel received his PhD from Stanford University. His research areas include statistical mechanics applied to cell biology and immunology, multiscale modeling of cell signaling networks, the cytoskeleton, and membranes.

Dr. Michael Kilbey

Dr. Kilbey received his PhD from the University of Minnesota. Kilbey's research areas include synthesis and characterization of polymeric materials used for surface and interface engineering, including advanced materials and composites for sustainable energy; structure-property relationships of ultrathin polymer films and molecular assemblies in solution.

Dr. Joshua Sangoro

Dr. Sangoro received his PhD from the University of Leipzig, Germany. Sangoro's research areas include materials for electrochemical energy applications, batteries and supercapacitors, dynamics under confinement, and charge transport in amorphous materials.

CBE Faculty Member Sangoro Receives Fellow Recognition, Presents to Organizations

Dr. Joshua Sangoro was recently selected as a Fellow of the first class of the Science Alliance JDRD Collaborative Cohort Program. This award carries with it $25K of funding per year for two years. The program is a new effort that will nurture collaboration between underrepresented UT junior faculty and ORNL junior scientists. Cohorts from UT will work closely with the newly established ORNL Liane B. Russell Fellows. The focus for the cohorts will be on enabling discovery and scholarly development, collaboration, team building, graduate student mentoring, and the obtaining of funding from a variety of sources, including UTK JDRD, ORNL Laboratory-directed Research and development (LDRD), the Department of Energy (DOE), and other funding organizations.

Sangoro also gave an invited talk about ionic liquid electrolytes on May 13, 2014, at the 225th Electrochemical Society conference in Orlando, Florida. The address was entitled "Charge Transport and Structural Dynamics in Ionic Liquids." For more information, visit: ***https://ecs.confex.com/ecs/225/webprogram/Session13015.html***

Additionally, Sangoro was one of the key speakers invited by the International Dielectric Society at the "8th International Conference on Broadband Dielectric Spectroscopy and its Applications," which took place on September 14-19, 2014 in Wisla, Poland. For more information, visit: ***http://www.bds2014.us.edu.pl/index.php/key-speakers***

Kilbey Elected Vice Chair of Professional Organization

In October 2013, Dr. Michael Kilbey was elected Vice-Chair of the Materials Engineering and Science Division of the American Institute of Chemical Engineers. Dr. Kilbey will be responsible for Division programming for the 2015 National AIChE meeting, and become chair of the Division in 2015-2016.

Research Team with Dr. Hu Wins 2014 R&D 100 Award

Dr. Michael Hu

A research team including CBE professor Dr. Michael Hu and ORNL researchers including Matthew Sturgeon, Ramesh Bhave, Brian Bischoff, Tolga Aytug, and Tim Theiss recently won a 2014 R&D 100 Award for their development of super-hydro-turntable HiPAS Membranes. This new class of membrane products can selectively separate molecules in the vapor/gas phase and perform liquid-phase separations, which could potentially be useful in reducing the price of bio-ethanol, ethanol-gasoline blend fuels, and drop-in fuels from bio-processing. For more information on the project and award, visit ***http://www.rdmag.com/award-winners/2014***.

CBE Welcomes Second Governor's Chair: Dr. Arthur Ragauskas

Dr. Arthur Ragauskas

Dr. Arthur Ragauskas, an authority in bioenergy, has been named the fifteenth UT–Oak Ridge National Laboratory Governor's Chair.

He will serve as Governor's Chair for Biorefining, based in the Department of Chemical and Biomolecular Engineering with a complementary appointment in the UT Institute of Agriculture's Department of Forestry, Wildlife, and Fisheries. He will serve in the US Energy and Environmental Sciences Directorate, Biosciences Division, at ORNL and as a member of the Department of Energy's BioEnergy Science Center (BESC).

Ragauskas started his appointment on June 1, 2014.

Ragauskas comes to UT from the Georgia Institute of Technology, where he was a professor of chemistry and biochemistry and researcher within the Institute of Paper Science and Technology. This year, he was honored with the American Chemical Society's Award for Affordable Free Chemistry and the Gunnar Nicholson Gold Medal Award from TAPPI, an arm of the American Paper and Pulp Association.

In 2013, Ragauskas was elected as a fellow of the American Association for the Advancement of Science, and he served as the Fulbright Distinguished Chair in Alternative Energy from 2008 to 2009. He was also a visiting fellow at ORNL in 2013, working on a carbon fiber initiative for the lab's Energy and Environmental Sciences Directorate.

Ragauskas's research is important to uncovering ways to convert biomass to biofuels, biopower, and biomaterials. Specifically, his work focuses on converting plant matter such as lingocellulose, found in the cell walls of energy crops, into biofuels. He also works to uncover applications of bio-based chemicals and materials for use in areas ranging from health care to packing material. As a founding member of BESC, Ragauskas served as the lead scientist of the Georgia Tech team researching the in-depth cell wall characterization of pretreated switch grass and poplar biomass.

Biomass is the only renewable source of carbon-based fuels and chemicals, and the United States has sufficient biomass stock to supply more than 1.3 billion dry tons per year, according to Ragauskas. Yet despite the nation's biomass abundance, conversion of biomass to biofuel remains expensive.

Ragauskas plans to change this.

"Using plant materials to take the place of plastics and other hydrocarbons in materials can work wonders for the environment, as it lessens our demand for petroleum and creates products that are biodegradable with net reductions in carbon dioxide emissions," he said.

Ragauskas said he plans to collaborate with UT students and faculty and ORNL research scientists to develop biorefining research programs. He also looks forward to utilizing resources at UT such as the polymer characterization laboratory and biomass processing facilities as well as ORNL resources like the Spallation Neutron Source and Titan supercomputer.

"The Governor's Chair position leverages the world-class students, faculty, researchers, and research infrastructure at UT and ORNL focused on biorefining and the potential of developing translational collaborative research in this field that will impact the state, nation, and world," he said, adding that he aims to establish biorefining laboratories at both institutions.

Ragauskas has served as a program leader for Georgia Tech's focused research program in biofuels, biopower, and biomaterials; a research theme leader at Georgia Tech, Imperial College London, and Oak Ridge National Laboratory; and team leader for the industrial consortium program Fiber Modification/Fiber Fiber Bonding. In 2008, he was nominated to the National Commission of Energy Policy and received the William H. Aiken Research Prize, among other honors for his research and teaching.

"The renewable biofuels enterprise is moving toward the development and commercialization of biomaterials from biomass feedstocks, largely to improve the cost of biofuel production," said Martin Keller, ORNL's associate lab director for energy and environmental sciences. "UT and ORNL have a strong role in the basic and applied research needed to accelerate the economic viability of this approach, and Dr. Ragauskas brings to both institutions an international reputation and skill set that will help strategically position us for this new phase in renewable fuels and biomaterials research."

Ragauskas received his bachelor's and doctoral degrees in chemistry from the University of Western Ontario.

The UT-ORNL Tennessee Governor's Chair Program is funded by the state of Tennessee and ORNL. It is designed to attract exceptionally accomplished researchers from around the world to boost joint research efforts that position the partnership as a leader in the fields of biological science, computational science, advanced materials, and neutron science.

Article by Whitney Heins, UT Media Relations

Faculty Emeritus Member Wang Receives Wheeley Award

UTRF President and CEO Dave Washburn (left) and Stephen Wheeley (right) present J. Douglas Birdwell and Tsewei Wang with the B. Otto and Kathleen Wheeley Award for Excellence in Technology Transfer.

On September 20, 2013, the University of Tennessee Research Foundation (UTRF) presented the B. Otto and Kathleen Wheeley Award for Excellence in Technology Transfer to Dr. J. Douglas Birdwell, a professor in the Department of Electrical Engineering and Computer Science, and Dr. Tsewei Wang, an associate professor emeritus in the Department of Chemical and Biomolecular Engineering. The award is a cash prize given to the member of the UT faculty who has had a major impact on the tech transfer success of the university.

Birdwell has been a faculty member at UT since 1978 and is currently the director of the Laboratory for Information Technologies. He has over 100 publications and has directed over $10 million in sponsored research projects at UT.

Wang joined the College of Engineering faculty in 1989. She has authored over 50 publications, presentations, and peer reviewed journal articles and has directed $7 million in sponsored research projects at UT. Wang retired from UT in December of 2012 but continues to be active with her research team.

Together, Birdwell and Wang have 23 issued patents and licensing agreements on their technologies have generated $1,124,012 in revenue.

“The work of Drs. Birdwell and Wang and their team has had a tremendous impact on the ability of law enforcement agencies around the world to exchange and compare forensic DNA evidence to help solve crimes,” said David Washburn, president and CEO of the UTRF. “From inventions in parallel data processing architectures, DNA forensics analysis, and advanced DNA database search techniques–their work aids in identifying missing persons and victims of disasters and crime.”

For more information, visit ***http://utrf.tennessee.edu/techtransfer/news/innovation-13.shtml***.

Dr. Stephen Paddison Named Gibson Endowed Chair in Engineering

Dr. Steven Paddison

The Gibson Endowed Chair in Engineering was created with the specific goal of expanding research into environmentally friendly, sustainable energy and Dr. Stephen J. Paddison, professor and Ferguson Fellow in the Department of Chemical and Biomolecular Engineering, has been named as the first chair.

“From the beginning I wanted this to be a position that solved energy problems in a responsible way,” said donor Jim Gibson, a 1971 UT graduate in industrial engineering. “With all the good things UT has going on, seeing their partnership with Oak Ridge National Laboratory, I wanted to be a part of that.”

The gift, from the Gibson Family Foundation, totals to a $1.5 million endowment.

Paddison has garnered worldwide acclaim for his role in understanding transport mechanisms in the polymer electroyte membranes utilitized in fuel cells.

In addition to the awards he has won and the research he has conducted in the United States, the United Kingdom, and Germany, Paddison also spent a number of years at Los Alamos National Laboratory and now leads his UT Research Group that investigates structural function relationships in the materials used in fuel cells and batteries.

While the endowment itself is a major plus for the college, the impact on research, funding, and breakthroughs that it could generate loom even larger.

An internal study indicates that over the next 20 years the initial investment could lead to as much as $10 million in additional funding, and that as many as 30 doctoral candidates will have their careers launched by related research work.

Paddison said being named the Gibson Endowed Chair in Engineering “is a great and unexpected honor.”

“It will also be a tremendous shot in the arm in terms of facilitating the pursuit of new research directions and further international collaboration,” he said.

With the requirements for the chaired position stating that it is to be used solely on energy research, Paddison was a logical choice.

“When I learned about him, about his background and what he does, he really was the perfect fit,” said Gibson. “He is a really talented person, and part of the College of Engineering being the best it can be involves investing in people as much as it does buildings. Hopefully, he’ll be there for a long time.”

The endowment marks a continuation of Gibson’s relationship with the College of Engineering, with the Jim Gibson Conference Room in the recently opened John D. Tickle Engineering building serving to highlight his close ties with UT.

Research Focus: Dr. Cong Trinh

Dr. Cong Trinh

Dr. Cong Trinh, an assistant professor in the Department of Chemical and Biomolecular Engineering, is currently working in the areas of researching systems and synthetic biology, cell physiology, and bioenergy/biofuels. Trinh’s research seeks to fundamentally understand and engineer cellular metabolisms with the ultimate goal to design, construct, and characterize novel production strains with optimized metabolic functionalities.

“Living cells have complex cellular metabolisms to function in complex environments,” Trinh said. “It is very fascinating and rewarding to fundamentally understand how cellular metabolisms work and then harness them for various biotechnological applications related to health, energy, and the environment.”

One project that Trinh and his research team are working on is to develop a modular chassis cell design principle that can systematically engineer modular microbial cell factories in rapid plug-and-play fashion from exchangeable biological parts. This technology can potentially minimize iterative strain optimization steps by several orders of magnitudes in terms of resources. Trinh’s group developed the theory and they are currently testing this design technology for engineering a modular E. coli chassis that can be plugged in with different production modules to produce a diverse class of esters used as fragrances, flavors, solvents, and biodiesels.

A second project is to elucidate and engineer robust metabolisms of single and consortia of oleaginous yeasts for direct conversion of renewable and sustainable non-food plants and agricultural residues/wastes into high-value chemicals and drop-in liquid biofuels (e.g., biodiesels and hydrocarbons).

Working out of laboratory facilities in Senter Hall, Trinh includes both undergraduate and graduate students and postdoctoral researchers in his projects.

“My group consists of postdoctoral researchers, graduate students, and undergraduate students,” Trinh said. “Each works in a small team that closely interacts with each other but has different research focuses. Each has a responsibility to achieve his/her milestones, and I work closely with them to achieve these goals. In my group, I nurture undergraduates by engaging them in research activities at their earlier years in school. They typically spend at least one year in my lab to sharpen their research skills. Besides doing research, they have opportunities to mentor other students via our outreach activities such as the Eastman High School Introduction to Engineering Systems (HITES) four-day workshop where high-school students work on a design engineering project in the summer.”

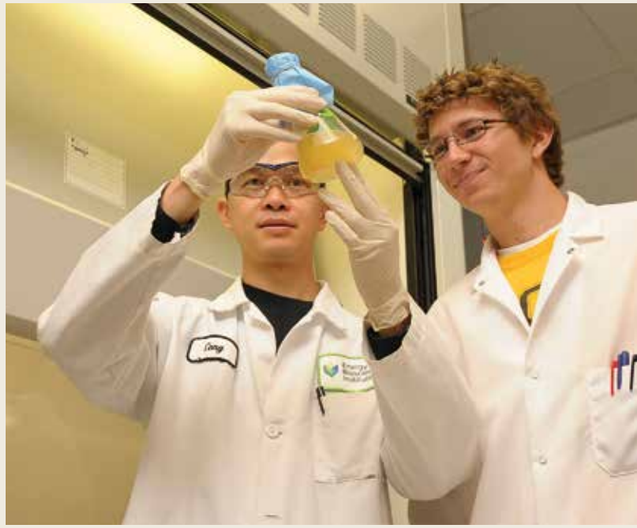
Trinh believes that the research practice that the students get through his projects is a valuable part of their engineering education.

“I strongly believe the hands-on research experience is an effective way to stimulate students’ curiosity and creativity,” Trinh commented. “It is the reason why I nurture undergraduate students at their earlier years in school to explore opportunities beyond the classroom and help them achieve their potential.”

Trinh’s laboratory is a member of the BioEnergy Science Center (BESC) at Oak Ridge National Laboratory (ORNL). He collaborates with several research scientists at ORNL on the BESC project. Currently, he is also working with a colleague, Dr. Carrie Eckert at NREL, to edit a book on Biotechnologies for Biofuel Production and Optimization that is scheduled for publication next year.

Trinh plans for continued progress in his fields of research in the future.

“One research advance I aim to achieve in the near future is to develop an innovative technology for designing ‘modular chassis cells’ to build modular microbial cell factories for production of high-value biochemical and biofuels in a rapid plug-and-play fashion with minimal iterative strain optimization steps,” he said. “The other advance is to develop robust and novel microbial platforms for efficient conversion of complex and toxic lignocellulosic biomass to high-value biochemicals and biofuels.”



Student News

CBE Student Named UT Torchbearer

Akshitha Yarrabothula (left) receives a plaque designating her as a UT Torchbearer from Chancellor Jimmy G. Cheek (right) at the Chancellor's Honors Banquet.

The Chancellor's Honors Banquet was held on April 8, 2013, and a College of Engineering student received the university's highest honor for an undergraduate student.

Akshitha Yarrabothula was named a Torchbearer. She is a chemical and biomolecular engineering major, a Haslam Scholar, Chancellor's Scholar, and Baker Scholar. Her dedication to research earned her a position as an undergraduate research assistant conducting graduate-level research. Her accolades include selection as the engineering first place divisional winner of the 2011 EUReCA competition and as UT's representative for the first SEC Symposium. She has helped others through volunteering with the Boys and Girls Club of Greater Knoxville and in the emergency room at Fort Sanders Regional Medical Center, among other organizations. Yarrabothula has led campus groups such as the Delta Phi Omega Sorority and the Society of Women Engineers. UT's Department of Housing honored her as one of its most outstanding resident assistants.

The Torchbearer is the highest honor the university gives to its students. The Torchbearer is awarded to seniors who have served UT with overall excellence. Recognition as a Torchbearer reminds all students that those who bear the Torch of Enlightenment shadow themselves to give light to others.

CBE Student Emma Hollmann Selected as Goldwater Scholar

Emma Hollmann

Chris Barnes

CBE junior Emma Hollmann was recognized by the Barry Goldwater Scholarship and Excellence in Education Program, which grants awards to students studying mathematics, science, and engineering.

Hollmann was named a 2014 Goldwater Scholar, and CBE sophomore Chris Barnes, was given honorable mention.

Hollmann, a Haslam Scholar studying chemical engineering, was selected based upon academic merit from a field of 1,166 students studying mathematics, science, and engineering, all of whom were nominated by faculties of colleges and universities nationwide. Selected students will receive up to $7,500 per year for tuition, fees, books, and room and board. Hollmann, who is from Cookeville, Tennessee, is studying state-of-change effects on the kinetics of vanadium redox flow batteries with Thomas Zawodzinski, Governor's Chair in Electrical Energy Storage. She is a reviewer for Pursuit: The Journal of Undergraduate Research, an Engineering Honors ambassador, and a member of the Society for Women Engineers. Hollmann plans to pursue a doctorate in chemical engineering.

Chris Barnes, from Knoxville, Tennessee, is a Haslam Scholar double majoring in chemical and biomolecular engineering. He has assisted with research at UT since he was a high school senior, working with Dr. Bin Hu, a professor of materials science and engineering, and Dr. Eric Boder, a professor of chemical engineering. He is the co-founder and leader of TEDxUTK and a reviewer for Pursuit. Barnes plans to pursue a doctorate in biomolecular engineering.

The Barry Goldwater Scholarship and Excellence in Education Program was established by Congress in 1986 to honor Senator Barry M. Goldwater. The purpose of the program is to provide a continuing source of highly qualified scientists, mathematicians, and engineers by awarding scholarships to college students who intend to pursue careers in these fields.

UT can nominate up to four undergraduates for the Goldwater Scholarship each year. The Office of National Scholarships and Fellowships facilitates the application process and relies on the standing UT Goldwater Selection Committee to make the final selection and nomination of its candidates. This year's committee members were R.J. Hinde, associate dean and professor of chemistry; Dr. Masood Parang, associate dean for engineering academic and student affairs and professor of mechanical, aerospace and biomedical engineering; and Jon Camden, assistant professor of chemistry.

CHEM-E Car News

UT AIChE members present their award from the 2013 AIChE National Conference. From left are Christian Wilson, Alex David, faculty advisor Dr. Gabriel Goenaga, Amanda Jones, Kelli Byrne, Aston Thompson, and Dennis Edralin.

Students from the College of Engineering's Department of Chemical and Biomolecular Engineering took part in the Chem-E-Car Competition at the Southern Regional Conference in Mayaguez, Puerto Rico, in March, taking home second place in the poster competition.

The American Institute of Chemical Engineers started the competition as a way to get engineers thinking about practical solutions and innovations involved in powering a car chemically.

The specific challenge this year required teams to design a car that could deliver a specific amount of payload a predetermined distance before stopping.

Students had an opportunity to take in some of the culture and history of Puerto Rico as well while on the trip, including a visit to the Bacardi headquarters.

A team of students from the UT AIChE Student Chapter returned from the 2013 AIChE National Conference in San Francisco with a list of awards to show for their attendance. The team was also featured in a set of YouTube videos related to the conference's Chem-E-Car competition.

Chem-E-Car team members Nikhil Patel, co-captain Aston Thompson, William Hawks, co-captain Christian Wilson, faculty advisor Dr. Gabriel Goenaga, Megan Farell, and Dennis Edralin stand with their second-place award at the Chem-E-Car Poster Competition in Puerto Rico.

Kelli Byrne won the Praxair's ScaleUp Award for her essay submission. Her paper compared the emissions of greenhouse gases from hydrogen production through reforming of natural gas and electrolysis of water.

Amanda Jones won first place in the Undergraduate Student Poster Session on Fuels, Petrochemicals, and Energy for her poster "Comparison of Membrane Performance for Vanadium Redox Flow Batteries."

The Chem-E-Car Team competed with their car, the Tennessee Titan, in the 2013 National Chem-E-Car Competition and brought home the National SAChE Award: Inherent Safety in Design for the best application of the principles of chemical process safety to the Chem-E-Car competition.

The team's introduction video was shown before each of the Tennessee Titan's runs during the competition. The video can be viewed at: ***https://www.youtube.com/watch?v=EJ5wfruoE_s***.

The Chem-E-Car Team Members are Kelli Byrne (captain), Amanda Jones (captain), Adithi Amarnath, Kristen Barnes, Alex David, Dennis Edralin, Megan Farell, Sam Kingkeo, Jordan Parkhurst, Kyle Saylor, Aston Thompson, and Christian Wilson.

AIChE officials interviewed team co-captain Amanda Jones about the UT entry. View the interview video here. ***https://www.youtube.com/watch?v=GSsxTMJ4YQY***.

The chapter's faculty advisor is Dr. Gabriel Goenaga and the safety advisor is Dr. Douglas Aaron.

CBE Doctoral Student Wins Poster Competition

Fatemeh Sepehr (center) is congratulated by Dr. John Hopkins (left) and Dr. Kelvin Chu (right) at theTN-SCORE conference in Nashville, Tennessee.

Fatemeh Sepehr, a doctoral student in the Department of Chemical and Biomolecular Engineering (CBE), won the Tennessee Solar Conversion and Storage using Outreach, Research and Education (TN-SCORE) poster competition at the organization's conference in Nashville.

Sepehr received a $1,000 travel stipend in addition to the award, funds she will use to attend the Electrochemical Society meeting in May 2015 to present her poster and research. Sepehr is a member of the Paddison Research Group, led by Dr. Stephen Paddison, professor in CBE.

Sepehr's entry covered the topic "Components and Devices for Energy Storage and Conversion."

AIChE Student Chapter Update

Amanda Jones presents her research poster at the Knoxville-Oak Ridge Chapter Meeting. Each month a CBE student presents their research at the chapter meeting.

CBE Department Awards and Recognitions

Chemical & Biomolecular Engineering Department 2013 Awards

AIChE Service Award
– Morgan Baltz

Dow Outstanding Junior Award
– Samantha Hawks

Kenneth M. Elliott Outstanding Senior Award
– Kevin Spellman

Jim and Sändra McKinley Outstanding Graduate Student Award
– Mahdy Malekzadeh Moghani

Most Exceptional Student Award
– Robert Bursley

Eastman Outstanding Scholar Award
– Hannah Haines

Award winners from the CBE 2013 Awards Banquet: Kevin Spellman, Katherine Lutes, Carrie Lloyd, Robert Bursley, Mahdy Malekzadeh, Samantha Hawks, Kelli Byrne, and Morgan Baltz.

2013 Faculty and Staff Awards:

Dr. Bamin Khomami (right) presents the CBE Outstanding Teacher Award to Dr. Brian Edwards.

Dr. Bamin Khomami (right) presents the CBE Thomas and Ruth Clark Chemical Engineering Excellence Award in Teaching to Dr. Robert "Pete" Counce.

Dr. Bamin Khomami (left) presents the CBE Outstanding Advisor Award to Dr. Paul Frymier.

External Awards and Recognitions

2014 Chancellor's Honors Banquet

The annual Chancellor's Honors Banquet is a showcase of the best and brightest at the University of Tennessee, and the 2014 edition proved to be quite a night for students and faculty of the Department of Chemical and Biomolecular Engineering (CBE).

CBE students Yi Ying Chin and Samantha Ann Hawks both received Extraordinary Academic Achievement awards.

The Top Collegiate Scholar awards went to Samantha Ann Hawks and Rebekah Kathryn Patton, both CBE majors.

Yi Ying Chin

Samantha Ann Hawks

Rebekah Kathryn Patton

Student Awards from Outside the Department:

American Chemical Society Outstanding Senior Award – Blake Lingerfelt

Alpha Chi Sigma Albert H. Cooper Memorial Scholarship Award – Katherine Lutes

AIChE Outstanding Student Award – Carrie Lloyd

AIChE Outstanding Baccalaureate Award – Hannah Haines

2014 College of Engineering Faculty and Staff Awards Dinner

COE Dean Wayne T. Davis (left) presents the Outstanding Faculty Advisor Award to CBE faculty member Dr. Paul Frymier.

COE Dean Wayne T. Davis (left) and Associate Dean for Academic and Student Affairs Masood Parang (right) present the Outstanding Staff Member Award to Rita Gray.

Dr. Paul Frymier, an associate professor in the CBE department, was the recipient of the Outstanding Faculty Advisor Award at the College of Engineering's 2014 Faculty and Staff Awards Dinner that took place on April 3, 2014, at the Knoxville Hilton. The award is presented to a faculty member who performs quality advising through availability and a clear commitment to advising. It was established in 1989 with a private gift.

Rita Gray, an administrative specialist II in the CBE department, was presented the Outstanding Support Staff Award at the COE's 2014 Faculty and Staff Awards Dinner. The recognition is awarded annually to a support staff employee who demonstrates professionalism and a positive attitude, initiative, and the willingness to go the extra mile in his or her job responsibilities.

2014 Faculty and Staff Awards

Dr. Bamin Khomami (right) presents the CBE Outstanding Staff Member Award to Jennifer Wolfenbarger.

Dr. Bamin Khomami (right) presents the CBE Outstanding Advisor Award to Dr. Paul D. Frymier.

Dr. Bamin Khomami (right) presents the CBE Outstanding Teacher Award to Dr. Cong Trinh.

Thomas Clark (right) presents the CBE Thomas and Ruth Clark Chemical Engineering Excellence Award in Teaching to Dr. Charles F. Moore.

Student Department Scholarship Recipients

Burton B. Simcox Chemical Engineering Scholarship:
Abullah Alzubairi
Aaron Armentrout
Joseph Birchfield
Kelli Byrne
Kelsey Dietz
Jon Jones
Amanda Jones
Kyle Saylor
Luke Weber

Dennis and Connie Denihan Scholarship:
Donovan Layton
Kevin Quigley

Homer Johnson Scholarship:
Stephanie Bailey
Morgan Baltz
Yi Chin
David Dickenson
Megan Farell
Hannah Haines
Samantha Hawks
Emma Hollmann
Cheryl Jackson
Carrie Lloyd
Micah Mohieddin
Kevin Spellman
James Templeton
Anna Zetterberg

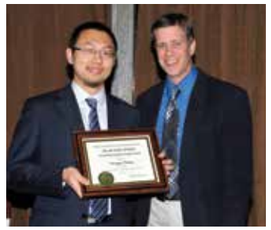
Shell Undergraduate Award:
David Dickenson

Chemical & Biomolecular Engineering Department 2014 Awards

CBE faculty, staff, and students at the CBE department awards banquet.

The CBE Department Awards Banquet was held at Calhoun's on the River in April. Faculty, staff, and students celebrated the outstanding achievers of the year.

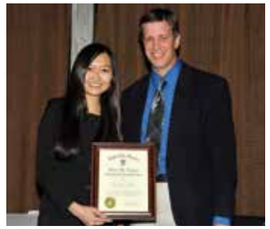
AIChE Outstanding Student Award —David Dickenson (not Pictured).



Dr. Brian Edwards (right) presents the Jim and Sandra McKinley Outstanding Graduate Student Award to Mengqi Zhang.

Dr. Brian Edwards (right) presents the Most Exceptional Student Award to Samantha Hawks.

Dr. Brian Edwards (right) presents the Eastman Outstanding Scholar Award to Anna Zetterberg.



Dr. Brian Edwards (right) presents the Alpha Chi Sigma Albert H. Cooper Memorial Scholarship Award to Yi Ying Chin.

Dr. Brian Edwards (right) presents the AIChE Outstanding Baccalaureate Award to Amanda Jones.

CBE alumnus John Shoemaker, Jr. (right) and wife Linda (left) present the AIChE Service Award to Kelli Byrne (center).

Dr. Brian Edwards (center) presents the Dow Outstanding Junior Award to Tyler Sprouse (left) and Emma Hollmann (right).

Dr. Brian Edwards (right) presents the Kenneth M. Elliott Outstanding Senior Award to Rebekah Patton.

Dr. Al Hazari (right), a faculty lecturer in the Department of Chemistry and a representative of the East Tennessee American Chemical Society, presents the American Chemical Society Outstanding Senior Award to Joseph Birchfield.

Outstanding Undergraduate Student: Emma Hollmann

Emma Hollmann describes attending the University of Tennessee as a family tradition. When the time came for her to choose a university, it was high on the list. A visit to campus during her senior year of high school cinched the deal.

"I left that day excited about all UT, particularly the College of Engineering, had to offer," said Hollmann, a Cookeville, Tennessee, native.

Hollmann, a senior in the Department of Chemical and Biomolecular Engineering (CBE), has kept that excitement working for her, earning a series of awards and honors. She is a member of both the Haslam Scholars and Neyland Scholars programs. She also received the Eastland Family Scholarship; the James B. Porter Jr. Scholarship; the C.W. Keenan Outstanding General Chemistry Student Award; the Pete Barile Design Competition Award; and the Homer Johnson Scholarship in Chemical and Biomolecular Engineering.

Most recently, she was named a 2014 Goldwater Scholar and received the Dow Outstanding Junior award from the CBE department. Along with her own enthusiasm, Hollmann credits the encouraging atmosphere in the department and college as a foundation for success.

"I love the community feeling fostered both in the CBE department and the College of Engineering (COE) itself," she said. "The CBE department is relatively small, and it doesn't take long for you to get to know most of your fellow students. We start out as classmates, but by the end, many strong friendships have formed. No one in engineering succeeds alone."

Hollmann's motivation to contribute to this CBE community began early on.

"I have had a passion for renewable energy technologies since middle school," she said. "Once I entered high school, I developed a passion for chemistry."

Chemical engineering allowed Hollmann to combine these interests. She found the COE pace invigorating from the start.

"Honors Engineering Fundamentals with Dr. Chris Pionke and Dr. Roger Parsons set the tone of my time at UT," said Hollmann. "We had a constant stream of homework, group projects, and tests. Somehow, though, we all managed to have quite a bit of fun along the way."

Hollmann found further encouragement from multiple faculty members.

"The CBE department is very lucky to have such strong faculty," she said. "Our professors continually push students to reach our full capabilities as future engineers. Their support of students allows us to succeed."

This support has greatly enhanced Hollmann's undergraduate studies and research efforts.

"Dr. Thomas Zawodzinski, known as Dr. Z. to CBE students, is the best research mentor for whom I could have wished," she said. "His continued support has taught me to be confident in my abilities and knowledge about my topic."

Zawodzinski is the UT Governor's Chair Professor for Advanced Energy Storage, researching advances in fuel-cell technology. Hollmann says that being in the "Z Group" has been vital to building her own research, especially with the guidance of research associate Dr. Douglas Aaron.

"Doug spent many hours teaching me fundamentals about redox flow batteries so that I could truly understand my research topic," she said. "Most importantly, though, he taught me to have a sense of humor. If you never learn to laugh and relax about the frustrations in lab, you will quickly make yourself miserable."

Hollmann also thanks Dr. Lee Riedinger, director of the Bredesen Center, for his support in joining the Z Group, and with her Goldwater Scholarship application. The scholarship brought rewards to Hollmann even before she received it.

"The application process for the Goldwater Scholarship taught me to communicate a technical topic in a way that it is accessible by a general audience," she explained. "The process, with the help of Dr. Zawodzinski, helped me to think more about the 'big picture' of my work."

An engineering service trip to Costa Rica in 2013, organized by the Global Initiatives program, gave Hollmann an international perspective on that big picture.

"I was better able to understand how what I learned in class could help make a true difference in the world," she said.

Hollmann also went to Padua, Italy, for research during the summer of 2014, mixing her engineering studies with her passion for travel. As she continues her family tradition at UT, she has found many ways to balance life in and out of the lab.

"I love practicing yoga, especially after stressful days on campus," she said. "Ultimately, it is spending time with my loved ones (pets included) that I enjoy the most. Without their support, I wouldn't be where I am today."

After graduation, Hollmann plans to pursue her chemical engineering PhD, continuing her investigation of redox flow batteries and fuel cells.

"Outside of class, I hope to fully enjoy all that UT and east Tennessee have to offer during my last year here," she said.

Outstanding Graduate Student: Mengqi Zhang

Mengqi Zhang developed a curiosity about the chemical reactions that happen between different substances while growing up in Ma'anshan, Anhui, a small city near the eastern coast of China known for its steel industry.

"The challenge to design and control these reactions and processes brought me to the area of chemical engineering," he said.

Zhang earned his bachelor's degree at China's Nanjing University of Technology, where he received the National Scholarship, awarded to a select number of undergraduate students annually. After graduating, he sought a school with a solid reputation to build on his success, and chose the College of Engineering at UT.

"The Department of Chemical and Biomolecular Engineering (CBE) has world famous faculty and they have firm connections with Oak Ridge National Laboratory (ORNL)," said Zhang.

His choice to join the CBE community has brought him well-deserved benefits. He recently earned the 2014 Jim and Sändra McKinley Outstanding Graduate Award. The award adds incentive and confidence to his investigative focus into areas of electrochemistry, including reaction kinetics, substance transportation, and thermodynamics.

"Although it brings more pressure on my research and always encourages me to work harder, I think I can handle these," said Zhang.

He is pursuing his PhD as part the "Z Group," the research team of Dr. Tom Zawodzinski, the UT Governor's Chair Professor for Advanced Energy Storage. Zawodzinski and team research advances in flow-battery and fuel-cell technology.

"I am working on making an innovative ionic liquid flow battery," explained Zhang. His investigation seeks to establish faster electrochemical reactions to create a more efficient, higher energy density battery. He also seeks materials that are best suited to fulfill this concept.

His classes at UT have also inspired optimism in Zhang as he digs deeper into his subject matter, particularly the transport phenomena class taught by CBE department head Dr. Bamin Khomami.

"He brings pressure in the class and it forces you try to learn more," he said.

Dr. Robert Counce is another CBE professor whose advising Zhang has valued. Most of his research time is spent in Counce's lab.

"We nearly meet every workday and he follows my progress," he said. "He really cares about his student's research and future."

Zhang appreciates the CBE's community atmosphere, which draws students in the department together even outside of the classroom or laboratory.

"I like activities like the potluck and the outside grill brought by the CBE graduate student association," he said.

Zhang keeps active with friends playing basketball and soccer, and also likes to go fishing. He looks ahead with professional possibilities in mind, but remembers to enjoy his progress as it is happening.

"My final plan is to become a scientist to bring advanced technology to our real life, but before this I may try to work in industry first," said Zhang. "I tell myself that to earn your PhD is not the only goal. To enjoy the process of improvement will become the treasure in your life."

Faculty Feature: Dr. Michael Kilbey

When Dr. Michael Kilbey came to Oak Ridge National Laboratory (ORNL) on a sabbatical a few years ago, the visit resulted in an appointment as a professor in the University of Tennessee Department of Chemical and Biomolecular Engineering (CBE).

"I came to East Tennessee on a sabbatical to ORNL to learn neutron scattering methods applied to polymeric materials," Kilbey said. "Prior to that, I had been a member of the Department of Chemical and Biological Engineering at Clemson University for 11 years. At the end of that sabbatical year I had the opportunity to stay–to become a UT/ORNL joint faculty member. I felt that the growing research intensity at UT and the new facilities at ORNL were a compelling opportunity, so I made that change. Initially, my joint appointment was between the UT Department of Chemistry and ORNL. In 2012, I began the process to return to academia full time, and was pleased that the CBE department was interested in having me join their faculty. I began full time at UT in the fall of 2013, with a joint appointment between the Department of Chemistry and CBE."

Kilbey was born in Wisconsin, and grew up in La Crosse. His father was an engineer, and he enjoyed chemistry and math in high school. The combination of those factors influenced him to study chemical engineering.

Kilbey received his BS degree at the University of Wisconsin-Madison and his PhD at the University of Minnesota.

Kilbey's current research interests focus on understanding the relationships between the chemical design of polymeric materials and their structure and properties in thin films and in solution. His research group is engaged with the Tennessee Solar Conversion and Storage using Outreach, Research, and Education (TN-SCORE) program, the state's first National Science Foundation (NSF) RII Track 1 Research Infrastructure award. Kilbey's team is also involved in the Sustainable Energy and Education Research Center (SEERC), a research initiative designed to thrust the UT Knoxville campus into the technological forefront as a global nexus of sustainable energy research, education, and innovation through partnerships with local, national, and global organizations with common interests, such as ORNL and the US Department of Energy (DOE), as well as concerned private corporations and foundations. The team also is coordinating research projects with the Institute for Biomedical Engineering (iBME), a program that incorporates engineering and medicine and unites three diverse campuses in a multi-disciplinary collaboration.

"...the enterprise of trying to empower students to better themselves through education and to help them become lifelong learners is a serious and enjoyable endeavor to me."

Kilbey's current research group consists of seven PhD students and two undergraduate researchers.

In addition to his work in the lab, Kilbey also enjoys his teaching responsibilities.

"Interacting with students guarantees that every class is different, and every day there is an opportunity to open a door for students to walk through," Kilbey said. "It doesn't always work out that way, but the enterprise of trying to empower students to better themselves through education and to help them become lifelong learners is a serious and enjoyable endeavor to me."

Kilbey is enjoying his time in the UT CBE department, and has long-term goals for the future.

"I want to continue to provide opportunities to students, both through classroom teaching and learning through research. I think learning through research may be the most stretching experience many of our students undertake–answers are not known, outcomes are not given, and success requires persistence and developing a depth of knowledge that changes and increases daily," Kilbey commented. " I would like to see UT's research stature and scope of research increase–particularly in soft materials, which are increasingly called upon to solve challenges in energy, the environment and human health, to name a few. Partly in response to that goal, along with my colleague Mark Dadmun in the Department of Chemistry, and backed by UT, we have developed the Soft Materials Research in Tennessee (SMaRT) Center, which we hope will serve as a focal point and generate new opportunities that engage a variety of researchers from various disciplines."

Faculty Feature: Dr. Paul Dalhaimer

Dr. Paul Dalhaimer, an assistant professor in the UT Department of Chemical and Biomolecular Engineering (CBE) has many strengths as a teacher and researcher, but he admits to one weakness.

"I grew up about two blocks away from Lake Michigan in Sheboygan, Wisconsin, and have fond memories of the shoreline–but I can't fish," Dalhaimer admitted. "It seems incredible to me that I went out only once on the lake in a boat to fish. The name 'Sheboygan' provided unending amusement for my fellow students in the wing of our freshman dorm in college.

As a young student, Dalhaimer was always attracted to the mathematical underpinnings of engineering. He received his bachelor of science and doctoral degrees from the University of Pennsylvania, and did post-doc work at Yale University.

Dalhaimer joined the CBE faculty in August of 2009.

"I was drawn to the other faculty members when I joined the CBE department," he said. "I also feel that we have excellent facilities here. I love the diversity of the research that is taking place in the Science and Engineering Research Facility (SERF) and our laboratory has benefitted tremendously from collaborations in that building."

Dalhaimer and his research team are primarily interested in researching the molecular mechanisms governing the onsets of obesity and type 2 diabetes. The group uses biophysical and engineering tools to understand the formation and distribution of organelles called lipid droplets (obesity organelles). Also, the team is looking at the effects of patient metabolism on the efficacy of drug delivery vehicles. Dalhaimer and his team have collaborated with multiple labs across several disciplines from chemistry to the College of Veterinary Medicine. He involves both undergraduate and graduate students in his research projects, and has also had participation from some very talented high school students as well.

"One of the greatest joys of my life is teaching the students the messages that I was taught when I was their age"

"We are seeing a new generation of undergraduates that are interested in the biological aspects of chemical engineering and this has caused a shift in the way that we educate engineers because of the striking differences in philosophies between bio-engineering and engineering pre-2000," Dalhaimer observed.

Dalhaimer finds great satisfaction in the classroom as well.

"One of the greatest joys of my life is teaching the students the messages that I was taught when I was their age," he commented. "I teach two courses: CBE 340 and CBE 579 and the differences between the two always keep me on my toes. I am constantly tweaking and refining the lectures for both classes. This past year I taught the undergrads in 340 the C++ programming language, which was an invigorating experience for all of us."

Dalhaimer hopes to keep the momentum going on both his research and teaching efforts in the future.

"I really want to focus on applying for and hopefully acquiring education-type grants to further the abilities of our undergraduate and graduate students," Dalhaimer said.

Alumni Feature: John Shoemaker, Jr.

Linda and John Shoemaker, Jr.

John Shoemaker, Jr. was introduced to the field of chemical engineering by his uncle, David Shoemaker, a 1954 University of Tennessee Chemical Engineering grad who worked for Eastman Chemical Company. Shoemaker was interested in math and science (especially chemistry) and his uncle took time to acquaint him with the chemical engineering field. By the time he began his senior year at Ketron High School, Shoemaker was firmly committed to attending UT and majoring in chemical engineering.

Once on campus, the classroom provided the technical and managerial education while his involvement in campus organizations provided the interface skills needed for managing people. He admired how faculty such as William Lyday (basic engineering and graphics), Dr. Edgar Eaves (math), and Dr. John Prados (chemical and metallurgical engineering), really cared about their students.

"Those three men helped me to a good start at UT and from there I developed a real love for chemical engineering," says Shoemaker.

After graduation in 1967, John spent 32 years in the uranium enrichment business in Oak Ridge and Ohio, then retired and started a one-person consulting business specializing in nuclear fuel cycle technical support. Today, Shoemaker still does a small amount of consulting work but looks forward to full retirement in the near future.

John and his wife Linda, have given generously to UT through the years. Recently, they established the John and Linda Shoemaker Scholarship Endowment for the Department of Chemical and Biomolecular Engineering and have also designated funds through their estate plan to benefit the department.

"Linda and I enjoy a comfortable retirement largely because of the education provided by the UT Chemical Engineering Department," said Shoemaker. "Our intention, through our giving, is to help today's chemical engineering students achieve that same goal."

Future Site of Alumni News

Please send us your announcements so we can share them with other CBE alumni. Sent your information to ***cbe@utk.edu*** and include your name, degree, and year of graduation.

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Department of Chemical & Biomolecular Engineering
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