

# CBEUPDATE

**T**CHEMICAL & BIOMOLECULAR ENGINEERING

## Governors Chairs Connect Department with ORNL

Page 4.

Art  
Ragauskas

Tom  
Zawodzinski

Rigoberto  
Advincula

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- Ross Joins Torchbearer Ranks
- Real Problems, Real Change
- Important Interactions
- Woodland Returns from Pre-Med World Tour





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Department Head  
**Bamin Khomami**

TCE Director of Communications  
**Christie Kennedy**

Designer  
**Mitchell Williamson**

Project Manager  
**Melissa Callahan**

Writers  
**Adria Amos, Randall Brown, David Goddard, and Meghan McDonald**

Printer  
**University Printing & Mail**

## A MESSAGE FROM THE DEPARTMENT HEAD



Dear Friends, Alumni, and Colleagues,

After 15 years of having the privilege to lead this department, I recently announced my decision to step down as head at the end of July 2021. Following a sabbatical, I will return to continue teaching and researching in the department. I am incredibly proud of our accomplishments during this period as we have transitioned from a small chemical engineering program of nine faculty and about 150 students to a more diverse family of 21 faculty and over 500 undergraduate and graduate students. Our research portfolio has broadened with unprecedented productivity in terms of grants, publications, and awards. I would like to take this opportunity, my last message to you as your department head, to summarize some of our significant accomplishments over this time.

Since 2006, CBE has had its largest growth period in its eighty-five-year history. Major changes include more than doubling the size of the faculty, including adding three UT-ORNL Governor's Chairs, two assistant professors and one associate professor from racial and ethnic minorities, the first female endowed chair, and a professor of practice; increasing the number of graduate students from 20 to 60, of which 96 percent are PhD students; increasing the number of undergraduate students from 95 to over 400; and an increase in faculty annual research expenditures from \$140K to \$360K.

Eighty percent of our new assistant professor hires have received well-earned NSF Early CAREER Awards—a first in the history of the program and something I prioritized during my tenure. Additionally, one junior hire also received a DARPA Young Investigator Award and two of our associate professor hires had received the CAREER award prior to joining our program.

Growing our student population has also been a key priority. We created and implemented a highly successful graduate and undergraduate student recruiting program

with an emphasis on diversifying. We have since experienced the highest student growth period in the history of the department. At the same time, the percentage of our female undergraduate and graduate students has increased from 25 to 45 percent and from 3 to 20 percent, respectively.

To finance this unprecedented growth, we had to secure significant resources from internal and external entities via various activities, including major development efforts. Most notable accomplishments on this front include securing \$6M to renovate instructional and research laboratories, faculty and staff offices, and student common areas; creating a \$2.75M endowment for faculty chairs and professorships; and increasing the department's permanent endowment for graduate fellowships from \$250K to more than \$2.5M.

As I close this year's message, I want to take the opportunity to sincerely thank all of our alumni, donors, and corporate sponsors who have continuously supported us over the years to enable this tremendous growth—it truly takes a team effort. I am confident the work we have all performed over the past 15 years will continue to bear fruit well into the future. The department is poised for continuous growth in terms of productivity, diversity, and reputation. I am looking forward to our continuing interactions in the future, as well as to watching the ongoing success of our amazing students, alumni, and faculty.

Bamin Khomami

Bamin Khomami  
Granger and Beaman Distinguished University Professor  
Head, Department of Chemical and Biomolecular Engineering



# Ross Joins Torchbearer Ranks

Writing and photography by Randall Brown.



Nicholas Ross was enjoying a day at the Delta Tau Delta fraternity house, in the days before the campus “went remote,” when Vice Chancellor for Student Life Frank Cuevas surprised him with a 2020 Torchbearer Award.

The location made the moment all the more meaningful: Ross is not just a Delt member, he was also the chapter president in 2018.

“It was an awesome experience because Delt was a huge part of my college experience,” he said. “I know the guys in my fraternity looked up to me both personally and as a chapter leader, so I am hopeful that their witnessing how UT recognizes its student leaders will inspire some of them to make their own impact on the UT community.”

Ross, a 2020 graduate from Johnson City, Tennessee, built a proper Torchbearer’s resume in his time at UT. He majored in chemical engineering through the Chancellor’s Honors program and was a National Academy of Engineering Grand Challenge Scholar with extensive undergraduate research experience, including an internship at ORNL.

Ross was an Ignite team leader and student director, a VOLbreaks trip leader and student coordinator, the founder and president of Knoxville Elementary Outreach, and a Student Ambassador for the college’s Office of Engineering Professional Practice.

Ross contributes the core of his success to the Grand Challenge Scholars program. “It’s a tremendous force for good in the college,” he said, citing the opportunity he received as a first-year student to design a student-run community development center, Knoxville Elementary Outreach, as his final project.

“Through this experience, I first learned that engineers have the potential and responsibility to be more than just technical professionals. The Grand Challenge program reinforced this lesson throughout my time at UT.”

From this foundation, Ross went on to participate as an undergraduate researcher with Jon Hathaway, associate professor in civil and environmental engineering, whom he came to know as a mentor and friend.

“He provided an example of how a professional should produce tangible results without wavering from their purpose and how a leader can get the most out of his team through kindness and investment,” said Ross. The research into green infrastructure and urban water issues inspired him to pursue a career in urban development.

With all that under his belt, he’s also proud of simply having his degree. “Honestly, I can get pretty emotional thinking about being a UT alumni,” he said. “It’s something I will have for the rest of my life. I am so proud of my degree from Tickle and my alma mater.”



To me, being a Volunteer means being committed to leadership as embodied through service, diligence, and excellence.”

—Nicholas Ross

For summer 2020, Ross did metal design in North Carolina as an engineering intern for Oak Ridge Industries—and put back money for grad school. He is on schedule to pursue a master’s degree in environmental engineering from Carnegie Mellon University (CMU).

Ross hopes to continue developing his leadership skills both as an engineer and as a public servant, eventually obtaining his PE and establishing a business that would help implement intelligent infrastructure for cities. “I plan to bridge my two leadership focuses by commissioning as a Civil Engineering Officer in the US Navy Reserves following my time at CMU,” he said. “Early in my career as a public servant, I plan on contributing to and leading community-based secondary education initiatives. Later in my career I hope to run for a local elected office.”

Ross’s grasp of the engineer’s responsibility exemplifies the role of the Torchbearer, and shines a light on his ongoing potential to conquer the grand challenges ahead.





“

Having a program like this where you are strongly supported and can call upon the advantages of both a national laboratory and an academic institution will greatly augment our research capabilities.”

—Rigoberto Advincula

# Building on Success

## Advincula Extends Connection to ORNL





(l-r): UT students Gillian Holcomb, Joseph Broady, Zane Smith, and Lucas Kilpatrick stand behind Advincula in his lab at the Joint Institute for Advanced Materials.

**T**hough times have changed in the many decades since the Department of Chemical and Biomolecular Engineering's (CBE) founding, the department's commitment to cutting-edge research remains as focused as ever.

As the world has turned to new technologies to provide more sustainable offerings ranging from energy to manufacturing to healthcare, CBE faculty have been there to answer the challenge and provide solutions to emerging problems and opportunities.

For UT and its frequent collaborator and key contributor Oak Ridge National Laboratory (ORNL), there is perhaps no better example of finding people to tackle critical issues than the joint Governor's Chair initiative.

Established in 2006, the program has helped recruit thought leaders in everything from energy to urban design to serve as joint faculty at UT and ORNL, giving them the opportunity to focus their research through the advantages offered by each institution.

There are 15 Governor's Chairs, of which the department is home to three: Governor's Chair for Biorefining Art Ragauskas, Governor's Chair for Electrical Energy Conversion and Storage Tom Zawodzinski, and the most recent faculty member to join the program, Governor's Chair for Advanced and Nanostructured Materials Rigoberto Advincula.

"We're very fortunate and honored to have three Governor's Chairs on our faculty," said Department Head Bamin Khomami. "It highlights and validates not only the research and work we do, but also the importance of the relationship we've built with ORNL."

Advincula's specialty is polymers and materials in general, with a specific focus on properties and mechanics at nanometer-sized levels.

His work impacts the production and improvement of bio-inspired technology and medicine, optics and sensors, energy, and advanced manufacturing.

Advanced manufacturing, in particular, is a key research focus across many colleges at UT and the source of a wide variety of collaborative projects and research between the university and ORNL.

"Being able to join ORNL and UT as a Governor's Chair has allowed me to more deeply explore new and better materials with more resources," said Advincula. "Having a program like this where you are strongly supported and can call upon the advantages of both a national laboratory and an academic institution will greatly augment our research capabilities."

Since his hiring in January, Advincula has served as the leader of ORNL's Macromolecular Nanomaterials group, where he is using various 3D printing techniques like stereolithography, fused deposition modeling, selective laser sintering, and digital light processing to improve and create new composites, polymers, and materials.

His research group—part of the Center for Nanophase Materials Sciences at ORNL, one of five US Department of Energy Nanoscale Science Research Centers—is able to utilize the lab's world-renown expertise in neutron sciences and high-performance computing to enhance its scientific exploration.

"The opportunities for collaboration and support at ORNL are part of what makes it such a global leader in several areas, nanomaterials among them," said Advincula.

While having a partner who is known around the world is a benefit itself, relationships between the lab and universities have their own rewards, with faculty being able to conduct research in a lab setting and take what has been learned back to the classroom, students being able to take part in important, educationally-relevant lab work, and giving the lab access to the scientists of tomorrow.

For the department, that's a win-win situation.

## Energy. Fuel. Storage. Sustainability.

The research areas of UT-ORNL Governor's Chairs Art Ragauskas and Tom Zawodzinski are critical to both organizations and the world at large.

With a focus on biorefining, Ragauskas has dual appointments to the department and the Institute of Agriculture's Department of Forestry, Wildlife, and Fisheries. His main focus is on finding plant and natural materials for both fuel and power sources, but he also researches ways of using such materials in health care and for use as packing materials. At ORNL, he serves as a member of the Biosciences Division of the US Energy and Environmental Sciences Directorate.

With a focus on conversion and electrical energy storage, Zawodzinski is researching ways to make fuel cells and other energy storage technologies more durable over time. His research also includes looking at ways to ensure cells function properly at high temperatures and working to improve the basic mechanics of the chemical reactions taking place in fuel cells and batteries. In addition to the department, Zawodzinski serves in the Division of Materials Science and Technology at ORNL.



Tom Zawodzinski



Art Ragauskas

Photo of Art Ragauskas by Gary W. Meek Photography, Inc.



# Real Problems, Real Change

“

I know that teaching students what it's like to work as an engineer in this liminal space, with beautiful folks who are so culturally different, transforms them forever.”

—Laura Lackey



By Meghan McDonald. Photography by Laura Lackey.

“I’ve never been more proud to bleed orange,” said Laura Lackey, “than I was when Tennessee Athletics and student–athletes peacefully protested to support Black Lives Matter.” Lackey, the Dean of Engineering at Mercer University, received her bachelor’s, master’s, and doctoral degrees in chemical engineering from UT. Here, she learned the fundamentals of engineering—and of inspiring students to venture outside what they know and where they feel comfortable.

Lackey found her way into chemical engineering largely due to the influence of her father (a materials engineering professor and the “coolest guy I know”) and her high school chemistry teacher. Despite her skill in math and chemistry, she seriously struggled in her first chemical engineering course.

In fact, she told her professor she hadn’t earned the C+ he’d given her. “Dr. Clark’s response was, ‘You did earn it. You never missed a class. You studied hard. You will be the first female executive of a big chemical company.’ That made me believe I could do it,” Lackey said. “It was transformational.”

When other faculty members suggested she consider graduate work, she accepted the challenge. “By that time, I understood the influence a faculty member could have on a young person,” Lackey said. She credits her advisors and her dad with inspiring her decision to go into academics.

The environmental applications of Lackey’s graduate research opened the door for her to join Mercer’s faculty. “My dad sent me the posting for an environmental engineering position with a note: ‘I have found you the perfect job. Love, Dad.’ That was 23 years ago.”

Mercer’s focus on undergraduates really was the bull’s eye for Lackey. “As much as I enjoyed PhD-level research,” she said, “I enjoy pulling undergrads into applied research more... watching them start to understand the impact they can have.”

In 2007, the university minister asked Lackey if she wanted to participate in the new Mercer On Mission program. She said yes before he could finish explaining this combination of study abroad and service-learning.

“The goal of it, in my mind, is social justice,” Lackey said. Another bull’s-eye. “We’re using university intellectual property to try to affect change.”

Each Mercer On Mission class starts with two weeks of intensive coursework before the group heads to another country to tackle a real-world engineering problem for three weeks. R&D takes place in the lab and in the community.

For years, Lackey took students to Sub-Saharan Africa to develop point-of-use water filtration methods and improve manual well drilling techniques.

Four years ago, Lackey shifted her focus to South America: reducing mercury emissions from artisanal and small-scale gold mining processes. She now guides students in designing and testing mercury capture systems that miners and gold shop owners can use to more safely separate mercury from gold ore.

The shops they’ve worked with stand across the street from a school and a health clinic, meaning reducing mercury emissions enough could significantly improve local conditions.

“We design, build, and test systems right there to fit specific needs,” she said. “I’ve never seen students so engaged. I have to tell them at 10 p.m. to stop working!”

Ask Lackey why she takes students on these adventures, and she’ll recall a hot, dusty bus ride through Kenya. “A student poked me in the back and said, ‘I finally get why you do this. There’s no way to understand unless you bring us.’”

The student was exactly right. “I hope the technologies we develop are impactful,” Lackey said. “More than that, I know that teaching students what it’s like to work as an engineer in this liminal space, with beautiful folks who are so culturally different, transforms them forever.”







“Biofuels can provide a great, almost limitless alternative to fossil fuels.”  
—Art Ragauskas

## Ragauskas Helps Lead Biofuel Related Breakthrough

By David Goddard. Photo by Dustin Brown.

UT-ORNL Governor’s Chair for Biorefining **Art Ragauskas** has built a reputation as a leading researcher in bioenergy and in efficiently turning plant-based materials into fuel.

Ragauskas was recently part of a team whose research was aimed at improving the usefulness of such biomasses by increasing the yield of sugars they produce, which can then be converted into fuel.

“Biofuels can provide a great, almost limitless alternative to fossil fuels,” he said. “But they also have to make sense economically if we want to have widespread adoption of them. Increasing the output of fuel that a given amount of biomass can produce is a big part of that process, and a great step in the right direction.”

A crucial part of that process are substances known as deep eutectic solvents, which help break down lignin, a key component of cellular walls of plants. Breaking down those barriers helps ease the conversion of given plants into a source for biofuels.

In the case of Ragauskas’s team, that model source plant was *Arabidopsis thaliana*, a prolific plant from the same family as cabbage and mustard. When they applied their

solvents to the plants, they got a two-fold yield in sugars, a highly promising development for the future of biofuels.

“By pretreating the biomass before processing it, we were able to greatly improve output, and at a much lower temperature than in typical processing,” Ragauskas said. “Furthermore, by being able to develop deep eutectic solvents from lignin itself, we greatly reduce the cost on that side as well and create a biorefinery that can basically sustain itself.”

The Proceedings of the National Academy of Sciences of the United States of America published the results of the project, but that was far from the only accolade Ragauskas recently received.

In November, the American Institute of Chemical Engineers bestowed him with the Andrew Chase Division Award in Chemical Engineering, given for discoveries, contributions, service, and academic contributions to forest products industry technologies.

In addition, ORNL honored him for his productivity, noting he has published more than 175 articles over the last five years, 90 percent of which were collaborations with outside institutions.

## Important Interactions

By Meghan McDonald. Photography by Shawn Poynter.

Associate Professor **Steven Abel** uses mathematical and computational tools to study cell biology. While COVID-19 has changed the way students, professors, and staff interact, Abel has been studying a different type of interaction—between immune cells and pathogens.

His 2018 CAREER Award from the National Science Foundation funds research specifically aimed at understanding T cells and B cells.

“We want to know how they identify and eliminate pathogens so well,” Abel said. “We’re not focused on a particular disease, but this is particularly relevant in the age of coronavirus.”

From his research, Abel develops physics and engineering-based theories that shed light on why lab results look like they do. “Based on that, we make predictions that experimenters can test in the laboratory,” he said.

He collaborates on other projects with experimental researchers from the UT Health Science Center and ORNL’s Center for Nanophase Materials Sciences. In those two studies, he said, “We take the same principles we learn about cells and then design synthetic systems or objects that let us engineer interactions with biological systems.”

Abel approaches each project by “taking complicated problems and paring them down, simplifying them, but keeping their essence.”

He’s teaching students to do this in his new first-year seminar, Exploring COVID-19. He envisioned this class back in the spring, during the early days of the pandemic in the US, and worked to get it on the books. This seminar serves as an educational component of his immunology-related CAREER Award.

He started students at the molecular and cellular levels and is guiding them toward population scale. “The idea is to try to understand how the coronavirus develops, and how we can develop a vaccine,” he said.

Abel believes it’s important for engineering faculty to work in biological systems because some of the most extensive and expensive problems in upcoming decades will be related to health.

“We’re doing work that’s at the cutting edge of thinking about how cells interact, how immune cells identify pathogens. Understanding the fundamentals of these processes is going to be important for engineering solutions in healthcare or taking principles to other problems using biology.”

Abel’s most recent doctoral advisee to enter the workforce joined a pharmaceutical company that is working on coronavirus vaccines. There, he works in data science and machine learning applications for immunology. “It’s great that someone went from UT directly to the pharmaceutical industry where they’re at the cutting edge.”





# Staff Spotlights

Writing and photography by Randall Brown.

## Alyssa Briggs



Alyssa Briggs joined the department early in November 2019 as an administrative specialist. In this position, her duties include details like payroll for staff, faculty, and students, plus travel reimbursement.

She also welcomes and assists visiting scholars into the department, helps plan and execute weekly seminars, hires new employees, and helps with any HR issues and concerns. “One of my best qualities is being a listening ear,” she said. “Any student, faculty, or staff should know that my door is

always open, whether you need encouragement, advice, or motivation, and I would be happy to help in any way.” Briggs grew up traveling with her family as her father’s position with the Navy took them to different home bases. “I was born in Rhode Island, where my parents are originally from, and moved around to California, Rhode Island, Connecticut, and finally residing in Mississippi for the majority of my life,” she said. “I call Mississippi my ‘home,’ but Rhode Island definitely is important to me.” Briggs attended Mississippi Gulf Coast Community College for two years and managed a restaurant while being a full-time student. She transferred to Mississippi State University and continued to pursue business management with an emphasis in human resources.

“I continued to manage a restaurant through my time in Starkville and landed a job with Target as an assistant store manager over human resources in Memphis,” she said. She stayed with Target for almost four years before moving to a corporate human resources role with Corky’s BBQ. “After two years with Corky’s, I decided I needed a change and wanted to pursue something fairly challenging,” said Briggs. The hunt for a challenge brought her to Knoxville in the middle of football season. “I moved in two days before the Mississippi State game here in Knoxville—because college football is most important,” she said. Beyond that popular pastime and tackling administrative challenges, Briggs enjoys trying out local dark beer, UT volleyball games, traveling, sitting on a beach with a book in hand, and online shopping.

## Amber Tipton



Amber Tipton works in CBE as a financial specialist. In her range of duties, she reconciles monthly ledgers, monitors sponsored projects, processes scholarships, certifies effort, and provides support to faculty and staff with regard to special projects. “I pride myself on always keeping my office door open,” she said. “Student, staff, faculty, or visitors can always seek assistance in my office. I may not have all of the answers but I will never turn down a challenge.” Tipton is originally from Lafayette, Tennessee, and worked as a supervisor for Averitt Express in their expedited division while finishing her degree in middle school education at Tennessee Tech University. “Our motto (at Averitt) was ‘It’s all about time.’ I attribute being hired at UT to this motto,” she said. “[CBE Budget Manager] Amy Brewer took a chance on this external hire because she believed that my sense of urgency was a quality that CBE needed.” Tipton enjoys creative activities and spending time with family and friends when the urgent workdays are done. She and husband Jonathan keep up with their children, five-year-old Brooks and one-year-old Harper.

# Faculty Notes

Associate Professor **Steven Abel** was recognized with the Professional Promise in Research Award as part of the college’s annual faculty and staff awards. The award recognizes tenured or tenure-track faculty members at the assistant or associate professor rank who have received national and/or international recognition in their fields and show professional promise in their research. Abel’s research applies theoretical and computational methods to investigate fundamental problems in cell biology and immunology.

The DOE Office of Science recently highlighted research from Ferguson Faculty Fellow **Cong Trinh** that examined how it strengthens its membranes and produced the most ionic liquid (IL) tolerant microorganism reported to date as a result. These insights will be critical to developing microbes that can directly convert plant biomass treated with ILs into biofuels and biochemicals.

Late in 2019, Research Professor **Abhijeet Borole** and Bredesen Center graduate **Alex Lewis** combined to exclusively license two biorefinery technologies invented and patented by their company, Electro-Active Technologies, while working at ORNL. The technologies work as a system that converts organic waste into renewable hydrogen gas for use as a biofuel.

Faculty across the college enjoyed well-earned promotions at the start of the 2020 fall semester: Promoted to full professor: Prados Professor **Gila Stein**; tenured and promoted to associate professor: **Steven Abel**.



Gila Stein



Steven Abel

## Student Notes

Several undergraduate students presented their research at the second annual CBE Undergraduate Research Paper Presentation in March. Awards were given for first, second, and third place. Taking top honor was senior **John Hill** (“Experimental Design of Light Utility Bioreactors for In-Home Bioprocessing and Chemical Production”). Fellow seniors **Makayla Hyde**, **Jaclyn Choate**, and **Nikolai Regenold** took second place (“Study Level Recovery Process of Thorium and Several Rare Earth Elements from Monazite Ore”) followed by junior **Deanna Riley** in third (“PEGylated high-aspect-ratio micelles interact directly with the high-density lipoprotein (HDL) receptor SR-B1”).

PhD student **Caleb Walker** earned the AIChE Division 15 (food, pharmaceutical, and bioengineering division) Oral Presentation Award at the 2019 AIChE annual meeting. Walker spent nearly four years researching and experimenting to produce the results in his presentation, “Engineering Exceptional Solvent Tolerance in Yarrowia Lipolytica for Biocatalysis.”

Research completed by recent alums **Hanieh Niroomand** (PhD/CBE, ’18) and **Tyler Bennett** (PhD/CBE, ’19) was recognized earlier this year with selection to be on the front covers of the Journal of Materials Chemistry A and the inaugural issue of Nanoscale Advances, respectively. These studies have paved the path for making micro-tailored PSI for artificial photosynthesis and quantum transduction processes into fruition.



Hanieh Niroomand



Tyler Bennett





# DEPARTMENTAL AWARDS

## Faculty and Staff Awards

Outstanding Staff Member Award  
**Brock Ellis**

Outstanding Teacher Award  
**S. Michael Kilbey**

Outstanding Faculty Mentor Award  
**Eric Boder**

Tom and Ruth Clark Excellence in  
Chemical Engineering Award  
**Steve Abel**

## Student Awards

AIChE Service Award  
**Maria Bruce**

CBE Outstanding Junior Award  
**James Baker and Seth Crawford**

Most Exceptional Student Award  
**Preston Nicely**

Kenneth M. Elliott Outstanding Senior Award  
**Samantha Cahill and Evan Newell**

Jim and S ndra McKinley Outstanding  
Graduate Student Award  
**Naijia Hao**

Professor Jack S. Watson Undergraduate Award for  
Excellence in Separation Research  
**Cora Smith and Michael Player**

Alpha Chi Sigma Albert Cooper Award  
**Chachthida Sukitjavanich**

American Chemical Society  
Outstanding Senior Award  
**Woodi Woodland**

AIChE Outstanding Student Award  
**Kaylie Richard**

AIChE Outstanding Baccalaureate Award  
**Edward Michaud**

## MCKINLEY AWARD Encourages Hao

*By Adria Amos.*

For Naijia Hao and countless others, the spring 2020 semester ended abruptly and without the usual fanfare and celebration typically associated with completing a PhD program. Hao didn't even get to say goodbye to many of her friends and colleagues before she left Knoxville for New Mexico to begin a post-doctoral research associate position at Los Alamos National Laboratory (LANL).

Little did she know, the department was planning a virtual celebration. Shortly after arriving in Los Alamos, she received a package reminding her of her accomplishments at UT.

"I received this award certificate in a very nice frame and a gift flash drive in my mailbox," she said.

Hao was awarded the 2020 Jim and S ndra McKinley Outstanding Graduate Student Award, given annually to CBE graduate students who show a high degree of effort and hard work in their studies. She had been notified of the recognition prior to leaving campus, but the traditional presentation of the award at the department's spring banquet was canceled due to the pandemic.

In his nomination letter, faculty advisor UT-ORNL Governor's Chair Art Ragauskas said Hao excelled at formal classroom studies and had become a leader in her research in developing fundamental insight into biorefining biomass and solving some of the pressing issues surrounding the pyrolysis of biomass.

Ragauskas hoped the award would bolster her future research, writing, "I believe the [award] will provide her a great opportunity to further explore fundamental and applied sciences in renewable energy and environmental research areas."

Hao said the award will do just that.

"When I slack or feel frustrated about my research, this award will remind me that I shouldn't give up," she added.

As a member of the Inorganic, Isotope, and Actinide Chemistry Group at LANL, her current research is focused on the synthesis of jet fuels from bio-derived molecules, not dissimilar to her biomass conversion research at UT.

The gift flash drive included with her award held another surprise for her. It contained a virtual commencement ceremony, during which animated versions of Department Head Bamin Khomami and Director of Graduate Studies Eric Boder congratulated CBE's 2020 PhD graduates. Ragauskas even placed a doctoral hood over the head of an animated Hao.

"I just can't express how touched I was when I saw this," she said. "I want to say thank you to CBE department for all the support and encouragement."

Hao came to UT after she completed her bachelor's degree in chemical engineering at Dalian University of Technology in China in 2014. She was attracted to UT because of the financial aid provided to CBE graduate students, but she admitted she didn't know much about Knoxville at the time she made her decision. Still, she doesn't regret her choice.

"I know it was the right decision I have made," she said. "I have had so many good memories here."





# A Pre-Med World Tour

*Writing and photography by Randall Brown.*

Woodi Woodland enjoyed extensive travels across the UT campus in her role as a student ambassador, but it was her studies that took this chemical engineering alumna across the globe. She completed her degree after returning to campus from a 15-month internship and study at Germany's Technical University of Hamburg.

"It was amazing," Woodland said. "All of my classes were taught in German, which was my biggest motivation to stay. I had always wanted to perfect my German, but did not think I would have the chance."

She previously visited Germany as a high school student from her home in Brentwood, Tennessee, and looked for opportunities to return. In 2017 she discovered the Research Internships in Science and Engineering (RISE) website.

"I had heard of their parent organization, DAAD, before because of a study abroad exchange I considered in high school," she said. "So, I was very ecstatic to find a reputable and known organization conducting research in my field that I could intern with."

With an eye toward a medical career, Woodland chose chemical engineering as an undergrad major to satisfy her personal requirements for academic rigor.

"I wanted to pursue medicine, but wanted to have a back-up plan," she said. "I debated studying math, but realized I would miss the science, and thought about majoring in a science field—neuroscience, chemistry, etc.—but knew I would miss math."

An advisor encouraged her to pursue chemical engineering after she explained her long-term career goals, which she started forming as a teen.

"In high school I researched in a biomedical engineering lab at a university in Nashville," said Woodland. "I was researching the quantification of biochemical changes in cervical tissue during pregnancy in order to possibly detect signs of a pre-term delivery."

To diversify her undergrad experience early on, she spent time in non-academic settings outside of her studies—such as working in a juice bar the summer before her sophomore year. Then the RISE program offered her the chance to shift focus to her chosen field in a big way.

"I had never worked in a chemical engineering lab before and wanted to get experience," said Woodland. In addition to being able to use her second language while learning, she also enjoyed getting acquainted with the German education system.

"Adjusting to a system where there is only the final and lecture only one time a week for 90 minutes was a lot to get used to at first, but it also allowed for me to have a lot of time to do things outside of the classroom," she said.

Woodland enjoyed spending the holiday season in Germany and visiting their holiday markets. She also came to appreciate the German work ethic.

"Many of the people I knew had a calmness about them when it came to work and did not let their work stress them out or let them over work themselves," she explained.

Part of Woodland's own strong work ethic is staying on the lookout for specific research opportunities in her medical-school future.

"I would like to research the effects of addiction on the brain and its repercussions," she said. "I want to go deeper than just the psychological and physiological effects we see and experience. I want to help investigate further the changes it has neurologically."

This focus and drive carried Woodland around the world and back and has laid the foundation for her continued impact as a standout Engineering Vol.

“

**I want to go deeper than just the psychological and physiological effects we see and experience. I want to help investigate further the changes [addiction] has neurologically.”**

**—Woodi Woodland**





# CBE Hall of Fame



## Oscar Martin Jr.

By Gerhard Scheibel.

Oscar Lee Martin Jr. (MS/ChemE, '96) has found career success in combining innovation and entrepreneurial mindsets, at both of which he excels.

Martin, who holds a PhD in chemical engineering, works as a regional technology leader for DuPont, and his team has secured patents including

materials designed for armored cables, flame and chemical protection garments, and composite sheet materials.

“DuPont makes products like Nomex, Kevlar, and Tyvek,” Martin said. “These are used in different subapplications, and I get to see a concept through scaling into manufacturing and launching into the marketplace. It’s a fascinating process, and I would say that, as engineers, we always have to bring to the table an entrepreneurial kind of mindset and ask ourselves how to be more nimble, faster, creative, and innovative.”

Martin joined the company after completing his master’s in chemical engineering at UT, and he credits the university with providing an applied education. He studied under Professor Robert Counce, in whose class a collaborative project with DuPont helped Martin secure his initial opportunity at the company.

“I knew I wanted to go into industry using the concepts I learned at UT,” said Martin, who completed his PhD at Virginia Commonwealth University while working at DuPont. “Professor Counce was a great mentor and helped me move in that direction. If my experience here at UT had been purely theoretical, then it would have taken me in a different direction.”

During a visit to campus in January, Martin delivered a guest lecture to a chemical engineering class and advised students to “stay engaged, stay hungry, and be serious.”

He enjoyed giving the lecture in part because he enjoys mentoring the next generation of engineers. As part of this goal, Martin established a company and online school in

2009 called TechnologyEd, which has grown from a handful of classes to more than a hundred and provides continuing education opportunities for scientists and engineers.

“I want students to understand the necessity of differentiating themselves from the competition,” Martin said. “We all need to think about what’s going to make us successful versus the next person being considered for a particular job or advancement. I encourage an entrepreneurial mindset.”

A self-professed fan of the TV show *Shark Tank*, Martin’s mind is always “working and spinning, thinking about new ideas.”

“What I like about *Shark Tank*, is that people come with fascinating ideas, and the process helps them take those ideas to the next level through investment, concept development, networking, and more,” Martin said. “The ultimate goal is always to commercialize an idea, add value, and make the company and world a better place.”



Oscar Martin receives the Accomplished Alumni Award from CBE Department Head Bamin Khomami. Photo by Randall Brown.



## Homer F. Johnson

Homer F. Johnson had a long and distinguished career at UT. He joined the chemical engineering faculty in 1949 and served as professor and head of the Department of Chemical, Metallurgical and Polymer Engineering from 1960 until his retirement in 1984. Under Johnson’s able leadership, the department grew from a small group of six professors to one of the larger departments in the college, in part due to his proposal to the National Science Foundation to designate the department as a “Center of Excellence,” resulting in approximately one million dollars of funding to significantly expand the staff and facilities. The department eventually split into two: CBE and Materials Science and Engineering.

“While on co-op as a process engineer, I designed process systems for food and beverage plants. I implemented concepts from UT courses into my work projects, but also gained new skills that will shape my future career and make me a better engineer. I appreciate the Volunteer donors who help create impactful experiences like this for me and other UT students. These opportunities would not be possible without their generous support.”

—Hana Gouto  
senior / chemical engineering



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# A Legacy by Design

By Laura Tenpenny.



Words flow fast, carried by a strong, altruistic current when Angie Cannon (BS/ChE '81) speaks about her life's work. The business she and her husband, Harold (BS/CE '81), owned for nearly 25 years now belongs to four of their employees.

"After so long with little turnover, Cannon & Cannon became a family. They're what I'll miss most," Cannon said. "We strive to be bottom-line aware, not bottom-line driven. People come first."

Cannon & Cannon serves the greater Knoxville area, with locations in Memphis and Bowling Green, Kentucky. Countless seen and unseen civil engineering projects, from parks to utility lines to schools, owe their existence to the company.

At UT, they consulted on over 40 projects, including the current west campus renovation.

"We offer creative solutions when a client's been told 'that can't be done,'" said Cannon. "I love seeing the team crack tough nuts, especially ones that truly enhance our community, like Suttree Landing Park."

Many have asked what it's like to work with a spouse or if she and Harold ever bump heads.

"I'm the typical, left-brained engineer, and he's the big-picture-thinker, creative type. We complement each other," Cannon said. "I'll miss working with him just an office away."

Their relationship began on a high school Young Life trip and grew at UT. As Volunteers, servant leadership skills were nurtured alongside their engineering education.

"Extracurriculars like serving as Young Life leaders were some of our best college experiences," said Cannon. "And academically, UT instilled the foundational principles of engineering and the analytical mindset I've relied on."

Cannon's senior design professor also reinforced her people-first approach.

"He filled three blackboards with alumni and their big-name employers," she said. "He told us their average GPA, which wasn't high, and said, 'There's more to life than just knowing facts. These folks knew how to listen, carry a conversation, and relate to people.' That stuck with me."

From serving on city diversity committees to mentoring female business leaders, Cannon's propensity for service feeds a rich personal life. At UT, she's engaged as a

“There’s a paucity of women and minorities in STEM and business, I want to encourage young people to go into these fields.”

—Angie Cannon

Chancellor's Associate and a member of the TCE Board of Advisors. Almost yearly, she leads young adults from her church to serve ministries in Mozambique.

Having enjoyed working with youth since her Young Life days, this is where her sights lie in retirement.

"There's a paucity of women and minorities in STEM and business," said Cannon. "I want to encourage young people to go into these fields."

The Cannon & Cannon family fully embraces the servant mindset. They live out the employee-created tagline, 'enhancing community life by design,' not only in hundreds of infrastructure projects but in personal service activities, for which the company grants ample leave.

This positive culture reaped the company multiple awards from the *News Sentinel* for being among the best small business workplaces in Knoxville—accolades that Cannon cherishes.

"We wanted to leave a legacy, not build an empire," Cannon said. "The Cannon & Cannon family is our legacy just as much as the community improvements we made possible."



419 Nathan W. Dougherty Building  
1512 Middle Drive, Knoxville, TN 37996-2200  
Phone: (865) 974-2421  
Fax: (865) 974-7076  
Email: [cbe@utk.edu](mailto:cbe@utk.edu)  
Web: [cbe.utk.edu](http://cbe.utk.edu)



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**Laura Lackey, alumnus and dean of engineering  
at Mercer, has been making changes. Page 8.**